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Lee

(54) **LEAK PROOF COLLAPSIBLE CUP**

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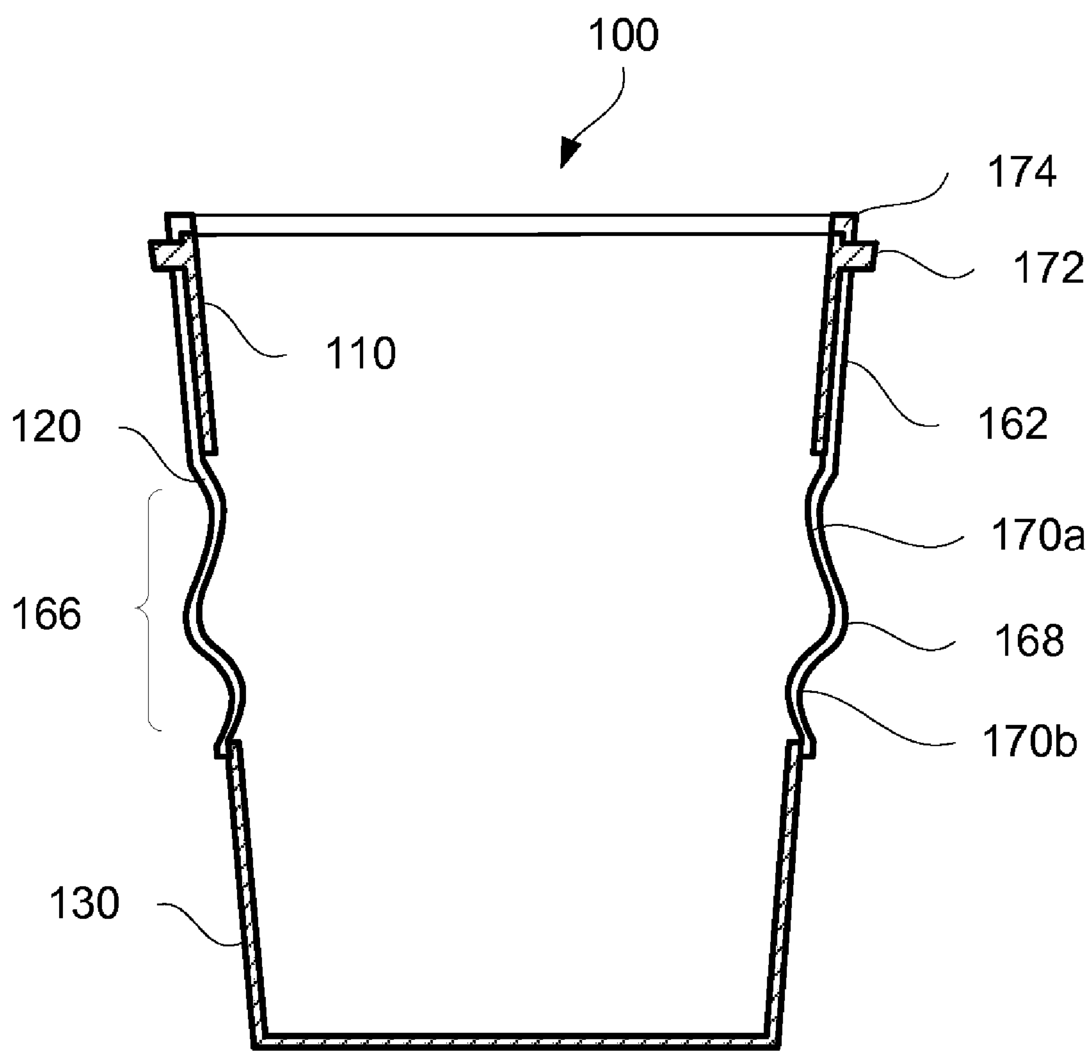
(57) **ABSTRACT**

Provided are a collapsible cup and a lid for sealing such cups. A collapsible cup includes a top cylindrical portion having a collapsible part and a sealing edge. The cup also includes a rigid bottom portion attached to the collapsible part and configured to move in and out with respect to the sealing edge by folding the collapsible part. The level of folding of the collapsible part determines different positions of the top portion, such as upper operating position corresponding to the maximum cup height, an intermediate operating position corresponding to an intermediate cup height, and a lower collapsed position corresponding to the minimum cup height. In the lower collapse position, the bottom portion may be substantially enclosed by the top cylindrical portion. The collapsible cup may include a reinforcement insert disposed within the top portion and used for engaging with a lid and providing support to the sealing edge.



