

SELF-COOLING DEVICE FOR BEVERAGES

Field of the Invention

- 5 The present invention relates to the field of self-cooling device for beverage containers. More particularly, it relates to a self-cooling device which cools a container of beverage, without using an external connection to a power source to cool the beverage in the said beverage container. Self-cooling or self-chilling beverage containers would allow users obtain a cooled beverage,
10 without the requirements of an additional component, such as ice, in the outdoors.

Background and Description of the Prior Art

- 15 There have been many inventions and patents for a self-cooling beverage container. The direction taken by inventors in the past can be in any one of these approaches:-

- (A) Inventions proposing endothermic or exothermic chemical reactions to
20 produce a chilling or cooling effect in the beverage.

- (B) Inventions proposing use of refrigeration effect by compression and expansion of a liquefied gas causing heat to be absorbed, producing a refrigerating effect in the beverage.
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- (C) Inventions proposing use of desiccant absorbing agents and water to produce a cooling effect on the beverage.

- (D) Inventions proposing use of portable power source to cool the beverage.
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- (E) Inventions proposing use of natural evaporative/cooling process (without power/chemical means) to cool the beverage.

The first group of devices generally requires two or more chemicals to be combined quickly to produce an endothermic or exothermic reaction. An example of an endothermic type chiller is the ICE PACK. The ice pack is a product that uses ammonium nitrate and water to absorb heat rapidly for emergency cooling in medical applications. Several devices depend on similar endothermic reactions to produce a chilling effect that can be put to effective use for commercialization.

The second group of devices generally relate to chilling devices. The household refrigerator belongs to this group of devices. The refrigeration effect occurs when a compressed and liquefied gas is expanded through a small tube. The evaporation of the liquefied gas to a gaseous state causes considerable heat to be absorbed through the walls of the expansion tube, thereby producing a refrigeration effect.

The third group of devices use desiccant absorbing agents and water. Typically, a water gel is smeared on the inside walls of a first sealed and evacuated chamber. A second sealed chamber contains a desiccant that absorbs the water vapour. By opening a small passage way between the first chamber and the second chamber, rapid vaporization of the water in the first chamber occurs, resulting in cooling. The absorbing desiccant usually heats up to a high temperature due to the heat of condensation of water vapour removed from the first chamber. Both a heating and cooling effect may be obtained by this method.

The fourth group of devices relies on well-known electrical effects for both heating and cooling.

Devices of the first group (chemical endothermic and exothermic reactions) generally rely on toxic and environmentally unfriendly chemicals. They have not been successfully used in the commercial applications for either the food

or the beverage industries. Devices of the second group require very bulky pneumatic circuits, and cannot economically be used in small containers such as beverage cans or food cans. Devices of the third group have been applied in some food and beverage applications but only under expensive research programs. Even so such devices still do not appear to hold any promise of commercialization due to the expensive designs involved and the toxic nature of the chemical desiccants involved.

Containers for beverages are known in which the components of this chemical reaction are arranged separately in respective compartments of a chamber formed between a first receptacle, containing the beverage, and a second outer receptacle into which the first receptacle is inserted. The components mentioned above generally consist of a liquid and a salt, present in granular form, and the reaction between them is initiated by tearing a diaphragm separating the two compartments, for example by means of a breaking device integral with an inward-flexible base of a second receptacle.

The approaches taken seem to be a self-cooling or self-chilling beverage container. Even though there are many inventions for such a product, these suffer from a number of disadvantages:-

- high unit production cost leading to a high retail price for a one-time use
- ecological damage caused by the self-cooling unit in the beverage container
- problems in re-cycling the beverage container due to existence of self-cooling unit
- use of chemicals to produce a cooling reaction causing possible contamination of the beverage

There are some self-cooling devices using Peltier effect to cool beverages.

Such uses for devices using the Peltier effect include small applications as small as a beverage cooler which is powered by a laptop using the USB wire. However such devices are not effective in cooling beverages due to their extremely low efficiency in using electrical energy to create a thermodynamic effect.

