Nov. 15, 1966 J. M. WARNER 3,285,033

SELF-CONTAINED REFRIGERATING SYSTEM

Original Filed Nov. 6, 1963

FIG. 3.

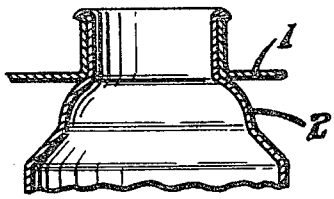


FIG. 4.

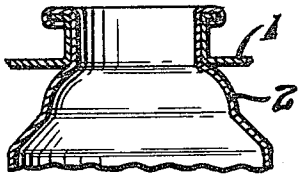


FIG. 5.

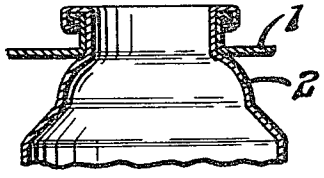


FIG. 6.

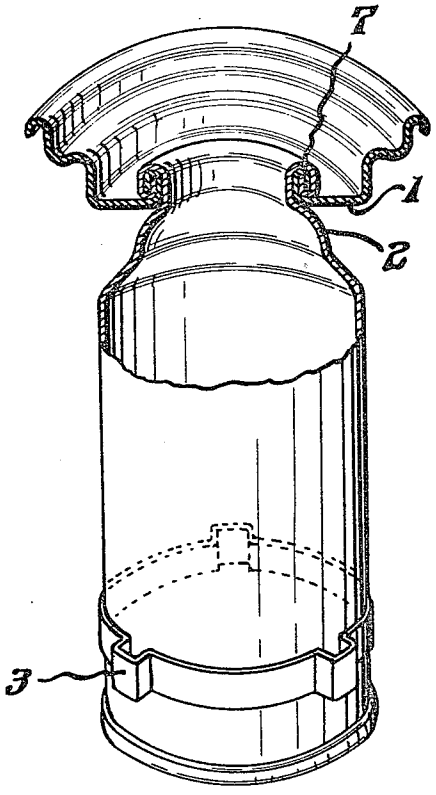


FIG. 7.

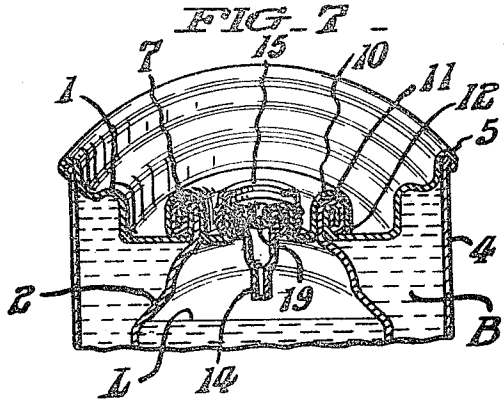


FIG. 1.

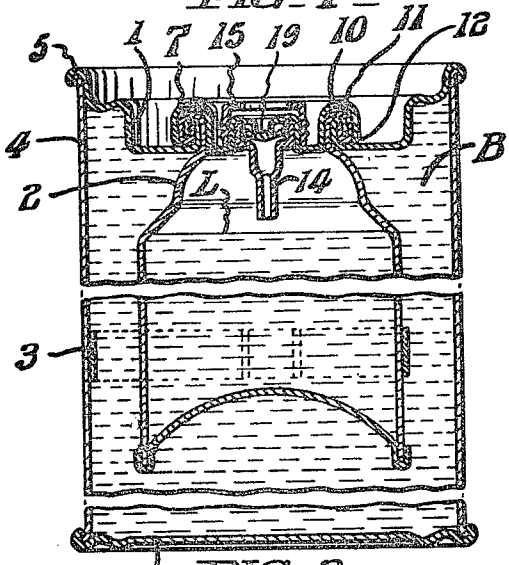
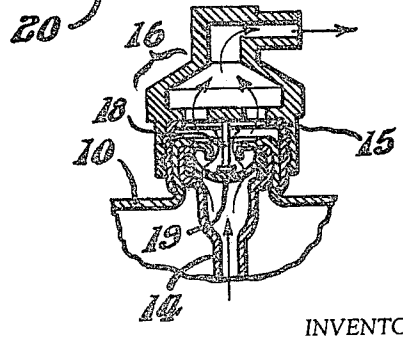


FIG. 2.



