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(54) METHOD AND APPARATUS FOR PARTIALLY SUPER-COOLING A FLUID

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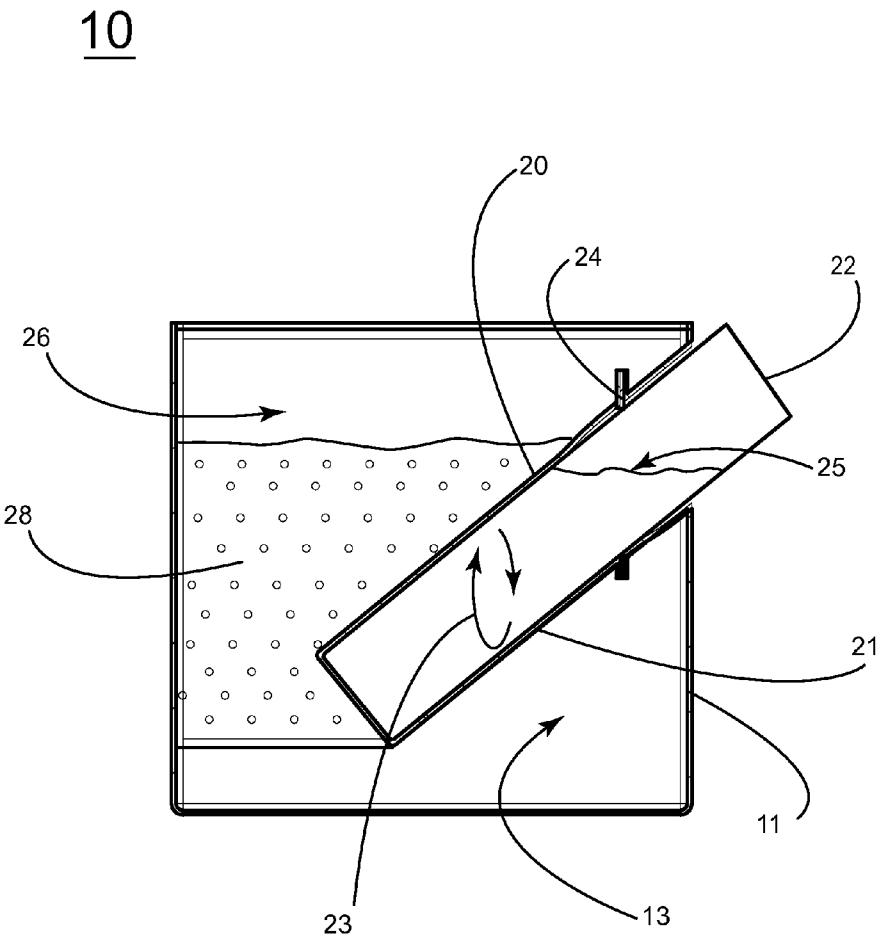
(57) **ABSTRACT**

The present invention relates to a method and apparatus for super-cooling a contained fluid by exposing a portion of the contained fluid to a cooling substance while leaving a portion of the contained fluid uncooled. The present invention works by causing both convection and super-cooling. A container includes at least three sections: an insulated upper chamber, referred to as a cooling chamber, which holds a cooling substance or refrigerating apparatus; a second, lower chamber, referred to as the uncooled chamber; and at least one hollow chamber that extends through and is in contact with both cooling and un-cooled chambers. The hollow chamber, referred to as a containment chamber, receives the contained (i.e., bottled or canned or otherwise contained) fluid that is to be partially super-cooled. A horizontal plane divides the cooling chamber and the uncooled chamber. In some embodiments the containment chamber is oriented at an angle to the horizontal plane, so that the containment chamber extends through the upper (cooled) and lower (uncooled) chambers.