The inventor has observed that while there is great interest in such an invention, there does not seem to be any viable product meeting the requirements for a self-cooling or self-chilling beverage container. The inventor has taken a different approach to propose a self-cooling or self-chilling device for beverage containers. Such an invention would not only meet the requirement for a beverage to be self-cooling or self-chilling, but also meet these criteria too:-

Practical,
cost effective,
simplistic design
easy to use,
safe for use, and
does not contaminate the beverage contents or the environment

What is needed, therefore, is a new approach for a self-cooling unit for a beverage container that is portable, and provides a self-contained cooling means without the need to freeze or chill the container or beverage first. It is also desirable to have such a container efficiently cool a beverage within the beverage container without the need to cool the surroundings of the beverage container in the process. It is further desirable that such a self-cooling unit be re-usable to offset the costs of such a self-cooling unit.

What is more desirable is if the self-cooling or self-chilling unit can be portable and re-usable so that with sufficient power sources, it has the

capability to cool more than 1 beverage container in the outdoors.

One consideration is to create an empty mug or container or receptacle with such a self-powered self-cooling or self-chilling device. Beverages can then
5 be used to fill up the empty container or receptacle or mug.

Creating and manufacturing empty containers or mugs with a self-powered cooling device while costly, would, through re-use, be considered less costly than a “one time usage” beverage container or beverage receptacle.

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SUMMARY OF INVENTION

A first objective of the invention is a self-cooling device to cool a container of beverage, the device comprising:

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- a compressor,
- a motor,
- a network of capillaries, containing a refrigerant, said network having a reservoir for the refrigerant,
- 20 a power source of electrical energy,
- temperature gauging devices,
- a micro-processor
- a simple user interface for temperature setting, and
- an on/off switch

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which upon turning on the on/off switch, the power source provides electrical energy to start the motor driving the compressor, sending the refrigerant from the reservoir through the network of capillaries, before returning said refrigerant to the reservoir, the refrigerant transferring heat from the interior
30 cylindrical wall of the beverage container, before the refrigerant returns to the reservoir. The cooling of the interior wall of the beverage container would then siphon the heat from the beverage within the container, thereby cooling

the beverage. The capillaries would be configured such that they are exposed to atmospheric air along the outer wall of the beverage container, allowing the absorbed heat to be dissipated into the atmosphere, before returning to the reservoir.

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Preferably, the self-cooling device has temperature gauging devices to detect the temperature of the beverage.

10 Preferably the self-cooling device has a network of capillaries embedded within the interior and exterior wall of the beverage container.

Alternatively, the network of capillaries is embedded within a sleeve used to enclose a container of beverage.

15 Alternatively, the self-cooling device may also have a network of capillaries embedded within the interior and exterior wall of a bucket-shaped container to contain a container of beverage.

20 Alternatively, the self-cooling device has a network of capillaries embedded within the interior and exterior walls, and frame of a mug-shaped container to hold a container of beverage.

25 Preferably the self-cooling device has a temperature gauging device to detect the temperature of the contents of the container.

30 Preferably, the temperature gauging device has the ability to detect that the contents are at a higher temperature that is desired by the user and would send its temperature readings to a microprocessor controlling the motor, which would then continue to pump refrigerant through the capillary network until the contents of the container come to the desired lower temperature. The description of how the temperature gauging devices would work is

described later in this document.

Preferably the self-cooling device has a power source consisting of batteries.

- 5 Preferably the self-cooling device has an USB inlet from which to take electrical energy.

DESCRIPTION OF THE DRAWINGS

- 10 For a better understanding of the invention, its advantages, and the objects attained by its use, reference should now be made to the accompanying drawings. The accompanying drawings illustrate some embodiments of the invention and together with the description herein, serve to explain the workings and principles of the invention.

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Fig 1: is a first embodiment of a self-cooling device is in the form of a mug or similar sized container to hold beverage poured into it.

- Fig 2: is a second embodiment of a self-cooling device is in the form of a
20 sleeve or similar holder in which a beverage container is put into to be cooled.