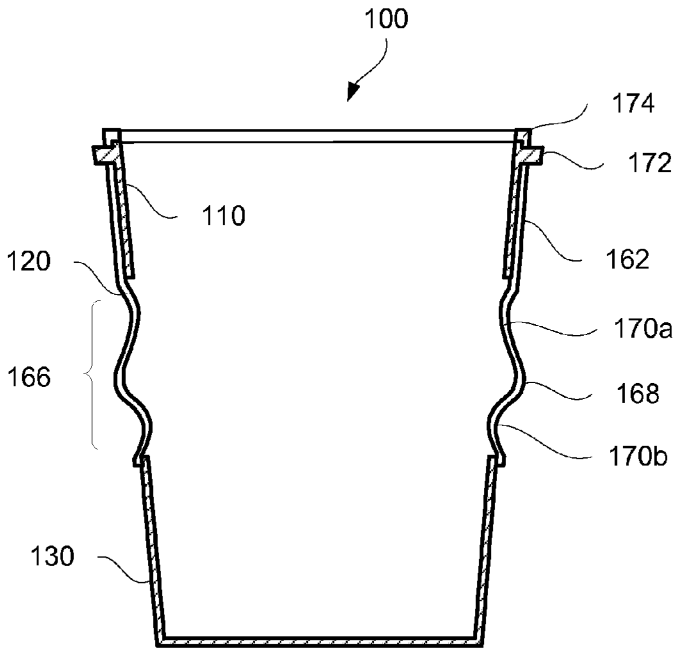


FIG. 1A

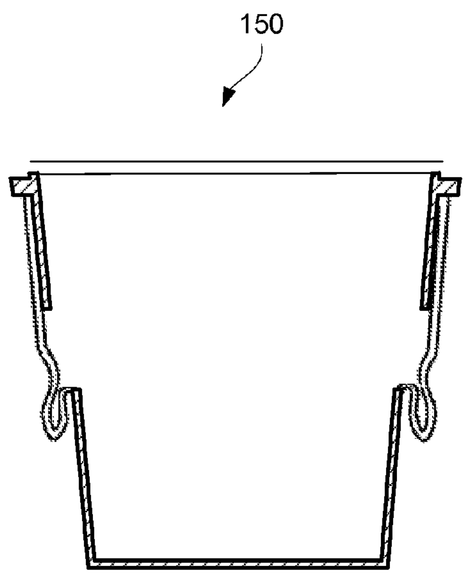


FIG. 1B

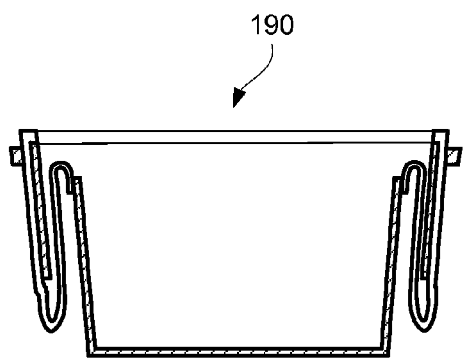


FIG. 1C

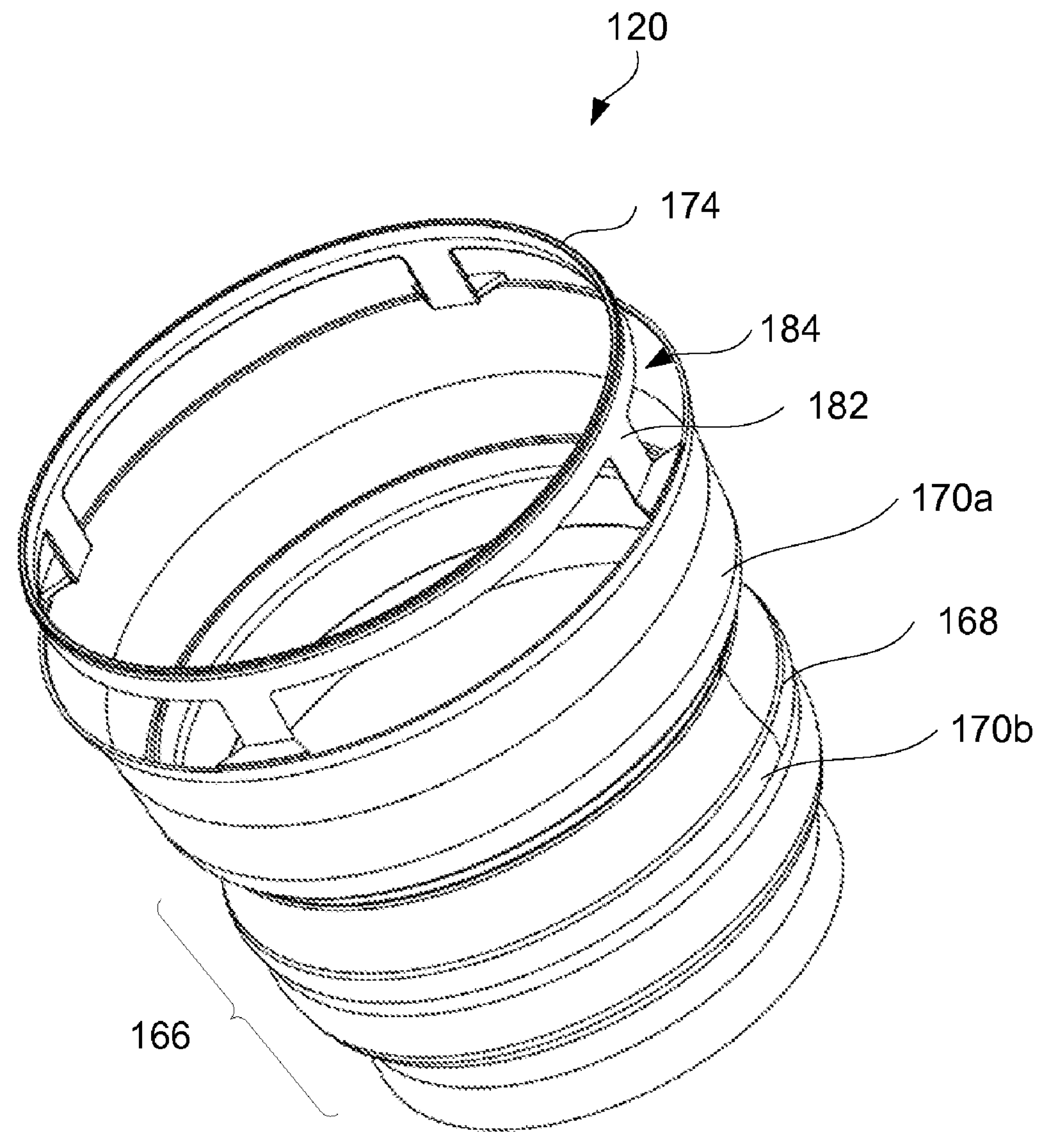


FIG. 2A

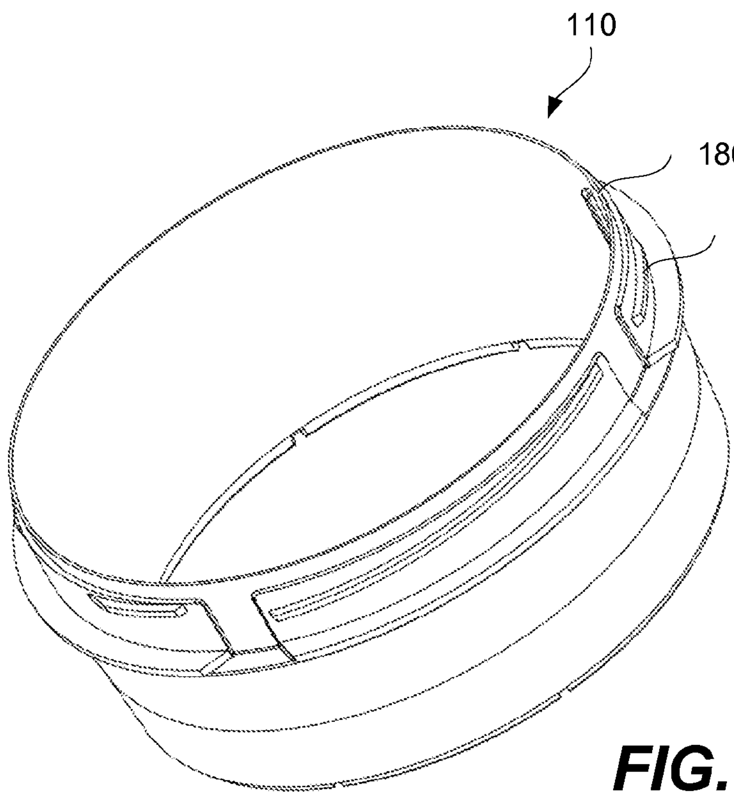


FIG. 2B

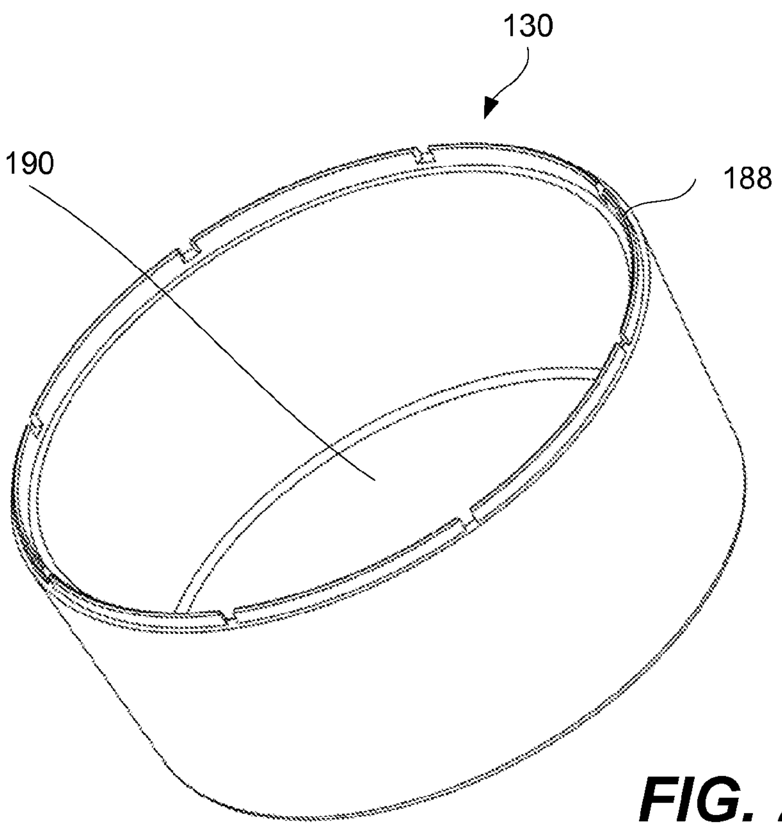


FIG. 2C

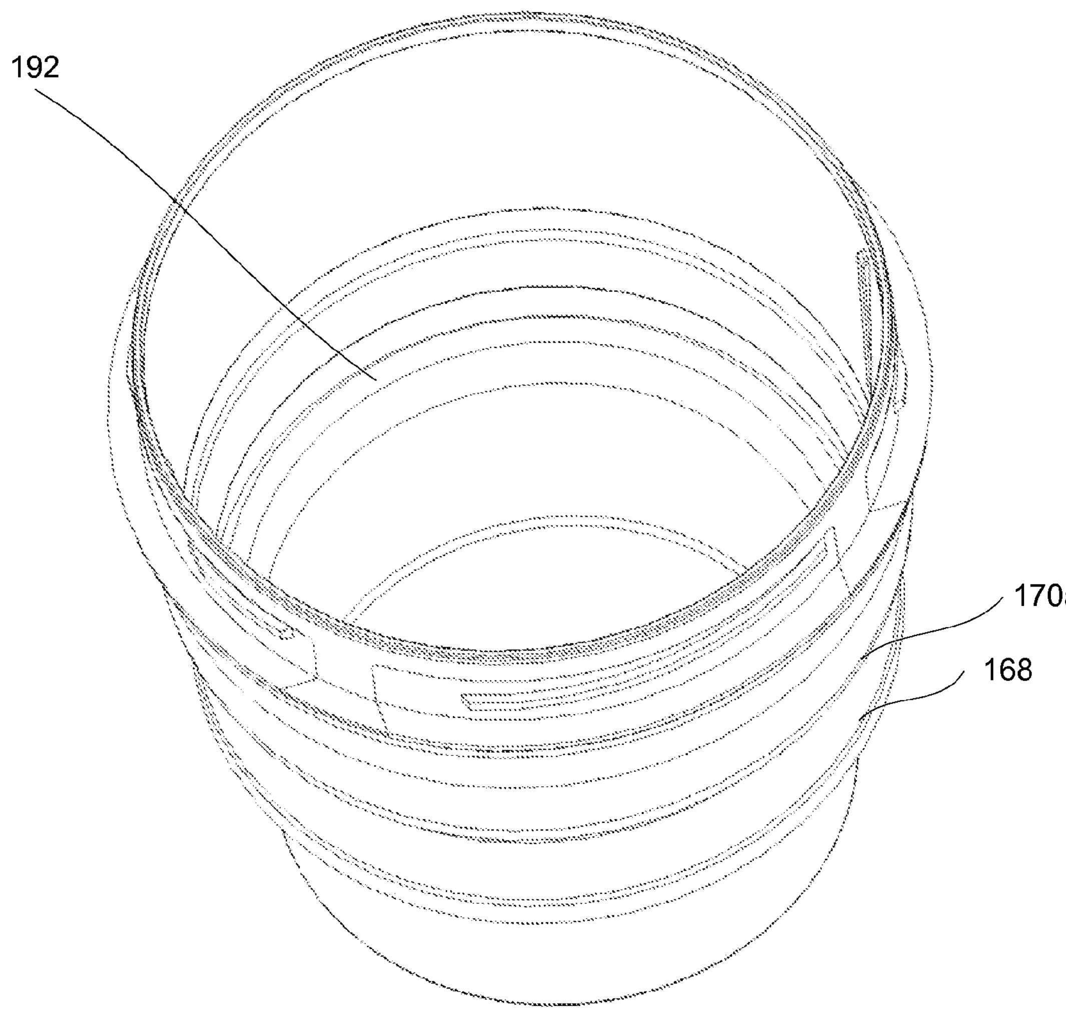


FIG. 2D

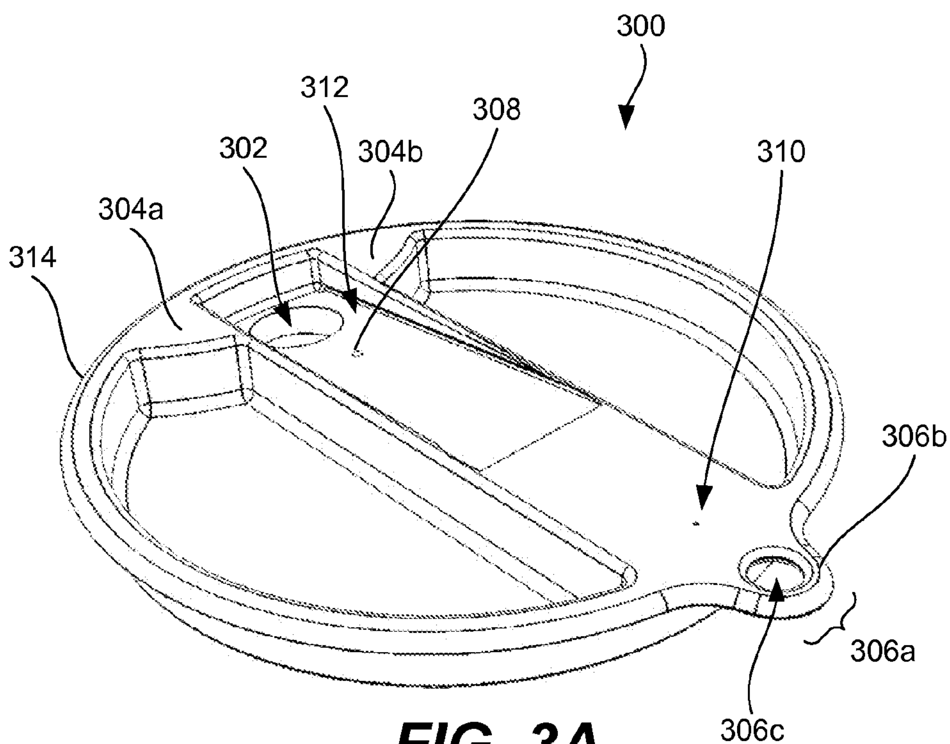


FIG. 3A

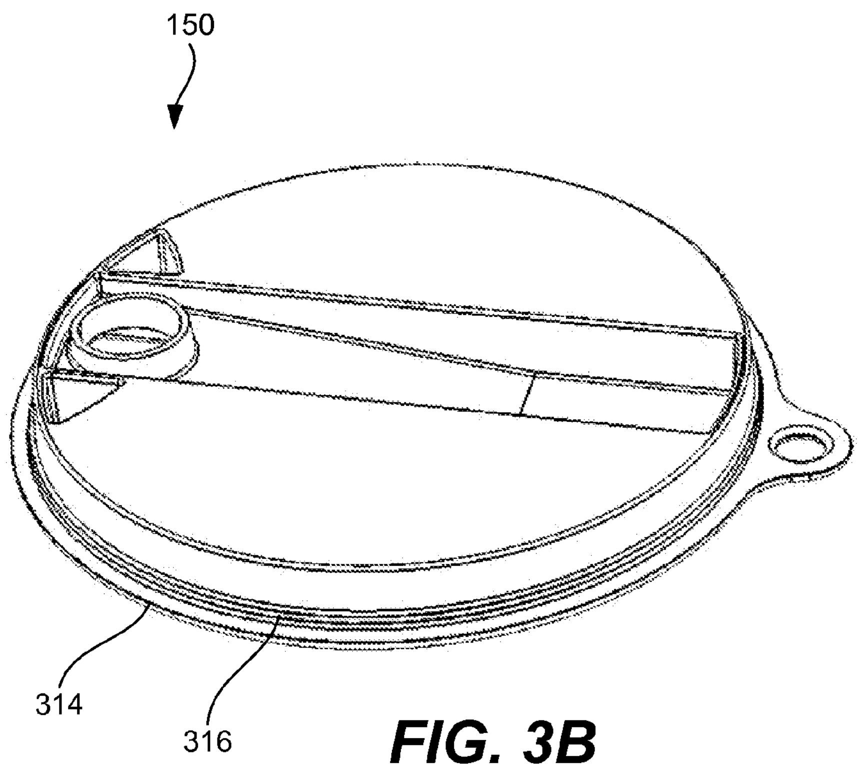


FIG. 3B

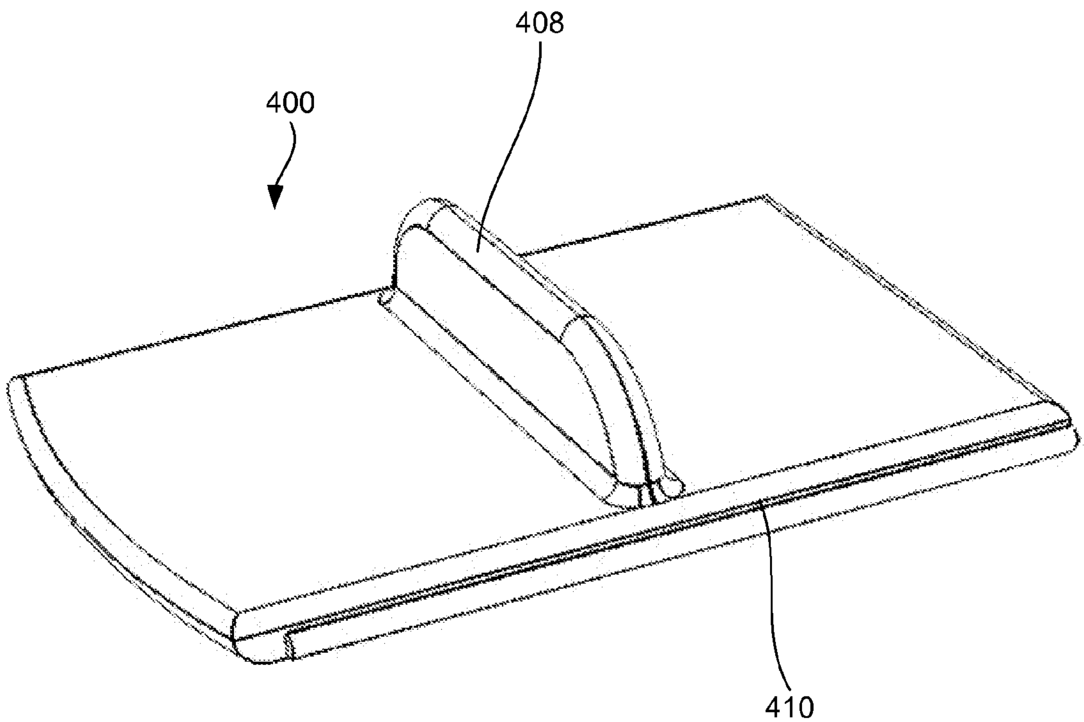


FIG. 4A

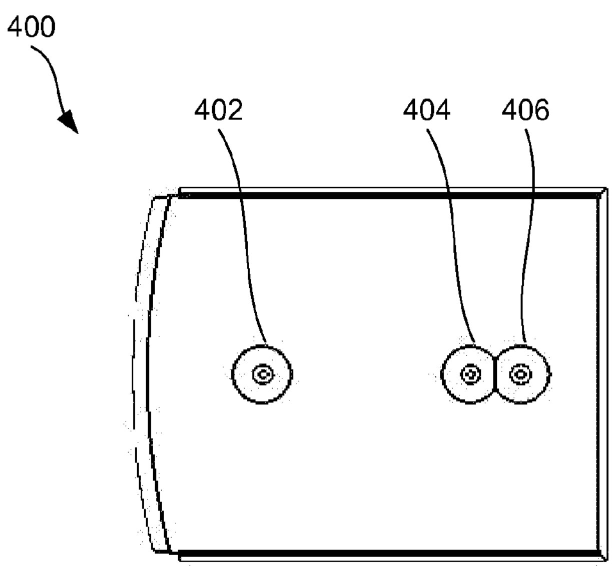


FIG. 4B

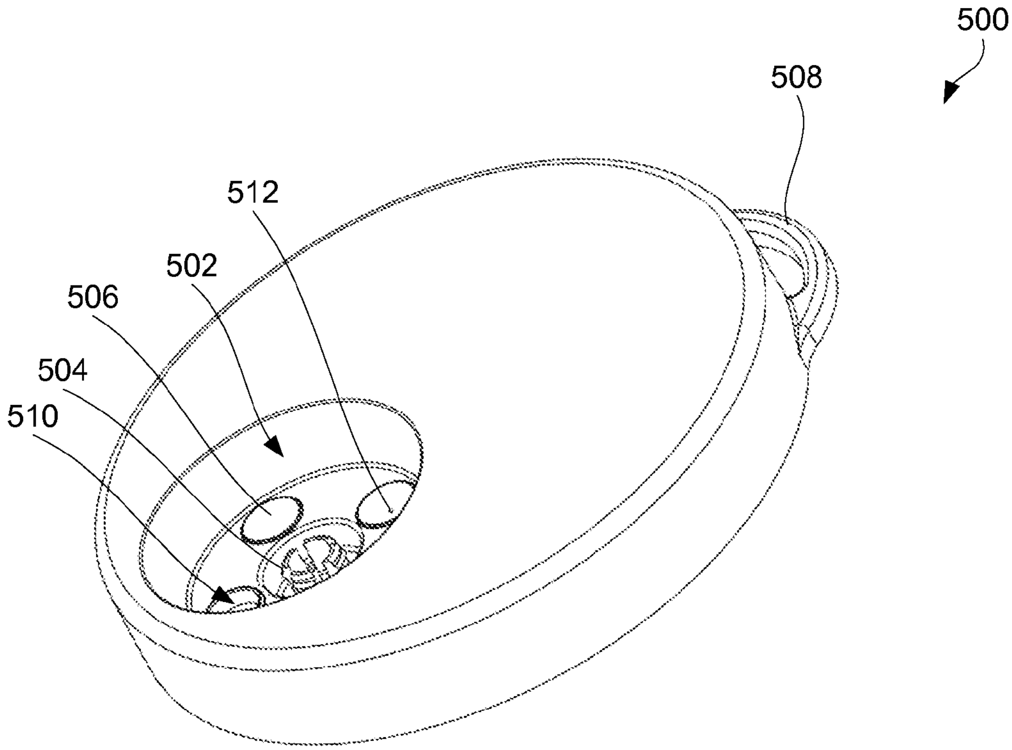


FIG. 5A

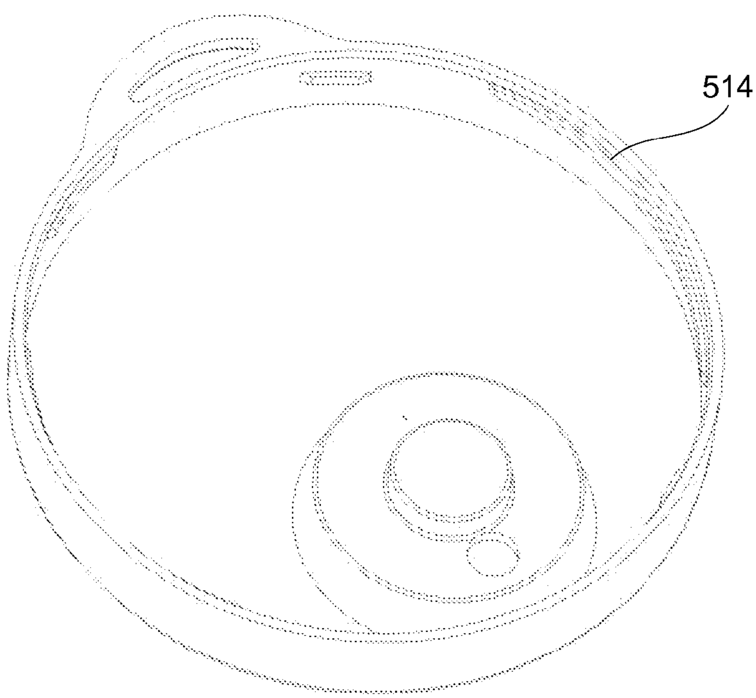


FIG. 5B

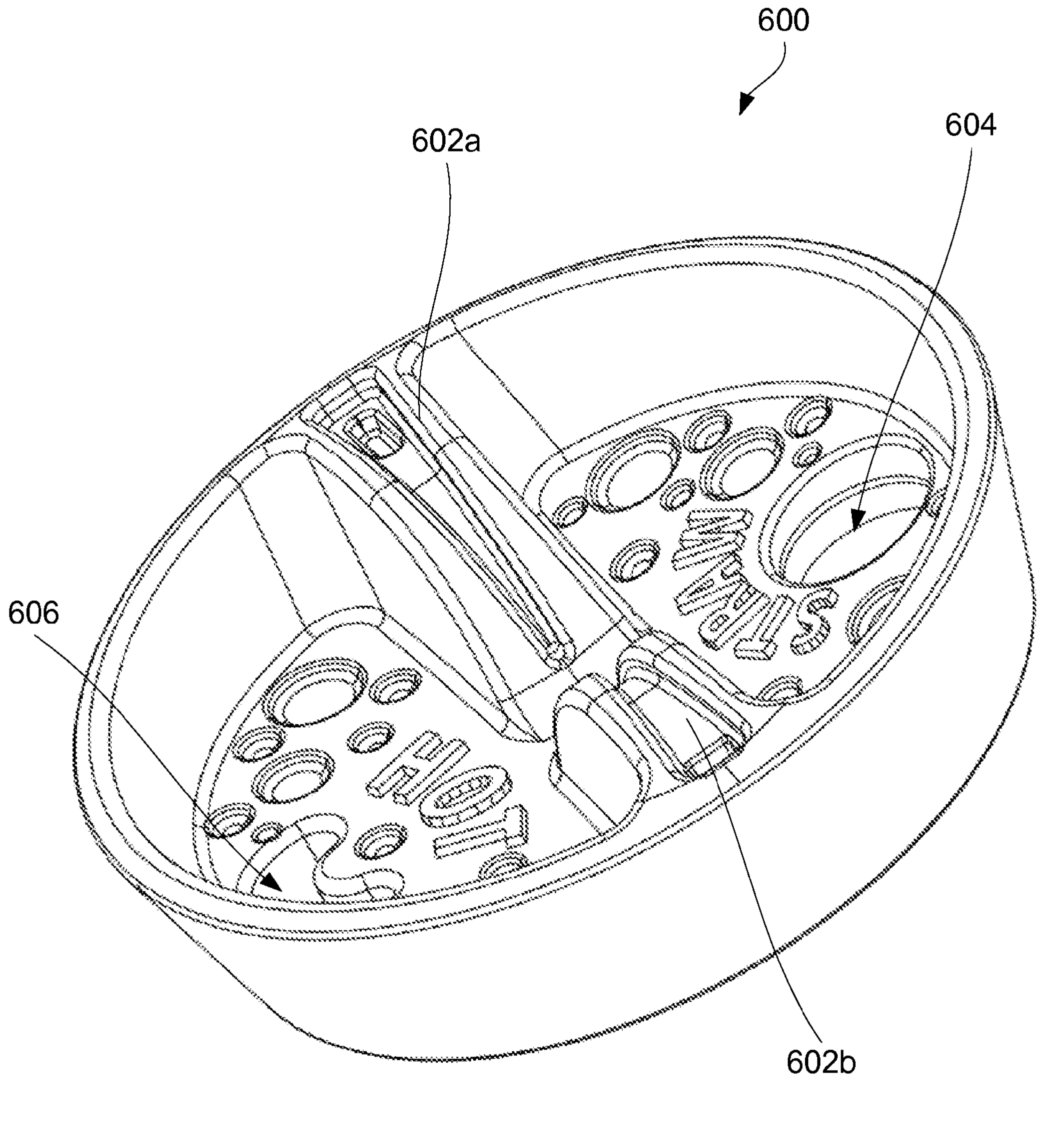


FIG. 6

LEAK PROOF COLLAPSIBLE CUP

CROSS-REFERENCED TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 13/025,340, entitled “Leak Proof Collapsible Cup,” filed on Feb. 11, 2011, which is incorporated herein by reference for all purposes.

FIELD

[0002] This application relates generally to collapsible cups and cup lids for sealing the collapsible cups and, more specifically, to collapsible cups having a rigid upper section, a collapsible mid section, and a rigid bottom portion.

BACKGROUND

