PORTABLE COOLING UNIT

Inventor: Javid Jalali (Karchay), 309 N. Maidson, Monrovia, Calif. 91016

Filed: Jan. 10, 1975

Appl. No.: 540,071

Foreign Application Priority Data
Jan. 11, 1974 Australia........................................ 6227/74


Int. Cl²................................. F25D 3/12

Field of Search ........ 62/59, 76, 330, 384, 388, 62/45, 10, 35, 385

References Cited
UNIVERSAL STATES PATENTS
1,556,734 10/1925 Taylor................................. 62/384

Claim 1

1. A portable cooling unit employing dry ice formed in situ as a refrigerant. The dry ice is formed in at least one hollow block within the unit by releasing pressurized liquid CO₂ through apertures in the hollow block.

5 Claims, 4 Drawing Figures

Primary Examiner—William J. Wye
Attorney, Agent, or Firm—Christie, Parker & Hale

ABSTRACT

A portable cooling unit employs dry ice formed in situ as a refrigerant. The dry ice is formed in at least one hollow block within the unit by releasing pressurized liquid CO₂ through apertures in the hollow block.
PORTABLE COOLING UNIT

BACKGROUND OF THE INVENTION

This invention relates to cooling units. There is a large and growing need for a lightweight and inexpensive cooling unit. This is especially so in recreational industries such as boating, recreational vehicles and the like. In one type of prior art device, frequently used in pleasure boats and in recreational vehicles, a refrigeration unit is provided that requires a source of electrical power to operate motors or compressors. One specific type uses compressors to compress refrigerant gases. This system is based on the principle that an expanding gas absorbs heat. Other specific types require the motors to manufacture solid refrigerants. All of the foregoing types suffer from the disadvantages that they are cumbersome, usually heavy, and need a continuous supply of power.

According to another prior art approach to cooling, solid refrigerants are packed into an insulated chamber to cool the chamber. Perhaps the most common of these is the styrofoam ice chest. This type of unit is of course sufficiently compact and lightweight for portability; however, it is disadvantageous in other respects. For example, the refrigeration effect does not last very long. In many cases, the refrigerator is more rapidly spent each time the unit is opened to gain access to the materials being cooled. And, after the refrigerator is spent there is in some cases liquid left to be removed. Thus, if the refrigeration unit is required for use over the span of several days at a time, or for intermittent use over an extended period in remote areas, a supply of solid refrigerants must be on hand at the required time.

In addition to the principles underlying the above-described prior art units, there are certain principles concerning dry ice that bear mention here. Dry ice is very cold (it sublimes at \(-110^\circ\text{F}\)) and thus is very effective as a refrigerant. However, because it is so cold, it presents a hazard in handling. In particular, unless gloves are used when handling it, one can easily burn his fingers. Another disadvantage to its use in an ice chest is that the evaporated \(\text{CO}_2\) can contaminate certain foods and thus give them a foul taste. The foregoing disadvantages have been so substantial as to outweigh certain other advantages. Among these advantages are the face the \(\text{CO}_2\) is an abundant resource. For example, cylinders of pressurized liquid \(\text{CO}_2\) are commercially available at reasonable cost. Also, it is known that dry ice can be formed by releasing the pressurized liquid \(\text{CO}_2\) through a device not unlike a bathroom shower head.

SUMMARY OF THE INVENTION

This invention overcomes the disadvantages discussed above and provides a portable cooling unit having remarkable advantages over prior art units. The portable cooling unit comprises an insulated container having first and second compartments therein and means defining a separating wall between the compartments. The first compartment provides storage space. In an embodiment adapted for use in the manner of an ice chest, the first compartment is deep enough to store such articles as soda bottles and the like. The second compartment has at least one hollow block concealed therein for containing dry ice formed in situ. Owing to the concealment of such hollow block and further owing to the in situ formation of the dry ice, the hazards that otherwise would accompany the use of dry ice as a refrigerant are overcome. Also, owing to the separating wall, the evaporating \(\text{CO}_2\) is not vented into the storage compartment, this precluding the contamination problem discussed above.

The second compartment further has a conduit therein for carrying liquid \(\text{CO}_2\) under pressure. An exhaust port exposes the second compartment to atmospheric pressure. A fitting is provided on the container to provide access to one end of the conduit. This enables an external cylinder containing liquid \(\text{CO}_2\) to be connected through tubing to the conduit. Each hollow block has an inlet port connected to the conduit for the liquid \(\text{CO}_2\), and has a plurality of apertures each for exposing liquid \(\text{CO}_2\) within the hollow block to the pressure existing in the second compartment so as to provide for the formation of dry ice inside the hollow block.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating the manner in which a portable cooling unit according to the invention is charged through connection to a cylinder of compressed \(\text{CO}_2\); FIG. 2 is a perspective view, partly broken away, of a hollow block and associated distribution conduit which are concealed in a refrigerant compartment in accordance with this invention; FIG. 3 is a vertical central cross-section of the portable cooling unit of FIG. 1; and FIG. 4 is a vertical central cross-section of an alternate embodiment of a portable cooling unit.