- Fig 3: is a third embodiment of a self-cooling device is in the form of a flexible
holder which can be wrapped around a beverage container to be cooled.

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DESCRIPTION OF PREFERRED EMBODIMENTS

- The inventive device is a self-cooling device which is used to cool a container of beverage. The device comprising:

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 a compressor (10),
 a motor (12),

a network of tiny capillaries (14), containing a refrigerant, said network
 having a reservoir (40) for the refrigerant,
 a power source (16),
 temperature gauging devices (20),
 5 a micro processor (22),
 an on/off switch (30)
 a simple user interface for temperature setting, and
 an inlet for power (32)

10 The device can be turned on using the on/off switch (30) so that energy from
 the power source (32) would start a motor (12) connected to a compressor
 (10). The compressor (10) sends the refrigerant from the reservoir (40)
 through a network of capillaries (14), before returning said refrigerant to the
 reservoir (40). As the refrigerant passes through the network of capillaries
 15 (14), a heat exchange operation works to transfer heat from the interior wall
 (52) of container (50) of the beverage to the refrigerant. The contents of the
 beverage container are thus cooled indirectly as heat is absorbed from the
 contents. The refrigerant passes around the network of capillaries (14)
 through exterior wall (52) of the device to dissipate the absorbed heat and
 20 then finally returns to the reservoir (40) before it is pumped back through the
 network of capillaries (14) by the compressor to further carry out the heat
 exchange operation. A plurality of temperature gauging devices (20) in the
 interior wall (52) of the container (50) would send temperature readings of the
 contents of the beverage container to the microprocessor (not shown)
 25 controlling the motor (12). The motor (12) will operate the compressor (10)
 until the contents of the container, as detected by the temperature gauging
 devices (20), match the temperature desired by the user, set by a simple
 user interface for temperature setting, which is not shown.

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The self -cooling device can be adapted in several embodiments:-

It could be used as in the form of a mug or bucket-like container to hold the beverage which is poured into it from a beverage container. An embodiment of this is illustrated in Fig 1.

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It could be used in the form of a sleeve or jacket to enclose a beverage container. An embodiment of this is illustrated in Fig 2.

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It could be in the form of two curved portions which can be wrapped around a beverage container. An embodiment of this is illustrated in Fig 3.

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Whatever form the self-cooling device can take, it consists of a compressor (10) of sufficient power and material strength to forcefully compress the refrigerant used, pumping the refrigerant from a reservoir (40) through a network of capillaries (14), to be returned to the reservoir (40), wherein the refrigerant is stored. The compressor (10) is driven by an appropriately sized and efficient motor (12). The refrigerant is pumped by the compressor (10) through the network of capillaries (14) which is spread out over the entire surface area of the self-cooling device, inclusive of the interior and exterior walls. The network of capillaries (14) can take several patterns or designs instead of being circular as shown in the drawings. The network of capillaries (14) can also be configured into any design that does not impair the functionality of the capillaries.

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The compressor (10) may be a scroll compressor. Alternatively, a piston compressor or any other type of compressor that is able to compress the refrigerant within the confines of the products' final design could be used.

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The network of capillaries (14) is made of any appropriate material, e.g. fine copper tubing or glass, and can be in the form of circular rings or lattice form thus covering a wide surface area.

The self-cooling device has a power source (16) which supplies electrical power to the motor (12) powering the compressor (10) to enable it to pump the refrigerant through the network of capillaries (14). The network of capillaries (14) would offer a larger combined surface area to absorb heat from the contents of the self-cooling device.

The self-cooling device also has a micro-processor (not shown) to control the entire cooling operation. The cooling device also has one or more temperature gauging devices (20) in the interior wall (52) of the self-cooling device which envelopes the beverage container or holds the beverage container. The temperature readings of the contents of the self-cooling device are monitored by the micro-processor which, in turn, would continue to run the motor (12) connected to the compressor (10) to pump refrigerant through the network of capillaries (14) until the user defined temperature is obtained, set by a simple user interface for temperature setting, which is not shown.

The self-cooling also has an on/off switch which can be manually operated to turn the compressor off or on as desired by the user.