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SELF-CONTAINED REFRIGERATING SYSTEM

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Original application Nov. 6, 1963, Ser. No. 321,792. Divided and this application Jan. 7, 1966, Ser. No. 519,275

2 Claims. (Cl. 62—371)

This invention relates to self-contained refrigerating systems and more particularly to noncyclic self-contained refrigerating systems. This application is a division out of copending application Serial No. 321,792, filed November 6, 1963, now abandoned.

There has long been a need for a simple means of cooling the contents of containers, particularly where there is no convenient source of power for operating commercial refrigerating systems or it is burdensome to maintain a cold environment by means of ice chests etc. for objects which are desirable when cold.

Picnickers, golfers, campers, fishermen, hunters and others who enjoy participating in outdoor activities have particular need for a small, portable beverage container having a light weight and automatic means for cooling the beverage itself.

It is therefore an object of this invention to provide a means for efficiently cooling the contents of a beverage container. It is a further object of this invention to provide such cooling with a minimum of inconvenience to the user of the beverage.

The above and further objects of this invention will further become apparent hereinafter and in the drawings, of which:

FIG. 1 is a cross-sectional view of a device embodying this invention, a central portion being broken away.

FIG. 2 is a detailed cross-sectional view of one form of valve which is suitable as a component of the device.

FIGS. 3, 4, 5 and 6 are fragmentary sectional views of successive stages in the formation of the upper portion of a container in accordance with this invention.

FIG. 7 is a fragmentary view in perspective of the completed upper portion referred to above.

Referring now specifically to the embodiment of the invention selected for illustration in the drawings. FIG. 1 shows an outer container **4** having a top **1** and a bottom **20**, which contains the beverage B. The number **2** designates an inner container which is a pressure container of stronger construction than the outer container, which is substantially completely full of a liquefied coolant under pressure, having a liquid level L. As will be seen, a spacer **3** is provided intermediate the inner and outer containers in order to maintain the lower portion of the inner container **2** in a predetermined fixed position.

The top **1** of the outer container **4** is sealed to the side wall at **5** and is also sealed to the inner container by means of the seal **7** which runs completely around the periphery of the upper portion of the inner container. Located at the center of the top of the inner container is a vent pipe **14** which is swaged into the upwardly flanged inner portion of a closure member **10** which covers the top opening of the inner container and is crimped to the seal **7**, as at **12**. Suitable gasketing material **11** is interposed between the rolled metal flanges at the seal **7** in order to assure a fluid-tight fit between the inner and the outer containers. The vent pipe **14** is provided at an upper portion thereof with a valve member **19**, of the self-closing variety, shown in a depressed position. The valve member **19** is protected from the outside by means of a cap **15** which is crimped onto the central assembly of the closure member **10**.

Turning now to FIG. 2 of the drawings, it will be seen that valve means are provided for controllably releasing the fluid under pressure from the inner container **2**. This

means comprises a valve actuator generally designated **16**, screwed onto the cap **15**. The valve actuator **16** is provided with a stem **18** which is arranged to contact the valve member **19** in order to open the valve in response to a turning movement of the valve actuator **16**. The top **1** is suitably corrugated recessively toward the center and the cap **15** and valve actuator **16** are preferably so proportioned such that the valve actuator **16** is completely recessed below the outward top rim of the outer container **4**.

Accordingly, in operation when the user of the device desires to cool the beverage B, he simply turns the valve actuator **16**, thus depressing valve member **19** and controllably releasing gas from the upper portion of the inner container **2**. The release of gas allows for vaporization of liquid at the liquid level L, and continuous vaporization of the liquid takes place until the supply of liquid is exhausted or until the valve member **19** is closed. The heat required for this vaporization is absorbed from the remaining liquid and the container **2** which in turn absorbs heat from the beverage B, rapidly cooling it.

It is important in accordance with this invention that the valve member **19** is located above the liquid level L to release the coolant in vapor form rather than in liquid form since the cooling effect in accordance with this invention is dependent upon the absorption of the latent heat of vaporization of the liquid in the inner container **2**. In addition to the heat of vaporization, this invention also takes advantage of the heat absorbed due to the expansion of the gas.

It will be appreciated that this invention takes advantage of convection, since as the liquid coolant absorbs heat from the beverage it cools the beverage adjacent the surface of container **2** and the cooled beverage descends along this surface thus setting up convection currents which increase the rate of heat transfer from the beverage to the inner container **2**.