[0003] Conventional foldable cups typically come in two designs, one includes a set of individual rings that telescopically expand into a cone-like shape to form a cavity for liquid. However, such cups are difficult to clean, for example, in the areas where two adjacent rings engage to each other, and often leak. Such cups also tend to break easily. The second type is made with a flexible material that folds but such cups often lack structural integrity in the open position and are poorly designed for hot liquids since they either become too soft, too hot, or difficult to fold. Other conventional designs also suffer from similar problems.

[0004] At the same time, collapsible cups can present many benefits to their users. For example, collapsible cups may be used to replace disposable cups, which would substantially reduce the amount of waste. It has been cited by the Clean Air Council that the average American office worker uses about 500 disposable cups every year. Furthermore, collapsible cups are extremely useful for travelers, hikers, and such.

SUMMARY

[0005] Provided are a collapsible cup and lid for sealing such cups. The cup body is composed of a total of three pieces that are co-molded together to form one seamless sealed water tight cup. These parts include an upper cylindrical portion made from a hard plastic, a mid-section having a flexible material, and a bottom hard plastic section all of which are molded and sealed together presenting one unit. The mid-section of the cup is made to allow the cup to have a tall cylindrical flexible middle that folds down instead of over to one side. This is done with the addition of a mid-flex crease that allows the cup to consistently fold down and along desired creases and not over to one side or in any other manner. Additionally, it allows the cup to fold into two volume positions: one half open or small volume position and one full open or large volume option. In total, there are three sizes that are created with the folding design. The level of folding of the collapsible part determines the three different positions, such as an upper operating position corresponding to the maximum cup height, an intermediate operating position corresponding to an intermediate cup height, and a lower collapsed position corresponding to the minimum cup height. In the lower collapse position, the bottom portion may be substantially enclosed by the top cylindrical portion. The collapsible cup may include an integrated soft upper lip of cup used for engaging with a lid and providing support to the sealing edge to seal liquid in cup when the lid is placed on.

[0006] In some embodiments, a collapsible cup includes a top cylindrical portion made from hard plastic material that is covered with a flexible upper cylindrical portion made from a soft upper cup section to provide comfortable cup holding temperature and protection from heat by forming an insulating sleeve.