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The self-cooling device can be incorporated into several embodiments, all of which are proposed as self-cooling containers.

An embodiment can be a self-cooling device is in the form of a mug or jug which can then be used to contain a beverage which is poured from a beverage container, as illustrated in Fig 1. In this embodiment, the compressor (10) (in this case, a scroll compressor) can be at the base of the mug or jug (50). The network of capillaries (14) is formed inside the wall (52) of the mug or jug into which the beverage is contained. The wall (52) of the mug or jug can be made of material which protects the network of capillaries (14) and at the same time allows for efficient heat exchange from the beverage in the mug or jug to the refrigerant in the network of capillaries (14)

within the interior wall of the mug or jug. Since the contents of the beverage are directly held within the mug or jug, the cooling efficiency of the self-cooling device is improved. As the beverage itself does not come into contact with the capillary network or the refrigerant, there is no concern over contamination by the refrigerant nor concern over chemical reaction between the refrigerant and the beverage itself.

In another embodiment, the self-cooling device can take the form of a cylindrical sleeve with a base, containing a compressor, in this case, a scroll compressor. This second embodiment is illustrated in Fig 2. In this embodiment, the network of capillaries (14) is formed inside the interior wall (52) of the cylindrical sleeve into which the beverage container is held. The sleeve (60) can be made of material which protects the network of capillaries (14) and at the same time allows for efficient heat exchange from the beverage container (70) to the refrigerant in the network of capillaries (14). Since the contents of the beverage are still in the beverage container (70), which is contained by the cylindrical sleeve (60), the cooling efficiency of the self-cooling device may be lower. Nonetheless, since the objective is to cool a beverage container in the outdoors, the self-cooling device of this embodiment would still work. As the beverage itself does not come into contact with the capillary network or the refrigerant, there is no concern over contamination by the refrigerant nor concern over chemical reaction between the refrigerant and the beverage itself.

In a third embodiment, the self-cooling device is in the form of a flexible sleeve adjustable to fit containers of different volumes and sizes. The third embodiment may be illustrated in Fig 3. The flexible sleeve (70) is open ended so that it can be adjustable to hold a container of beverage of different sizes. The open ends have Velcro® or similar closures to wrap the beverage container (not shown) snugly around it. In this embodiment, the compressor (there is no necessity for a scroll compressor in this embodiment) can be at the base of the sleeve, or attached to the middle of the flexible sleeve, or in a

casing or box completely (shown in Fig 3) separated from the flexible sleeve (70) itself, whilst still connected to the flexible holder through the necessary wires and tubes contained within a protective tubing for wires. The network of capillaries (14) is formed inside the wall of the flexible sleeve (70). The interior-wall material of the flexible sleeve can be made of material which protects the network of capillaries (14) and at the same time allows for efficient heat exchange from the beverage container (not shown) to the refrigerant in the network of capillaries (14) within the interior-wall of the flexible sleeve. As the beverage itself does not come into contact with the capillary network or the refrigerant, there is no concern over contamination by the refrigerant nor concern over chemical reaction between the refrigerant and the beverage itself. However, since the content of the beverage is not directly in contact with the cooling device, its cooling efficiency of the self-cooling device is not as efficient.

If the self-cooling device is in the form of a mug, the temperature gauging devices (20) can directly monitor the temperature of the contents of the beverage since the beverage is held within the mug as shown in Fig 1. In this case, as the contents of the beverage is consumed, and the level of the beverage in the mug drops, the temperature sensors (20) at the upper level of the mug would pick up the surrounding higher ambient temperature and continue to send incorrect readings (incorrect readings for the purposes of this device's cooling functionality) to the micro-processor (not shown) which will continue to pump refrigerant in an effort to lower the temperature detected at that area. In order to maintain efficient energy usage, additional sensors may be installed in self-cooling devices in the mug to monitor level of beverage contained in the mug. Therefore even though the beverage is consumed and the level of beverage within the mug drops, the microprocessor is able to detect the boundary between cooled beverage and ambient air. As the boundary lowers from consumption, the microprocessor will be configured to expend the correct amount of energy to only cool the beverage rather than ambient air.