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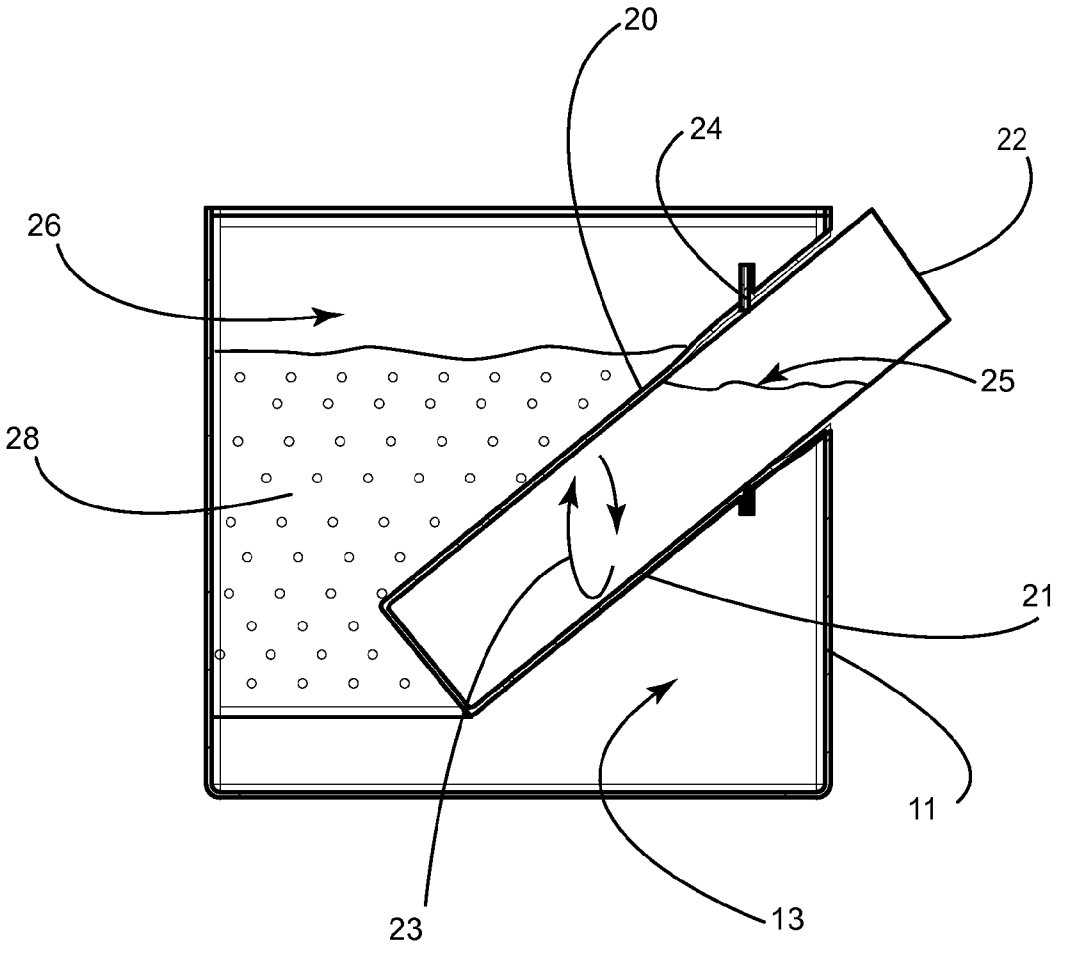