[0007] The mid section may include a collapsible part configured to change its shape and fold when a downward force is applied to the collapsible cup. The mid section also includes a unique design that allows for a taller shaped cylindrical folding object to fold straight down without folding over to the side. This unique feature is described as a mid-flex crease. This crease allows the cup to track strait down when pressure is applied so that the cup always folds as intended in the downward direction. Additionally this feature creates the ability to have a second half way open sized cup or two cup sizes in one. One of the sizes being the full open position having a larger volume and the second size being the half open position having a smaller volume.

[0008] Additionally, in this half open size, the folds are designed in such a manner that allows them to interlock against themselves so that no ridges or channels are created on the inside of cup for the liquid to run over or get trapped in. This creates a smooth internal surface for the liquid to flow evenly across.

[0009] The collapsible cup also includes a bottom portion made from a second rigid plastic material. The bottom portion forms a bottom of the collapsible cup and may have a cup shape, i.e., a closed end cylinder shape. The bottom portion may be attached and sealed with respect to the top cylindrical portion.

[0010] The collapsible part allows folding to move with respect to the bottom of the collapsible cup between two more positions. One of these positions is an upper operating position, in which the top cylindrical portion and the bottom portion are extended with respect to each other, resulting in a maximum cup height and forming a closed end cavity configured for storing contents. Another position is a lower collapsed position, in which the bottom portion is inserted into the reinforcement insert of the upper cup resulting in a minimum cup height. The minimum cup height is less than about 2 inch. The cup is configured to store a variety of volumes of the contents in the upper operating position. In some embodiments, the cup is configured to store the contents in the lower collapsed position.

[0011] Also, provided are collapsible cups and cup lids for sealing the collapsible cups. The cups are designed with two or more rigid portions that are used to engage with the cup lids and support the cup on the surfaces. These multiple rigid portions are interconnected by one or more flexible middle portions configured to support the upper rigid portion when the cup is in the upper operation position. At the same time, the flexible portion may bend under a certain force exerted by the user during collapsing of the cup and may allow one rigid portion to slide over another rigid portion. The flexible portion may move in the desired downward direction. Even in this lower collapsed position, all rigid and flexible portions of the cup may remain seamlessly connected to each other preventing any spills from the cups (e.g., residual liquids). The cup lid may include a slidable element configured to move between multiple positions for controlling a size of a liquid delivery opening.

[0012] In certain embodiments, a collapsible cup for storing liquid includes a top portion including a first rigid plastic material, a bottom portion including a second rigid plastic material, and a middle portion including a flexible plastic material. These portions form one unified body consisting of a hard upper and lower portion with a flexible center section forming one seamless unit. The middle portion is seamlessly attached to the top and bottom portions at the two interfaces defined by these three portions (i.e., at a first interface between the top and middle portions and at a second interface between the middle and bottom portions). Furthermore, the middle portion allows the top portion to move between an upper operational position in which the top, bottom, and middle portions are extended with respect to each other resulting in a maximum cup height and a lower collapsed position in which these three portions are collapsed resulting in a minimum cup height. Additionally, the middle portion is designed with a mid-flex crease that allows for consistent downward folding in the intended downward direction and does not fold sideways or in any direction other than down. In the upper operational position, the three portions form a closed end cavity configured for storing the liquids or solids. In the lower collapsed position, the top portion is positioned around the bottom portion and the connection between the top and bottom portions is maintained. As such, the collapsible cups may also store liquids or at least prevent some residual liquid from spilling outside of the cup when the cup is the lower collapsed position.

[0013] In certain embodiments, the first rigid plastic material and/or second rigid plastic material may include eastrogenic activity (EA) free polypropylene. In the same or other embodiments, the flexible plastic material includes a flexible polymer. The rigid plastic materials and flexible plastic material may be transparent and allow detecting a liquid level when the cup is used to store liquid. The middle portion of the cup may have a variable thickness of the flexible plastic material along the height of the cup. This variable thickness may be configured to support the top portion of the cup when the top portion is in the upper operational position.

[0014] The minimum cup height may be less than about 2 inch. Specifically, in the collapsed position the cup may be sufficiently small to fit into a users pocket, a small bag (e.g., laptop bag), and other similar carrying options, or hung on a hook attached to a belt loop or other location. The cup may be configured to store, for example, 16 ounces of liquids or solids in the upper operational position and be used as a hot coffee cup or a cold smoothie juice cup. The cup may also be used to store items in the middle sized position such as a small drink, ice-cream, cereal, soup, crackers, candy and any other items that fit into its cavity. The cup may be also configured to store items in the lower collapsed position and used as a smaller cup, such as an espresso cup or a pill cup.

[0015] In certain embodiments, the collapsible cup also includes a lid configured for sealing with the top portion of the cup. The lid may include a slidable element configured to move between multiple positions for controlling a size of a liquid delivery opening. For example, the slidable element may be configured to temporary stop and/or lock in at least the three following positions: a fully-closed position, an intermediate open position, and a fully-open position. These positions correspond to three different sizes of the liquid delivery opening. The liquid delivery opening may be configured to accommodate a straw for delivering the liquid out of the collapsible cup when the slidable element is the fully-open position. Furthermore, the cup may be spill proof when the slidable element is the fully-closed position. The cup may remain spill proof, when the slidable element is the fully-closed position, in both the upper operational position and the lower collapsed position of the collapsible cup.

[0016] In certain embodiments, the lid includes a ventilation aperture. The slidable element of the lid, described above, may include a center column knob extending in an upward direction from the lid and configured to assist in moving the slidable element between the multiple positions. In certain embodiments, the lid includes an open channel disposed on a top surface of the lid and in communication with the liquid delivery opening. The channel is configured to maintain the liquid within the channel during delivery of the liquid to a user. The lid may include two protrusions positioned adjacent to the channel for supporting walls defining the channel with respect to an outside rim of the lid. These protrusions are positioned adjacent to the liquid delivery opening to provide comfort to the user during consumption of the beverage. Specifically, the protrusions provide a smooth surface to the lips to rest against to provide additional comfort.

[0017] In certain embodiments, the lid may include a thread configured for engaging with a corresponding thread on the top portion during engaging and sealing the lid with respect to the top portion. The lid or the top portion may also include a sealing gasket for establishing a better seal in between these two components. The gasket may be integrated with co-molding of a softer elastomer into a harder material (e.g., high density polyethylene (HDPE), or be a standalone component. In certain embodiments, the lid and/or top portion have sufficiently flexible engaging surfaces to form a seal in between these two components. The lid may include a carrying feature having a protrusion extending from an edge of the lid and a through opening made in the protrusion. This can be used for hanging to display the item or to hook onto a carabineer.

[0018] Also provided is a cup lid configured for use with a cup, such as a collapsible cup described above. However, one skilled in the art will understand that this lid may also be used with other types of cups as well. In certain embodiments, a cup lid includes a lid body forming a sealing edge configured for sealing with a top portion of a cup. The lid body may include a ventilation aperture. The lid body may also include an open channel disposed on a top surface of the lid body and in communication with the liquid delivery opening and configured to maintain the liquid within the open channel during delivery of the liquid. The lid body may also include two protrusions positioned adjacent to the channel for the lips to rest against while drinking to provide comfort, thus defining the channel with respect to an outside rim of the lid. Finally, the lid body may also include a thread configured for engaging with a corresponding thread on the top portion of the cup during engaging and sealing the lid with respect to the top portion.

[0019] In certain embodiments, the cup lid also includes a slidable element supported by the lid body and configured to move between at least three positions with respect to the lid body for controlling a size of a liquid delivery opening, the three positions including a fully-closed position, an intermediate open position, and a fully-open position. The liquid delivery opening is configured to accommodate a straw for delivering the liquid out of the cup when the slidable element is the fully-open position. Furthermore, the cup may be maintained spill proof when the slidable element is the fully-closed position. The cup remains spill proof, when the slidable element is in the fully-closed position, in both the upper operational position and the lower collapsed position of the compact cup. The slidable element may include a center column knob extending in an upward direction from the lid and configured to assist in moving the slidable element between the multiple positions.

[0020] These and other aspects of the invention are described further below with reference to the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. **1**A illustrates a schematic side cutout view of a collapsible cup in its upper operating position, in accordance with certain embodiments.

[0022] FIG. **1**B illustrates a schematic side cutout view of the same collapsible cup in its intermediate operating position, in accordance with certain embodiments.

[0023] FIG. **1**C illustrates a schematic side cutout view of the same cup in its lower collapsed position, in accordance with certain embodiments.

[0024] FIG. **2**A illustrates a schematic perspective view of the total flexible portion including the middle portion of the collapsible cup illustrated in FIGS. **1**A-**1**C, in accordance with certain embodiments.

[0025] FIG. **2**B illustrates a schematic side view of a top cylindrical portion, in accordance with certain embodiments.

[0026] FIG. **2**C illustrates a schematic view of a bottom portion, in accordance with certain embodiments.

[0027] FIG. **2**D illustrates a schematic view of an inner part of a collapsible cup in its intermediate operating position, in accordance with certain embodiments.

[0028] FIGS. **3**A and **3**B illustrate two schematic perspective views of a lid with a slidable element removed from the lid, in accordance with certain embodiments.

[0029] FIGS. **4**A and **4**B illustrate a schematic perspective and bottom views of a slidable element for use with the lid illustrated in FIGS. **3**A-**3**B, in accordance with certain embodiments.

[0030] FIG. **5**A illustrates a schematic view of a lid, in accordance with certain embodiments.

[0031] FIG. **5**B illustrates a schematic view of a reverse side of a lid, in accordance with certain embodiments. FIG. **6** illustrates a schematic view of a cover for attaching to the lid shown in FIG. **5**, in accordance with certain embodiments.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

[0032] In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. The present invention may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail so as to not unnecessarily obscure the present invention. While the invention will be described in conjunction with the specific embodiments, it will be understood that it is not intended to limit the invention to the embodiments.