DETAILED DESCRIPTION

One specific embodiment of a portable cooling unit according to this invention takes the form of a chest generally indicated at 1 (FIG. 1). The chest or container 1 comprises a bottom portion 2 and a removable lid 3. A fitting 5 is provided at the base of the bottom portion 2. The fitting 5 mates with a conventional fitting 7 to provide for a releasable connection through tubing 9 to a standard cylinder 11 of compressed liquid \(\text{CO}_2\).

As best shown in FIG. 3, a wall 15 separates the interior of the container 1 into two compartments, one being an upper or storage compartment 17 and the other being a lower or refrigerant compartment 19. Preferably, the wall 15 has a configuration such as to define a cap whereby the lower compartment is generally T-shaped in vertical central cross-section.

The lower compartment 19 has a distribution conduit 21 therein for carrying liquid \(\text{CO}_2\) under pressure. One end of the conduit terminates at the fitting 5. An exhaust port 22 exposes the lower compartment to atmospheric pressure.

A key feature of the invention is the employment of at least one concealed hollow block in which dry ice is formed in situ. In the container 1, there are three such hollow blocks 23, 24, and 25. The number of such blocks and the size of each is related to overall size of the container 1. A convenient overall size from the point of view of easy portability is about that which is commonly used in the conventional styrofoam ice chests. For example, the overall exterior dimensions may be about 2 feet long by about 1 1/2 feet wide by about 1 1/2 feet deep. It is desirable to provide sufficient
depth so that there can easily be stored in the storage compartment such food items as 16 oz. soda bottles.

To form the dry ice, the fittings 7 and 5 are interconnected. Then, a valve on the cylinder 11 is opened so that liquid CO₂ is discharged from the cylinder to be carried under pressure through the tubing 9 so as to be distributed by the conduit 21. Each hollow block has an inlet port for receiving the liquid CO₂. When the liquid CO₂ reaches the hollow block, a portion of it is released from the hollow interior thereof through a plurality of spaced-apart apertures (FIG. 2). Thus, some of the liquid CO₂ sprays out of the interior of the hollow block and its pressure is sufficiently reduced that a portion of it expands rapidly and absorbs sufficient heat from the rest of it whereby there is a change of phase from liquid to solid (dry ice).

The dry ice so formed is very cold (its sublimation temperature is −110°F), and thus is very effective as a refrigerant. With a suitably insulated container, its refrigeration effect is long-lasting. Because the dry ice is so cold, it is preferable to use a metal material in constructing the hollow blocks. Aluminum in particular is advantageous here owing to its light weight and relative low cost. The separating wall 15 is preferably metal also to ensure that as the dry ice evaporates it does not enter the upper compartment and cause contamination. Instead, the evaporated dry ice is simply exhausted through the conduit 21 and open fitting 5.

The illustrated configuration of the wall 15 is preferred because it enables one of the concealed blocks (25) to be oriented upwardly. With this block providing a cooling effect from the side, in the compartment 17 on opposite sides of this block especially cold zones result and foods such as ice cream can be effectively kept cold therein. The illustrated configuration of the perforated surface of the hollow block is employed to ensure high efficiency in converting CO₂ from liquid to solid phase. As to the size and number of the apertures, it is believed that from the point of view of high efficiency, the more and smaller the apertures the better. For example, it is suitable to make each perforation about ¼ mm diameter, and space them apart from each other by about ½ mm. It is important that the pressure of the liquid CO₂ be maintained sufficiently high in the conduit that dry ice is not formed therein. If it did, it would impede the flow toward and through the apertures.

It will be appreciated that various modifications within the scope of this invention can be made to the specific embodiment illustrated in FIGS. 1–3. For example, the overall configuration of the container can be such as that shown in FIG. 4 so as to be suitable for use as a portable water cooler. In such case, a tap 40 would be provided so that the cold water or other liquid can be dispensed therefrom as needed.

I claim:
1. A portable cooling unit comprising:
   an insulated container having first and second compartments therein and means defining a wall between the compartments; the first compartment for storing material to be cooled; the second compartment having at least one hollow block concealed therein for containing dry ice formed in situ, and further having a conduit therein for carrying liquid carbon dioxide under pressure;
   an exhaust port exposing the second compartment to atmospheric pressure;
   a fitting on the container and communication with one end of the conduit for releasable connection to external tubing through which the liquid carbon dioxide is supplied; and
   each hollow block having an inlet port connected to the conduit for the liquid carbon dioxide to flow through into the hollow block, and having a plurality of apertures each for exposing liquid carbon dioxide in the hollow block to the pressure existing in the second compartment so as to provide for the formation of dry ice inside the hollow block.
2. The cooling unit of claim 1 wherein each hollow block is constructed of metal.
3. The cooling unit of claim 2 wherein the separating wall is metal.
4. The cooling unit of claim 1 wherein the separating wall is shaped to define a cap extending into the first compartment, and wherein at least one hollow block is disposed in the cap.
5. The cooling unit of claim 1 wherein the first compartment provides for storing a liquid, and a tap is provided for dispensing the liquid.

* * * *