Figure 1

100

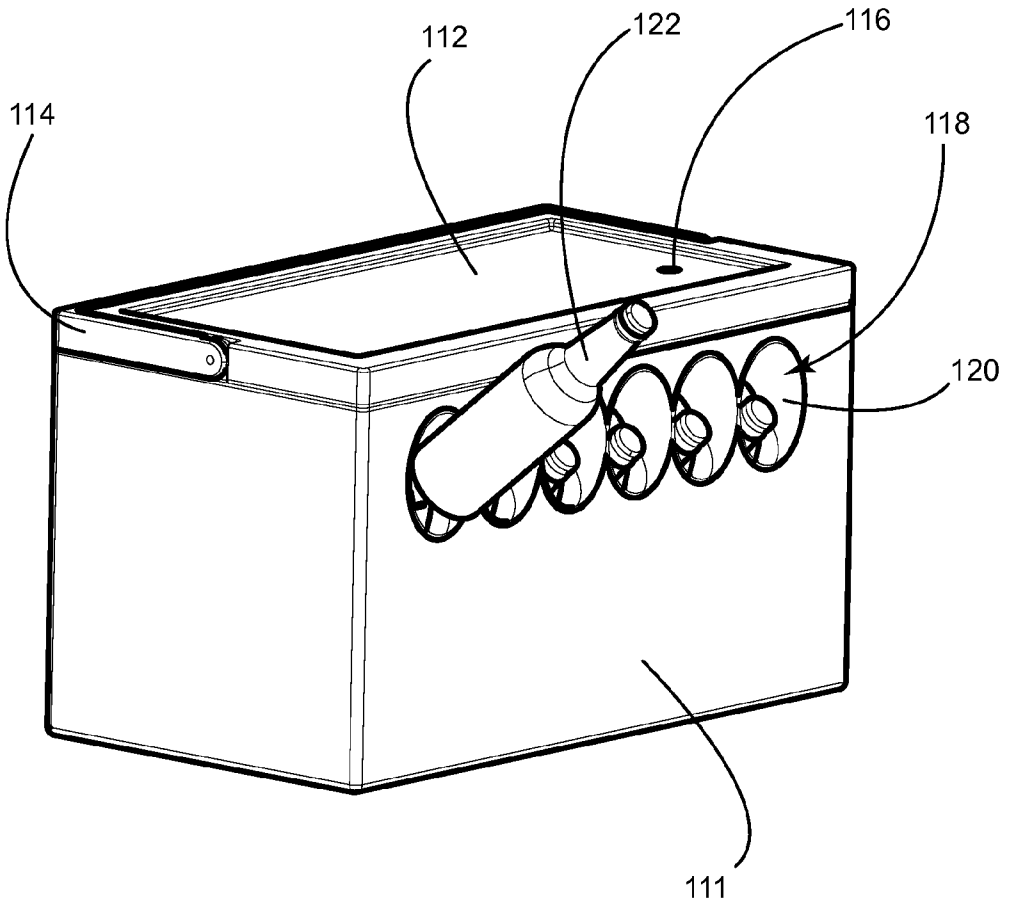

Figure 2

100

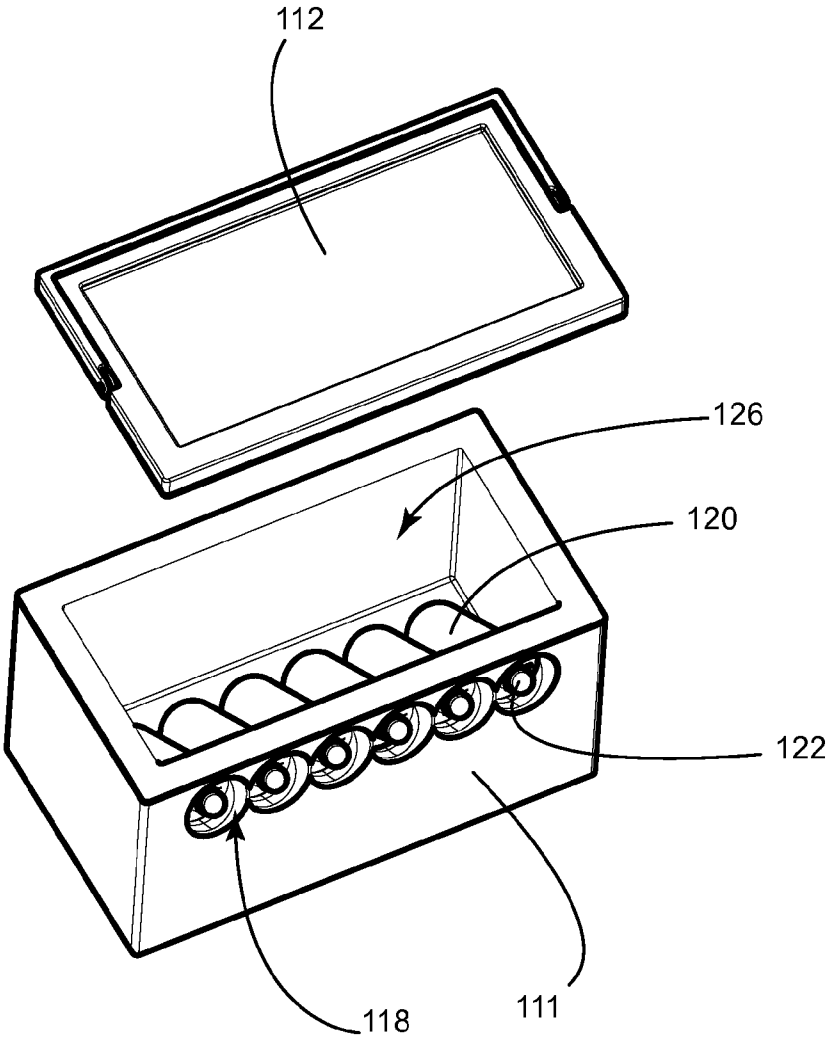

Figure 3

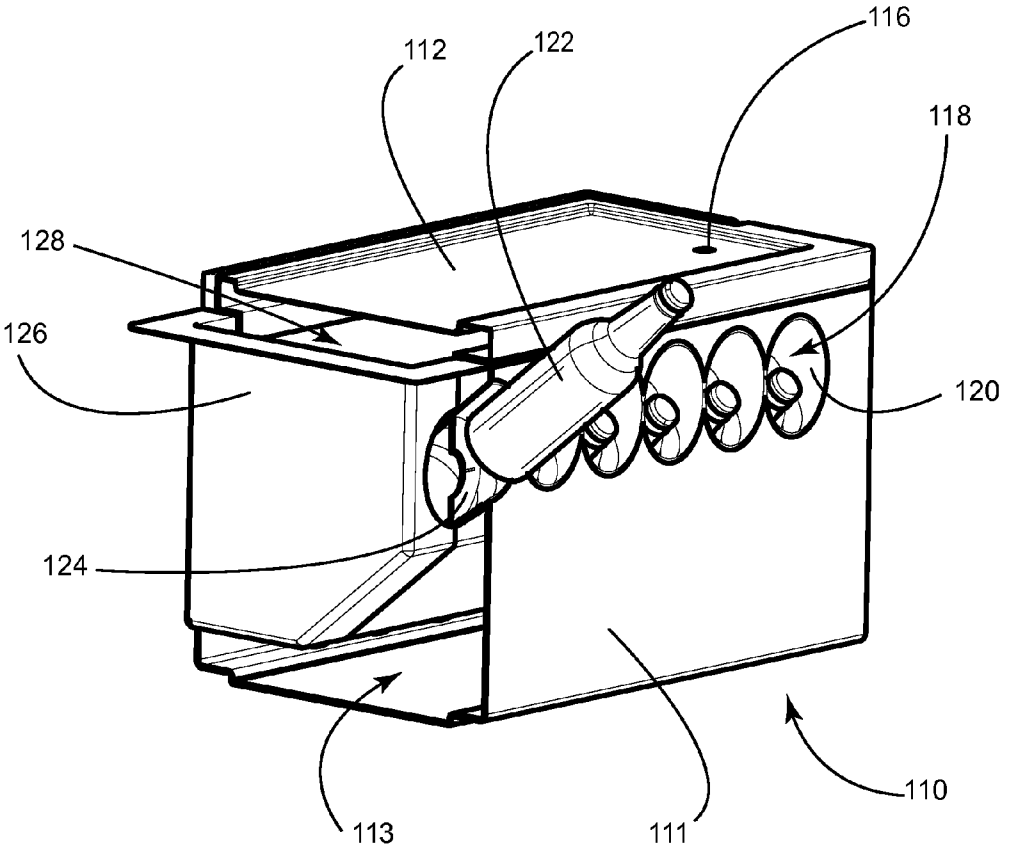

Figure 4

100

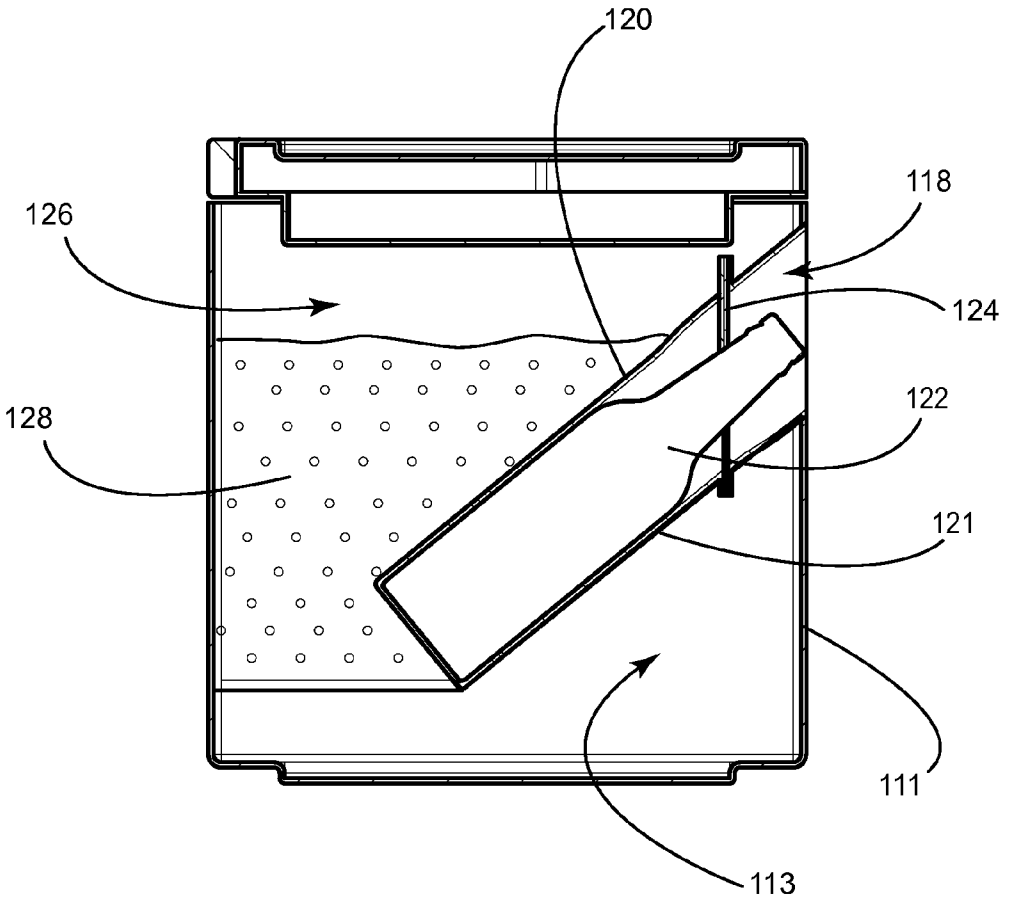

Figure 5

METHOD AND APPARATUS FOR PARTIALLY SUPER-COOLING A FLUID

FIELD

[0001] The present disclosure relates to a method and apparatus that partially cools a fluid below its freezing point while maintaining the fluid in a liquid state by exposing a portion of a fluid container to a cooling substance. The process of cooling a fluid below its freezing point while maintaining its liquid state is known as super-cooling. A liquid at a temperature below its freezing point will crystallize in the presence of a seed crystal. or nucleus, around which a crystal structure can form, thus creating a solid. However. lacking any such nucleus, the liquid phase can be maintained down to a temperature below the liquid's freezing point. For example, water normally freezes at 0 degrees Celsius or 32 degrees Fahrenheit, however it can also be super-cooled at ambient pressure to temperatures below −40 degrees Celsius or −50 degrees Fahrenheit if the water is free of nuclei, such as water that has been sufficiently filtered as to be devoid of particulate that might act as a seed crystal.