[0033] Provided are a collapsible cup and a cup lid for sealing the collapsible cup. The cup may have two or more rigid portions that are used to engage with the cup lid and support the cup on the surfaces. These multiple rigid portions are interconnected by one or more flexible portions configured to support the upper rigid portion when the cup is in the upper operation position. The flexible portion may bend under a certain force exerted by the user during folding of the cup and may allow one rigid portion to slide down over another rigid portion. The flexible portion may have a mid-flex crease across the mid-section to improve downward collapsing without folding over to a side or any other direction. Additionally, the crease may allow multiple folding positions of the collapsible cup.

[0034] The portions of the collapsible cup may be seamlessly connected to each other preventing any spills from the cups (e.g., residual liquids). The cup lid may include a slidable element configured to move between multiple positions for controlling a size of a liquid delivery opening.

[0035] The collapsible cup with the lid may be used for storing various liquids or solids, including cold and hot drinks such as coffee and juices. In general, the cup may be configured to operate at a temperature range of −30° C. (e.g., for storing frozen liquids) and 100° C. (e.g., for storing boiling liquids). Materials used for the cup and the lid, which are further described below, may allow dishwashing, sterilization, and other processing of collapsible cup. It should be noted that collapsible cup may be used with or without the lid. Furthermore, the lid may be used with collapsible cup or some other types of cups. Various features of the lid are described in more detail below with reference to FIGS. **3**A and **3**B.

[0036] In certain embodiments, the collapsible cup includes a top cylindrical portion with a reinforcement insert, and a bottom portion. The reinforcement insert and the bottom portion are generally made from rigid plastic materials, such as HDPE, polyethylene terephthalate (PET), polybutylene terephthalate (PBT), nylon, polyphenylene sulfide (PPS), polyamide (PA), polycarbonate (PC), polyester (PE), polypropylene (PP), and polyvinyl chloride (PVC), and so forth. One skilled in the art will understand some or all materials used for construction of the cup assembly, including the lid, may need to be food grade materials. In certain embodiments, the reinforcement insert and the bottom portion are made from semi-rigid and even flexible materials. The top over-mold cylindrical portion overlaying the reinforcement insert is generally made from a sufficiently flexible plastic material, such as silicone polymers. The top cylindrical portion may continue below the reinforcement insert, thus forming a flexible mid-section. The top cylindrical portion may be attached to the reinforcement insert and the bottom portion to provide a connection between them.

[0037] FIG. **1**A illustrates a schematic side cutout view of a collapsible cup in its upper operating position **100**, in accordance with certain embodiments. The collapsible cup may have a top cylindrical portion **120** overlaying a reinforcement insert **110**, and a bottom portion **130**. The top cylindrical portion **120** may include a collapsible part **166** that allows the collapsible cup to take various positions, such as an upper operational position **100** shown in FIG. **1**A, an intermediate operating position **150** shown in FIG. **1**B, a lower collapsed position shown **190** in FIG. **1**C, and so forth. Specifically, in the upper operational position **100**, the top cylindrical portion **120** is extended, which results in a maximum cup height and forms a closed end cavity configured for storing the liquid or solids. In this position, the cup may be configured to between about 2 ounces and 24 ounces of liquid.

[0038] In the intermediate operating position **150** shown in FIG. **1**B, the collapsible cup may be semi-collapsed due to various convex and concave portions of the collapsible part **166**. When semi-collapsed, convex and concave portions interlock and seal with each other allowing no liquid in between. Thus, a smooth inner surface may be created for liquid to flow over.

[0039] In the lower collapsed position **190**, the top cylindrical portion **120** is collapsed over the bottom portion **130**, which results in a minimum cup height (e.g., less than about 2 inch). The size of the top cylindrical portion **120** should be sufficient to accommodate the entire height of the bottom portion **130** and the entire collapsible part **166**. The connections between the portions are maintained in the lower collapsed position **190** and the intermediate operating position **150**, thus preventing the spilling of residual liquids or solids when the cup is in full collapsed, mid-collapsed or cup open position.

[0040] In certain embodiments, the cup in the intermediate operating position **150** and the lower collapsed position **190** may be used to hold smaller volumes and effectively used as a smaller cup, such as an espresso cup or a pill cup. The folding may be specifically designed for certain volumes and, therefore, the collapsible cup may be used as a multi size measuring cup. Furthermore, the portions may be made from transparent materials that allow detecting a liquid and solid level inside the cup.

[0041] Back to FIG. **1**A, the top cylindrical portion **120** may be made from a flexible plastic material. The cylindrical shape of the collapsible portion **166** may be tapered towards the bottom and may have various convex and concave portions, such as portions **168**, **170***a*, and **170***b*. These features allow the cup to fold thereby changing the height of the cup as further described below. The inward taper of the top cylindrical portion **120** may be between about 5° and 30° or, more specifically, between 10° and 20°.

[0042] The top cylindrical portion **120** includes a sealing edge **174**, which defines the top most portion of the cup. The sealing edge **174** is configured to form a seal with a lid positioned over the cup and isolate the internal environment of the cup from the external environment. The sealing edge **174** may be shaped as a ring of the flexible plastic material provided over the reinforcement insert **110**. Since sealing edge **174** in a part of the top cylindrical portion **120**, it is also formed from a flexible polymer material that conforms to the shape of the lid while forming the seal. The sealing edge **174** may be supported by the reinforcement insert **110**, which is made from a rigid plastic material. In some embodiments, the height of the sealing edge **174** (e.g., above the reinforcement insert **110** is between about 0.5 millimeters and 2 millimeters.)

[0043] The top cylindrical portion **120** may extend below the reinforcement insert **110** (the collapsible part **166**) and connect it to the bottom portion **130**. The collapsible part **166** may have various convex and concave portions. Specifically, FIG. **1**A illustrates one convex portion **168** and two concave portions **170***a* and **170***b* showing a crease across the body of the top cylindrical portion **120**. In general, any number of concave and convex portions may be used. A pair of a concave and convex portion may be used to form one fold. The folding may reduce the height of the cup and fix it in the folded position until sufficient force is applied to unfold it. By folding a pair of a concave and convex portions, the volume of the cup may be modified, thus allowing customizing the size of the cup. One of the sizes may be the full open position with a larger volume of the cup. Another size may be the position with one pair of a concave and convex portion folded, thus reducing the volume of the cup. The convex portion may provide space for folding of the corresponding concave portion. In some embodiments, the collapsible part **166** has a variable thickness of the flexible plastic material along a height of the cup that allows the collapsible part **166** to fold.

[0044] Specifically, the collapsible part **166** allows the upper cup to move with respect to the bottom portion **130** between multiple positions. One position is an upper operating position **100**, in which the collapsible part **166** is extended such that the top cylindrical portion **120** and the bottom portion **130** are as far away with respect to each other as possible resulting in a maximum cup height and forming a closed end cavity configured for storing contents. Another position is a lower collapsed position **190**, in which the bottom portion **130** is inserted into the top cylindrical portion **120** or, more specifically, into the reinforcement insert **110** (e.g., in a concentric manner) resulting in a minimum cup height. The minimum cup height is less than about 2 inch, while the maximum cup height may be over 4.5 inches. The cup is configured to store up to 24 ounces of the contents in the upper operating position **100**.

[0045] The cup may also include one of more intermediate positions. One such position is shown in FIG. **1**B. The number of these intermediate positions may depend on a number and degree of folds within the collapsible part **166** of the top cylindrical portion **120**. It should be noted that cup can be used to store liquids and other contents in all or at least one position. For example, the cup may be used as a **16**-oz cup in its upper operating position, as a 12-oz cup in one of its intermediate positions, as a 8-oz cup in one of its other intermediate positions, and still as a 4-oz cup in its lower collapsed position. Of course, other volumes may be used as well.

[0046] The reinforcement insert **110** may be formed from a rigid plastic material. The reinforcement insert **110** may be disposed within top cylindrical portion **120** between sealing edge **174** and collapsible part **166**. In other words, the top cylindrical portion **120** may be positioned as a sleeve over the reinforcement insert **110**. In other embodiments, the reinforcement insert **110** may be provided without an insulating overmolded sleeve.

[0047] The reinforcement insert **110** may include one or more interlocking features **172** for engaging with a lid. Interlocking features **172** may protrude through one or more openings in top cylindrical portion **120**. Interlocking features **172** may be in the form of a thread, latches, and other types.

[0048] The cup also includes the bottom portion **130** made from a rigid plastic material. The materials of the bottom portion **130** and reinforcement insert **110** may be the same or different. For example, high density polyethylene (HDPE) may be used for bottom portion **130** and/or the reinforcement insert **110**. In some embodiments, at least one material used for the bottom portion **130**, reinforcement insert **110**, or top cylindrical potion **120** is transparent for detecting presence of liquid in the collapsible cup.

[0049] The bottom portion **130** forms a bottom of the collapsible cup. The bottom portion **130** is attached and sealed with respect to top cylindrical portion **130** to prevent content of cup from escaping it. For example, the bottom portion **130** and the top cylindrical portion **120** may be over-molded, welded, glued, or otherwise permanently attached to each other. Similar attachment and sealing techniques may be used between the top cylindrical portion **120** and reinforcement insert **110**.