How the microprocessor determines the boundary between the cooled beverage and the ambient air is as follows: there will be one Control sensor which continuously records the ambient air's temperature. The remaining
5 sensors will be vertically lined along the interior wall of the self-cooling container. As the beverage level decreases, the boundary between the cooled beverage and ambient air lowers, thus exposing some of the sensors lining the interior wall to ambient air. As the interior-wall vertically aligned sensors are exposed to ambient air, their temperature would match the
10 Control sensor's reading, thus telling the microprocessor that the volume of the content has decreased. The microprocessor would be configured to know how much energy to expend from the number of vertical sensors matching the Control sensor.

15 Since the self-cooling device is meant for outdoor use, it would be powered by batteries. Alternatively the power source consists of a rechargeable battery which can be re-charged when the energy level is low. For the recharging, the charging could be through a wire connected to any power source, including a laptop, via a USB wire..

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While some embodiments of the self-cooling device have been described, it should be apparent, however, that various modifications, rearrangements, substitutions alterations and adaptations to those embodiments may occur to persons skilled in the art with the attainment of some or all of the advantages
25 of the present invention. Accordingly, it should be clearly understood that the present invention is not intended to be limited by the particular features and structures hereinbefore described and depicted in the accompanying drawings. It is therefore intended to cover all such modifications, alterations and adaptations without departing from the scope and spirit of the present
30 invention as defined by the appended claims.

ADVANTAGEOUS EFFECTS OF THE INVENTION

The invention offers a light, portable and practical device to cool beverages directly or indirectly in the outdoors.

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CLAIMS

1. A self-cooling device to cool a container of beverage, the device comprising:
- 5 a compressor (10),
a motor (12),
a network of capillaries (14), containing a refrigerant, said network having a reservoir (40) for the refrigerant,
10 a power source (16),
temperature gauging devices (20),
a micro-processor,
a simple user interface for temperature setting, and
an on/off switch (30)
- 15 characterised in that upon turning on the on/off switch (30), the power source (16) provides electrical energy to start the motor (12) which drives a compressor (10), sending the refrigerant from the reservoir (40) through the network of capillaries (14), before returning said refrigerant to the reservoir
- 20 (40), the refrigerant transferring heat from the interior wall of the device (50), thereby cooling its beverage contents indirectly, before the refrigerant returns to the reservoir (40), after discharging the gathered heat to the ambient air through the network of capillaries (14) lining the outer wall of the container (52).
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2. The self-cooling device as claimed in Claim 1, having temperature gauging devices (20) to detect the temperature of the contents of the container.
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3. The self-cooling device as claimed in Claim 1, wherein the network of capillaries (14) is embedded in the interior wall of a container which will hold a container of beverage.

4. The self-cooling device as claimed in Claim 1, wherein the network of capillaries (14) is embedded in a sleeve to enclose a container of beverage.

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5. The self-cooling device as claimed in Claim 1, wherein the network of capillaries (14) is embedded in the interior and exterior wall of a bucket-shaped container used to contain a container of beverage.

10 6. The self-cooling device as claimed in Claim 1, wherein the network of capillaries (14) is embedded in the interior and exterior wall of a mug-shaped container to hold a container of beverage.

7. The temperature gauging devices as claimed in Claim 2 wherein they send
15 their temperature readings to the microprocessor which would then continue to control the motor connected to the compressor as appropriately to maintain the cooling effect on the contents of the self-cooling device in an efficient manner, thereby saving electrical power.

20 8. The compressor as claimed in Claim 1, wherein the compressor can be a scroll compressor or a piston compressor or any other appropriately shaped compressor.

9. The self-cooling device as claimed in Claim 1, wherein the power source
25 consists of batteries (rechargeable or non-rechargeable).

10. The self-cooling device as claimed in Claim 1, wherein the power source is an inlet from which to take electrical energy.

30 11. The self-cooling device as claimed in Claim 1, wherein the power source is an USB inlet from which to take electrical energy.