[0002] Contained fluids have been known to reach super-cooled temperatures when the container is smooth and devoid of foreign particulate and the fluid and container are exposed to a cooling means capable of reaching a temperature below the freezing point of the contained liquid.

[0003] Modern beverage containment methods include the manufacture of unique containers for each contained beverage. Health and safety standards often dictate beverage liquids to be of pure, filtered nature. Pure, filtered liquid in a new container tends to provide the necessary conditions for super-cooling to occur.

[0004] One embodiment of the present disclosure relates to portable containers that cause a contained fluid(s) to be super-cooled by the exposing a portion of the container to a cooling substance, such as a separately contained bath of rock-salt and ice.

SUMMARY

[0005] The present invention relates to a method and apparatus for super-cooling a contained fluid by exposing a portion of the contained fluid to a cooling substance while leaving a portion of the contained fluid uncooled.

[0006] A container includes at least three sections: an insulated upper chamber, referred to as a cooling chamber, which holds a cooling substance; a second, lower chamber, referred to as the uncooled chamber; and at least one hollow chamber that extends through and is in contact with both cooling and uncooled chambers. The hollow chamber, referred to as a containment chamber, receives the contained (i.e., bottled or canned or otherwise contained) fluid that is to be partially super-cooled. A horizontally oriented plane divides the cooling chamber and the uncooled chamber. In some embodiments the containment chamber is oriented at an angle to the horizontal plane, so that the containment chamber extends through the upper (cooled) and lower (uncooled) chamber(s).

[0007] The present invention works by causing both convection and supercooling. Convection is achieved by exposing only part of the contained fluid to a cooling substance. Placing the contained fluid in the invention's hollow containment chamber exposes the contained fluid to both the upper, cooling chamber and the lower, uncooled chamber; in this way the fluid becomes partially cooled. The partial cooling results in convection. That is, the contained liquid moves from a warmer to a cooler part of its container.