[0050] FIG. **2**A illustrates a schematic perspective view of the top cylindrical portion **120**. FIG. **2**A shows the entire top cylindrical portion **120** including the collapsible part **166** with the convex portion **168** and two concave portions **170***a* and **170***b*, thread canal **182**, protrusions **184**, and sealing edge **174**. The collapsible part **166** is also shown in three different functions in FIGS. **1**A-**1**C. The sealing edge **174** is configured to form a seal with a lid positioned over the cup and isolate the internal environment of the cup from the external environment. The collapsible part **166** may have various convex and concave portions, such as one convex portion **168** and two concave portions **170***a* and **170***b*. These are described as concave and convex in terms of the inner dimension as well as the outer dimension.

[0051] FIG. **2**A also illustrates protrusion **184** that allow interlocking features of the reinforcement insert (not shown in FIG. **2**A) to extend through top cylindrical portion **120**. Protrusion **184** lays even with the thread canal **182** that allows flexible material to flow into and make the sealing edge **174**. In some embodiments, the sealing edge **174** may be a separate component not molded to the rest of the top cylindrical portion **120**.

[0052] In some embodiments, the first concave portion **170***a* is located at the inner diameter of a top crease closest to the opening of the cup and is configured to fold IN thereby pushing the lower center of the mid-section OUT. The collapsible part **166** further may include a second convex portion **170***b* located at the inner diameter of the mid-flex crease. The second convex portion **170***b* with added pressure from the dynamics of the first concave section **170***a* pushes out and causes the mid-flex crease to fold out, down and roll over the bottom portion. This design results in a cup that uniformly and consistently folds down sequentially, the collapsible part rolls over the bottom first, then the bottom pushes into the top.

[0053] In some embodiments, the mid-flex crease design allows the cup to have a height of, for example, 4 ¾ inch with an upper cup diameter of 3.5 inch and a lower cup diameter of 2.5 inch resulting in a ratio of 1:1.4 inch. With this ratio, there is a tall mid-section of approximately 2 inches that needs to fold down in the intended downward direction. The mid-flex crease essentially allows the height of the mid-section to be folded in half reducing the vertical tension of 2 inches of material to be broken up into two 1 inch sections. This allows the 4 ¾ inch cup to consistently fold in the intended downward direction.

[0054] The mechanical consistency and control over the exact step by step procedure of folding is also needed to ensure that the cup will function within a varying range of mid-flex material hardness or durometer. As this cup is designed to be used for ice cold drinks and boiling hot drinks, the temperature will affect the hardness/softness of the mid-section. As such the mechanics of the design has been developed to function independent of these variations and fold within a wide range of durometer.

[0055] This mid-flex crease is also designed to create a sealed smooth surfaced inner cup when folded in the half open size. In some other cups or collapsible items collapsing halfway will also yield a smaller sized container but in all of these cases the inside surface has a ribbed staircase like design where the liquid must flow over and may get trapped between the layers, altering the flow of liquid from that of a normal smooth interior cup. The unique design of the collapsible part **166** with a mid-flex crease has avoided these ridges by designing a one fold cup with a crease that tightly seals against itself allowing the liquid to flow over a smooth even surface in the half open position.

[0056] In some embodiments, the reinforcement insert includes one or more interlocking features for engaging with a lid. The one or more interlocking features protrude through one or more opening in the top cylindrical portion **120**. This thread feature is made with multiple protrusions **184** within the thread canal **182** allowing the lid to go on with a minimum of turning to accomplish its desired task of interlocking the lid onto the cup.

[0057] The sealing edge **174** is formed by a ring of the flexible plastic material provided over the upper lip of cup. As noted above, the over-molded flexible material provides support to the sealing edge **174**, when the sealing edge **174** engages with the lid.

[0058] In some embodiments, the flexible plastic material of the top cylindrical portion **120** is permanently attached to the first rigid material of the reinforcement insert and/or to the second rigid material of the bottom portion. The different material may be molded over one another, glued, welded, or attached by some other techniques. The attachment ensures that contents of the collapsible cup do not leak out of the cup and that the three sections of the cup body stays together as one unit. In the same or other embodiments, the flexible plastic material is a flexible polymer. At least one of the first rigid plastic material, the second rigid plastic material, and the flexible plastic material may be transparent for detecting presence of liquid in the collapsible cup.

[0059] FIG. **2**B illustrates a schematic view of the reinforcement insert **110**, in accordance with certain embodiments. The reinforcement insert **110** includes interlocking features **172** for engaging with corresponding features on a lid. Furthermore, FIG. **2**B shows a top edge **186** of the reinforcement insert **110** that provides support to the sealing edge of the top portion.

[0060] FIG. **2**C illustrates a schematic view of the bottom portion **130**, in accordance with certain embodiments. The bottom portion **130** has a cup shape, i.e., a closed end cylinder shape. It includes a bottom **190**, which may be flat. The bottom portion **130** may also include features **188** for attaching to the top portion.

[0061] FIG. **2**D illustrates a schematic view of an inner part of a collapsible cup in its intermediate operating position, in accordance with certain embodiments. The concave portion **170***b* (not visible) is covered by the convex portion **168**. The concave portions **170***a* is not involved in folding the collapsible cup to intermediate operating position, so its position and shape remains unchanged in relation to the upper operating position.

[0062] In the intermediate operating position, the concave portion **170***b* and the convex portion **168** are interlocked and sealed with each other, thus fixing the collapsible cup in the intermediate operating position and holding water from entering between the concave portion **170***b* and the convex portion **168**. An inner part **192** of the collapsible cup creates a smooth surface that may not trap liquid and/or other substances.

[0063] FIGS. **3**A and **3**B illustrate two schematic perspective views of a lid **300** that may be used with the cup shown in FIGS. **1**A-**1**C, in accordance with certain embodiments. Lid **300** is shown without the slidable element to better illustrate some additional features. However, as indicated above, lid **300** is generally coupled to the slidable element, which is configured to move with respect to lid **300** between multiple positions for controlling a size of a liquid delivery opening **302**.

[0064] In certain embodiments, the slidable element is configured to temporary stop and/or lock in at least the three following positions with respect to lid **300**: a fully-closed position, an intermediate open position, and a fully-open position. In the fully-open position, liquid delivery opening **302** may be configured to accommodate a straw for delivering the liquid out of the collapsible cup. The straw may have a diameter of about 5 millimeters, 6 millimeters, 7 millimeters, 8 millimeters, 10 millimeters, and even 12 millimeters. Interlocking may be provided by one or more interlocking features, such as protrusion **308** shown in FIG. **3**A. Protrusion **308** is configured to couple with one or more indents **402**, **404**, and **406** shown of slidable element **400** shown in FIG. **4**B. For example, when protrusion **308** is coupled with indent **402**, slidable element **400** is temporary locked in the fully open position. This position may be used for consumption of cold drinks and/or viscous drinks (such as smoothies), for protruding a straw through the liquid delivery opening **302**, and other purposes when a large orifice to the liquid containing vessel may be needed. When protrusion **308** is coupled with indent **404**, slidable element **400** is temporary locked in the intermediate open position. This position may be used for consumption of hot drinks (e.g., when accidental release of large volumes of liquids should be prevented). Finally, when protrusion **308** is coupled with indent **402**, slidable element **400** is temporary locked in the fully-closed position. The cup may be spill proof when the slidable element **400** is the fully-closed position.

[0065] In certain embodiments, lid **300** includes a ventilation aperture **310**. Ventilation aperture **310** may be used to supply air back into the cup when the liquid is being discharged through liquid delivery opening **302**. As such, the cup assembly may be fully discharged without a need for repeatedly tipping the assembly to equalize the pressure inside the assembly and outside the assembly. Ventilation aperture **310** is typically rather small and configured to prevent liquid spills through ventilation aperture **310** when the assembly is tipped over. This is typically due to a rather high surface tension of various liquids, such as coffee, tea, juices, and smoothies. In these embodiments, the side of ventilation aperture **310** may be less than about 1 millimeter or, more specifically, less than 0.5 millimeters, or even less than 0.25 millimeters. In the same or other embodiments, lid **300** and the corresponding slidable element **400** are configured to block ventilation aperture **310** when the liquid delivery opening **302** is in the fully-closed position.

[0066] In certain embodiments, lid **300** includes an open channel **312** disposed on the top surface of lid **300** and in communication with liquid delivery opening **302**. This open channel **312** may be configured to maintain liquid within its channel while the liquid is being delivered from liquid delivery opening **302** to the user. In other words, open channel **312** helps to improve the spill proof properties of lid **300** and to contain the liquid within the certain designated area. In certain embodiments, lid **300** also includes two protrusions **304***a* and **304***b* positioned adjacent to open channel **312** for supporting walls defining channel **312** with respect to an edge **314** of the lid.

[0067] In certain embodiments (shown in FIG. 3B), lid **300** includes a thread **316** configured for engaging with a corresponding thread on the top portion **104** during engaging and sealing lid **300** with respect to the top portion. The lid **300** or the top portion **104** may also include a sealing gasket for establishing a better seal in between these two components. The gasket may be a part of either one of these components or be a standalone component. In certain embodiments, the lid **300** and/or top portion **120** have sufficiently flexible engaging surfaces to form a seal in between these two components.

[0068] In certain embodiments, lid **300** includes a carrying feature **306***a*. Carrying feature **306***a* may be used to hang lid **150** or the cup assembly **100** for display (e.g., in a retail environment) or for carrying the assembly between uses of the cup (e.g., attaching to a belt or back-pack). Carrying feature **306***a* may include a protrusion **306***b* extending from edge **314** and a through opening **306***c* made in protrusion **306***b*.