It is important in accordance with this invention that the container **2** is substantially surrounded by the container **4**, with an intervening layer of beverage to be cooled. The heat of vaporization plus the heat of expansion of the liquid coolant is so great that the temperature at the surface of the container **2** would drop to a value so low as to give the user frostbite in many cases, if the container **2** were exposed to the touch.

FIGS. 3–7 show a preferred method of assembling the apparatus according to this invention. In FIG. 3 the members **1** and **2** are shown in overlapping relationship, and in FIG. 4 they are rolled down forming an upper, outwardly extending flange. FIG. 5 shows the outwardly extending further rolled down, and FIG. 6 shows the entire vertically extending flange turned down upon itself forming the seal **7**. FIG. 7 shows the resulting sealed structure, with the beverage in the outer container and with the liquid coolant in the inner container, and with the valve assembly secured in place and the cap **15** crimped in place.

The method of forming and filling the container in accordance with this invention is of importance. The structure is preferably formed in the sequence illustrated in FIGS. 3, 4, 5, and 6, and the cylindrical portion of the outer container **4**, without any bottom **20**, is sealed to the top **1**, by means of the seal **5**. The outer container **4** is then filled with beverage through the bottom and the bottom **20** is then sealed in place. Then, the liquid coolant is charged into the inner container **2** in a conventional manner and the valve assembly and the cap **15** are crimped in place. The valve actuator **16** is then assembled in a proper position, ready for operation in conjunction with the valve member **19**.

It is an advantage that the inner container is seamed to only one end of the outer container. In this manner, the

entire bottom of the inner container is available as a heat transfer surface and this speeds the cooling of the beverage B.

Although any suitable liquefied gas refrigerant may be utilized, excellent results have been obtained in accordance with this invention, utilizing the fluorinated hydrocarbon referred to in the trade as "Freon," particularly "Freon 12," which is dichlorodifluoromethane.

It will be appreciated that many variations may be made without departing from the spirit or scope of this invention. For example, although it is desired to provide a valve actuator **16** which may be screwed and unscrewed in order to open and close the valve, and although this is of great advantage in allowing the user to prevent overcooling of the beverage, in some cases it is possible to utilize a simple "one-shot" valve which simply opens up and emits all of the liquefied gas vapors.

It will be appreciated that various changes may be made in the materials used in the containers such as a substitution of glass for metal or plastic or the like. Further, changes in shape may be made, for example, the outer container may be in the shape of a bottle.

Further, variations may be made in the sequence of steps used in the method, for example, inner container **2** may be assembled to top **1** as shown in FIG. 6 with the valve assembly already in place and then charged with liquefied refrigerant. This assembly may be charged before or after outer top **1** is sealed to outer can **4**. Also, the liquefied refrigerant may be introduced prior to the insertion of the valve assembly. Of course, other variations may be made when desired.

Although this invention has been described with particular reference to a preferred embodiment thereof, it will be appreciated that various modifications may be made without departing from the spirit or scope of the invention. For example, equivalent elements may be substituted for those shown and described, certain parts may be used independently of the use of other parts, and parts may be reversed and assembly and filling sequences may be reversed all without departing from the spirit and scope of the invention as defined in the appended claims.

The following is claimed:

1. A self-cooling beverage container comprising an outer container containing a beverage to be cooled, an inner container substantially completely surrounded within and substantially completely spaced from said outer container, said inner container being a pressure container of substantially stronger pressure resistant construction than said outer container, said inner container containing a charge of liquid refrigerant under pressure and forming a liquid level therein, said inner and outer containers having sheet metal extensions which are sealed to one another inwardly of the periphery of the outer container in such manner that even if leakage in the seal should occur, neither container can leak into the other through such leaking seal, said seal being formed of parallel upper sealing extension of said sheet metal inner and outer containers positioned against one another, and including an inner axial portion disposed generally axially with respect to the container, an end portion disposed in an outwardly extending arc, an outer axial portion arranged generally axially outwardly of said inner axial portion, said extension of said inner container having an end portion which is curled inwardly and upwardly within the end of the sealing extension of the outer container.

2. The apparatus defined in claim **1** wherein another sheet metal member is located at the end of the outer container located inwardly of the seal, and has a sealing extension which extends upwardly over both said sealing extensions and curls outwardly and downwardly and terminates with its edge substantially adjacent the outer surface of said end of said container.

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