[0008] The action of super-cooling is achievable because contained fluids such as currently marketed bottled or canned beverages are of a purity that allows super-cooling. Super-cooling can occur when a fluid that is devoid of particulates is cooled to a temperature below its freezing or crystallization point. Any liquid devoid of particulates can be cooled to a temperature that is below that liquid's freezing point because it is the presence of particulates in liquids that allows the binding which leads to crystallization. Thus a contained fluid in a clean, smooth container—for example a bottled or canned beverage—could be super-cooled, dropping to a below-freezing temperature. The present invention receives such contained fluids and causes this super-cooling. Two aspects of the present invention, the super-cooling plus the aforementioned convection, keep the contained fluids in their super-cooled, liquid state. In a context of beverages, the present invention provides a container for super-cooling and storing a contained fluid (for example a beverage) for a convenient period of time in which beverages may be stored and consumed.

[0009] One skilled in the art will realize that a cooling substance may include a powered cooling system such as a refrigerant and compressor combination or may be a chemical combination that produces low temperatures such as rock salt and ice.

[0010] The present invention offers improvements to the prior art by permitting super-cooling of contained fluids to extremely chilled liquid states while avoiding solid freezing. It also keeps contained fluids separate from any cooling substance (such as ice-and-rock-salt mixtures), allowing, for example, enjoyment of a canned or bottled beverage which has no taste of rock salt, and with no unwanted ice or water on the beverage bottle or can.

The details of one or more variations of the instant subject matter are set forth in the accompanying drawings and the description below. Other features and advantages of the instant subject matter will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

[0011] The accompanying drawings, which are incorporated in and constitute part of this specification, show certain aspects of the instant subject matter and, together with the description, help explain some of the principles associated with the disclosed embodiments and implementations. One skilled in the art will understand that a container-apparatus can take various forms and shapes. It is described here as a rectangular volume for purposes of simplicity. In the drawings:

[0012] FIG. **1** is a side diagrammatic view of an example of the embodiment of the present disclosure.

[0013] FIG. **2** is a left, front, perspective view of an example of the embodiment of the contained-fluid-cooling apparatus.

[0014] FIG. **3** is a top-perspective, partially exploded view of an example of the contained-fluid-cooling apparatus.

[0015] FIG. **4** is a perspective, partial cutaway view of an example of the contained-fluid-cooling apparatus.

[0016] FIG. **5** is a side, orthographic section view of an example of the contained-fluid-cooling apparatus.

DETAILED DESCRIPTION OF DRAWINGS

[0017] FIG. **1** is a cross-section of the present embodiment **10**. An apparatus and method for cooling a portion of a contained fluid is described. The fluid-cooling apparatus comprises an enclosure **11**. The enclosure **11** further comprises an upper chamber **26** and a lower chamber **13**. A containment chamber **22** is partially surrounded by walls of the upper chamber **20** and is further surrounded by walls **21** of the lower chamber **13**. A cooling substance creates a bath **28** contained within the upper chamber **26**. The bath is capable of producing temperatures below the freezing point of the fluid to be cooled. The lower chamber **13** remains empty or uncooled. Fluid **25** in the containment chamber **22** is partially cooled by being partially surrounded by the cooling bath **28** which surrounds the upper portion of the containment chamber **22**. The portion of the containment chamber **22** that is in contact with the wall **21** is not cooled. By convection, fluid **25** in the containment chamber **22** will move from relatively warmer areas to relatively cooler areas as illustrated by arrows **23**. A liquid of significant water composition in a clean, smooth container, devoid of particulate that may cause crystallization, in combination with movement of the fluid caused by the aforementioned convection, will be cooled below the freezing point of the liquid while maintaining a liquid state.

[0018] Gaskets **24** reside between walls **21** so that the majority of the containment chamber **22** and the fluid **25** contained therein is insulated from ambient temperature. The containment chamber **22** is made of a rigid material that conducts cold from the cooling bath **28** to the interior of the containment chamber **22**, which holds the contained fluid **25**. The cooling chamber partially cooling the contained liquid **25** below its freezing temperature, in conjunction with the empty lower chamber **13** provide a cool liquid for a significant duration of time, a greater period of time than if the contained fluid were submersed entirely in a cooling substance.