[0069] FIGS. **4**A and **4**B illustrate a schematic perspective and bottom views of slidable element **400** for use with the lid **300** illustrated in FIGS. **3**A-**3**C, in accordance with certain embodiments. In certain embodiments, slidable element **400** includes a center column knob **408** extending in an upward direction and configured to assist in moving the slidable element **400** with respect to the lid. Center column knob **408** is shown with chamfers for additional user's comfort and ease of cleaning the lid assembly. Slidable element **400** also shown with edge rails **410** for engaging with corresponding rails on the lid **300** and allowing for slidable element **400** to move with respect to the lid **300** and stay attached to the lid **300**.

[0070] FIG. **5**A illustrates a schematic view of a lid **500**, in accordance with certain embodiments. Lid **500** may include a cavity **502** for receiving a rotatable cover (not shown in FIG. **5**), which is described below with reference to FIG. **6**. Within cavity **502**, lid **500** may include an interlocking feature **504** for interlocking with a corresponding feature of the rotatable cover and providing a rotatable and removable attachment between lid **500** and the cover. The removable aspect of this attachment helps with cleaning of this assembly. The rotatable aspect is used for selecting a flow orifice among multiple flow orifices provided on the cover and aligning the selected flow orifice with an opening **510** provided in lid **500**. These flow orifices may be also referred to as liquid delivery openings.

[0071] Within cavity **502**, lid **500** may include one or more positioning features **506** for engaging with corresponding features of the cover and maintaining the position of the cover corresponding to the selected flow orifice. In other words, positioning features **506** prevent uncontrollable rotation of the cover with cavity after one of the flow orifices has been selected.

[0072] Additionally, there may be a protruding ring around the orifice and in the three other stop positions for seating into each location. This creates a locking feature to better seal in liquid in the closed position.

[0073] Within cavity **502**, lid **500** may include a ventilation aperture **512**. Ventilation aperture **512** is aligned with one of orifices in the cover and allows the air into the cup thereby preventing substantial reduction of pressure inside the cup that may interfere with the flow of the liquid out of the cup. Specifically, the cover may be configured to move between multiple positions with respect to lid **500** for controlling a size of a liquid delivery opening. The cover may be also configured to temporary stop and/or lock in at least three positions, such as a fully-closed position, an intermediate open position, and a fully open position. Ventilation aperture **512** may be aligned with one of openings in the cover when the cover is in the intermediate open position or the fully open position.

[0074] In certain embodiments, lid **500** includes a carrying feature **508**. Carrying feature **508** may be used to hang lid **500** or the entire cup assembly for display (e.g., in a retail environment) or for carrying the assembly between uses of the cup (e.g., attaching to a belt or back-pack). Carrying feature **508** may include a protrusion extending from.

[0075] FIG. 5B illustrates a schematic view of a reverse side of the lid **500**, in accordance with certain embodiments. On the reverse side, the lid **500** may include grooves **514**. In certain embodiments, the grooves **514** may be configured to fit with the interlocking features on the reinforcement insert and ensure interlock of the lid **500** with the reinforcement insert. Thus, liquids and/or other substances may be held inside the collapsible cup.

[0076] FIG. **6** illustrates a schematic view of a cover **600** for attaching to the lid shown in FIG. **5**, in accordance with certain embodiments. The cover **600** may include one or more handles **602***a* and **602***b* to help user to rotate the cover **600** with the cavity of the lid. Furthermore, the cover **600** includes openings **604** and **606**. Larger opening **604** may be used, for example, for colder beverages, beverages that are more viscous (e.g., yogurts, smoothies). Larger opening **604** may be sufficiently large to accommodate a straw through the opening. Smaller opening **606** may be used for hot beverages, when fast (e.g., accidental) discharge of liquids out of the cup is not desirable.

[0077] The cover **600** may also include an interlocking feature on underside of cover (not visible in FIG. **6**) for engaging with a corresponding interlocking feature on the lid and providing removable and rotatable attachment between the lid and the cover **600**. Furthermore, the cover **600** may include one or more positioning features for engaging with corresponding features of the lid and maintaining the position of the cover **600** corresponding to the selected flow orifice. Also a protruding bump may be located over the closed position location to further seal the cup in the closed position. The subsequent depressions on the lid are located in each of the three open positions to store the bump and lock into desired position.

[0078] The cover **600** may be made from a flexible polymer material to ensure sealing of interfaces between cover **600** and the lid. At the same time, the lid may be made from a rigid plastic material.

[0079] Although the foregoing invention has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced within the scope of the appended claims. It should be noted that there are many alternative ways of implementing the processes, systems and apparatus of the present invention. Accordingly, the present embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

What I claimed is:

1. A collapsible cup comprising:

a top cylindrical portion comprising a flexible plastic material,
  the top cylindrical portion comprising a sealing edge and a collapsible part;
a reinforcement insert comprising a first rigid plastic material,
  the reinforcement insert disposed within the top cylindrical portion between the sealing edge and the collapsible part; and
a bottom portion comprising a second rigid plastic material,
  the bottom portion forming a bottom of the collapsible cup,
  the bottom portion attached and sealed with respect to the top cylindrical portion,
wherein the collapsible part allows the sealing edge to move with respect to the bottom of the collapsible cup between at least:
an upper operating position, in which the top cylindrical portion and the bottom portion are extended with respect to each other resulting in a maximum cup height and forming a closed end cavity configured for storing contents; and
a lower collapsed position, in which the bottom portion is inserted into the reinforcement insert resulting in a minimum cup height.

2. The collapsible cup of claim **1**, wherein the collapsible part comprises a convex portion and a first concave portion, the first concave portion configured to fold thereby reducing the height of the collapsible part.

3. The collapsible cup of claim **2**, wherein the collapsible part further comprises a second concave potion, the second concave portion configured to fold thereby reducing the height of the collapsible part.

4. The collapsible cup of claim **3**, wherein the first concave portion and the second concave potion are configured to fold independently thereby resulting in at least one additional intermediate operating position.

5. The collapsible cup of claim **3**, wherein the convex portion provides space for folding of the first concave portion and the second concave potion creating a smooth surface that holds liquids or solids.

6. The collapsible cup of claim **5**, wherein the collapsible part further comprises an additional convex portion.

7. The collapsible cup of claim **1**, wherein the reinforcement insert comprises one or more interlocking features for engaging with a lid, the one or more interlocking features protruding through one or more opening in the top cylindrical portion.

8. The collapsible cup of claim **1**, wherein the sealing edge is formed by a ring of the flexible plastic material provided over the reinforcement insert.

9. The collapsible cup of claim **1**, wherein the flexible plastic material is permanently attached to the first rigid material and the second rigid material.

10. The collapsible cup of claim **1**, wherein the first rigid plastic material and the second rigid plastic material comprise high density polyethylene (HDPE), and wherein the flexible plastic material comprises a flexible polymer.

11. The collapsible cup of claim **1**, wherein at least one of the first rigid plastic material, the second rigid plastic material, and the flexible plastic material is transparent for detecting presence of liquid in the collapsible cup.

12. The collapsible cup of claim **1**, wherein the collapsible part has a variable thickness of the flexible plastic material along a height of the cup that allows the collapsible part to fold.

13. The collapsible cup of claim **1**, wherein the minimum cup height is less than about 2 inch.

14. The collapsible cup of claim **1**, wherein the cup is configured to store between about 2 ounces and 24 ounces of the contents in the upper operating position.

15. The collapsible cup of claim **1**, wherein the cup is configured to store the contents in the lower collapsed position.

16. The collapsible cup of claim **1**, further comprising a lid and a rotatable cover configured for sealing with the top portion, the rotatable cover configured to move between multiple positions with respect to the lid for controlling a size of a liquid delivery opening.

17. The collapsible cup of claim **16**, wherein the rotatable cover is configured to temporary stop and/or lock in at least three positions comprising a fully-closed position, an intermediate open position, and a fully open position.

18. The collapsible cup of claim **17**, wherein the lid comprises a ventilation aperture such that the ventilation aperture is aligned with one of openings in rotatable cover when the rotatable cover is in the intermediate open position or the fully open position.

19. The collapsible cup of claim **15**, wherein the rotatable cover is removably attached to the lid by a set of interlocking features.

20. A collapsible cup comprising:

a top cylindrical portion comprising a flexible plastic material,

the top cylindrical portion comprising a sealing edge and a collapsible part;

a reinforcement insert comprising a first rigid plastic material,

the reinforcement insert disposed within the top cylindrical portion between the sealing edge and the collapsible part;

a bottom portion comprising a second rigid plastic material,

the bottom portion forming a bottom of the collapsible cup,

the bottom portion attached and sealed with respect to the top cylindrical portion,

a lid; and

a rotatable cover configured for sealing with the top portion together with the lid,

the rotatable cover configured to move between multiple positions with respect to the lid for controlling a size of a liquid delivery opening,

the rotatable cover being removably attached to the lid by a set of interlocking features,

wherein the collapsible part comprises two concave potions configured to fold independently thereby allowing the sealing edge to move with respect to the bottom of the collapsible cup between at least:

an upper operating position in which the top cylindrical portion and the bottom portion are extended with respect to each other, resulting in a maximum cup height and forming a complete closed end cavity configured for storing contents;

additional intermediate operating position resulting in an intermediate cup height and forming an intermediate closed end cavity configured for storing contents, the intermediate closed end cavity being smaller than the complete closed end cavity; and

a lower collapsed position in which the bottom portion is inserted into the reinforcement insert resulting in a minimum cup height.

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