[0019] FIG. **2** shows a portable, contained-fluid-cooling apparatus **100** in its closed state with lid **112** on and handle **114** folded down. On at least one side of the outer chamber **111** at least one opening **118** joins with an integrated containment chamber **120**. The integrated containment chamber **120** is shaped to hold contained fluids, for example canned or bottled beverages **122**. A vent **116** provides a means of relieving pressure between the interior of the apparatus and the ambient pressure so as to allow for easy lid-opening, as a cooling process on the interior of the apparatus tends to create a pressure differential.

[0020] FIG. **3** shows the portable, contained-fluid-cooling apparatus **100** with its lid **112** removed. The upper portions of the integrated containment chamber **120** meet the upper chamber **126**. An opening **118** in the outer chamber **111** receives a contained fluid **122** such as a canned or bottled beverage.

[0021] FIG. **4** is a partial cutaway view of the apparatus **100** showing contained fluids **122** placed as intended in the integrated containment chamber **120** so that the contained fluids **122** are cooled by contact with a cooling bath **128** which surrounds a portion of the integrated containment chambers **120** in the upper chamber **126**. Thus only the upper portion of the contained fluid **122** is cooled.

[0022] Gaskets **124** integrated with the integrated containment chambers **120** create a seal between the interior of the containment chambers and the exterior of the contained fluids so as to keep the contained fluids **122** insulated from the ambient temperature. The integrated containment chambers **120** are made of a rigid material that conducts cold from the cooling bath **128** to the interior of the integrated containment chambers **120**. where the contained fluids **122** are stored. On at least one side of the outer chamber **111** at least one opening **118** joins with an integrated containment chamber **120**. The integrated containment chamber **120** is shaped to hold contained fluids **122**, for example canned or bottled beverages. A gasket **124** makes a seal between the integrated containment chamber **120** and contained fluid **122**. The integrated containment chambers **120** extend from an opening **118** in the outer chamber **111** into the inside of the upper chamber **126** and the lower chamber **113**.

[0023] FIG. **5** is a cross-section of the present embodiment **100**. An apparatus and method for cooling a portion of a beverage container is described. The fluid-cooling apparatus **100** comprises an enclosure **111**. The enclosure **111** further comprises an upper chamber **126** and a lower chamber **113**. A containment chamber **122** is partially surrounded by walls of the upper chamber **120** and is further surrounded by walls **121** of the lower chamber **113**. A cooling substance creates a bath **128** that is capable of producing temperatures below the freezing point of the fluid to be cooled, and is contained within the upper chamber **126** while the lower chamber **113** remains empty and uncooled. A beverage container **122** in the containment chamber **118** is partially cooled by being surrounded by the cooling bath **128** which surrounds the upper portion of the containment chamber **122**. The portion of the containment chamber **122** that is in contact with the wall **121** is not cooled.

We claim:

1. An apparatus for partially super-cooling a contained fluid, comprising:

(a) at least one upper chamber and at least one lower chamber, between which at least one receptacle for a contained fluid resides;

(b) a horizontally oriented plane separating the upper chamber and the lower chamber,

(c) the upper chamber engaged with a cooling means;

(d) the receptacle engaged with both upper and lower chambers;

(e) the receptacle engaged with both upper and lower chambers containing a fluid, allowing the contained fluid to be in partial contact with the cooling substance, providing partial super-cooling of the contained fluid.

2. The apparatus of claim **1** in which the receptacle is a cylindrical, longitudinal form.

3. The apparatus of claim **1** wherein the receptacle has an inner surface and an outer surface and a longitudinal axis that is inclined at an angle to the horizontally oriented plane.

4. The apparatus of claim **3** wherein the angle is between 20 and 80 degrees.

5. The apparatus of claim **1** comprising a plurality of receptacles, each having an inner surface, an outer surface, and a longitudinal axis; with an axis disposed at an angle between 20 and 80 degrees on said horizontal plane; further comprising said inner surface surrounding an area sufficient to receive a contained fluid.

6. The apparatus of claim **5** wherein the contained fluid is a canned or bottled beverage.

7. The apparatus of claim **5** wherein the receptacle comprises a gasket that seals between the inner surface of the receptacle and the outer surface of the contained fluid; therefore providing a barrier between the ambient air and the inside of the receptacle.

8. A method of partially super-cooling a contained fluid, comprising:

a. obtaining a contained fluid, and

b. inserting the contained fluid into the apparatus of claim **1**.

9. The method of claim **8**, wherein the contained fluid is a canned or bottled beverage.

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