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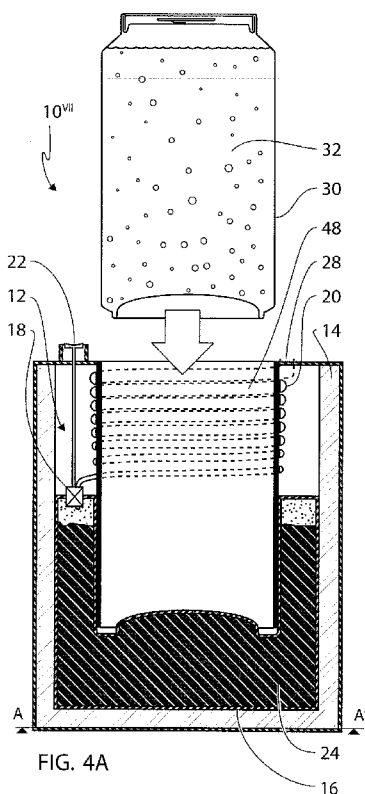
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(54) Title: A SYSTEM FOR EXTERNALLY COOLING A BEVERAGE HOLDER AND A METHOD OF EXTERNALLY COOLING A BEVERAGE HOLDER



(57) Abstract: A system for externally cooling a beverage holder holds a specific amount of beverage. The system comprises a cooling device defining a cooling space for accommodating the beverage holder and an insulating housing made of a thermally insulating material and enclosing the cooling device opposite the cooling space. The cooling device comprises a canister including a specific amount of a propellant gas, preferably CO₂, at a pressure exceeding the ambient atmospheric pressure at sea level. The canister comprises a valve defining an open state for releasing the propellant gas from the canister and a closed state for keeping the propellant gas within the canister. The cooling device further comprises a gas channel defining a gas intake for receiving the propellant gas from the valve of the canister and a gas exhaust for expelling the propellant gas outside the insulating housing.



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A SYSTEM FOR EXTERNALLY COOLING A BEVERAGE HOLDER AND A METHOD
OF EXTERNALLY COOLING A BEVERAGE HOLDER.

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Background

Beverage cans and beverage bottles have been used for decades for storing
beverages, such as carbonated beverages, including beer, cider, sparkling wine,
10 carbonated mineral water or various soft drinks, or alternatively non-carbonated
beverages, such as non-carbonated water, milk products such as milk and yoghurt,
wine or various fruit juices. The beverage containers, such as bottles and in particular
cans, are typically designed for accommodating a maximum amount of beverage,
while minimizing the amount of material used, while still ensuring the mechanical
15 stability of the beverage container.

Most beverages have an optimal serving temperature significantly below the typical
storage temperature. Beverage containers are typically stored at room temperature in
supermarkets, restaurants, private homes and storage facilities. The optimal
20 consumption temperature for most beverages is around 5°C and therefore, cooling is
needed before serving the beverage. Typically, the beverage container is positioned in
a refrigerator or a cold storage room or the like well in advance of serving the
beverage so that the beverage may assume a temperature of about 5°C before
serving. Persons wishing to have a beverage readily available for consumption must
25 therefore keep their beverage stored at a low temperature permanently. Many
commercial establishments such as bars, restaurants, supermarkets and petrol
stations require constantly running refrigerators for being able to satisfy the customers'
need of cool beverage. This may be regarded a waste of energy since the beverage
can may have to be stored for a long time before being consumed. In the present
30 context, it should be mentioned that the applicant company alone installs
approximately 17000 refrigerators a year for providing cool beverages, and each
refrigerator typically has wattage of about 200W.

As discussed above, the cooling of beverage containers by means of refrigeration is
35 very slow and constitutes a waste of energy. Some persons may decrease the time
needed for cooling by storing the beverage container for a short period of time inside a

freezer or similar storage facility having a temperature well below the freezing point. This, however, constitutes a safety risk because if the beverage container is not removed from the freezer well before it freezes, it may cause a rupture in the beverage can due to the expanding beverage. Alternatively, a bucket of ice and water may be used for a more efficient cooling of beverage since the thermal conductivity of water is significantly above the thermal conductivity of air.

In the present context, it may be considered to provide the beverage container with an internal cooling element which may be activated shortly before consuming the beverage for cooling the beverage to a suitable low temperature. Various techniques relating to cooling of beverage cans and self-cooling beverage cans have been described in among others US4403567, US7117684, EP0498428, US2882691, GB2384846, WO2008000271, GB2261501, US4209413, US4273667, US4303121, US4470917, US4689164, US20080178865, JP2003207243, JP2000265165, US3309890, WO8502009, US3229478, US4599872, US4669273, WO2000077463, EP87859 (fam US4470917), US4277357, DE3024856, US5261241 (fam EP0498428), GB1596076, US6558434, WO02085748, US4993239, US4759191, US4752310, WO0110738, EP1746365, US7117684, EP0498428, US4784678, US2746265, US1897723, US2882691, GB2384846, US4802343, US4993237, GB2261501, US20080178865, JP2003207243, US3309890, US3229478, WO2000077463, WO02085748.

German published patent application DE 21 50 305 A1 describes a method for cooling beverage bottles or cans. A cooling cartridge including a soluble salt is included in the bottle or can. By dissolving the salt in a specific volume of water, a cooling effect is obtained by utilizing the negative solution enthalpy. However, by using the negative solution enthalpy as proposed, the lowest temperature achieved was about 12°C, assuming an initial temperature of 21°C. None of the examples of embodiments achieves the sought temperature of about 5°C. By calculating the heat reduction in the beverage ($Q=c*m*\Delta T$), the example embodiments achieve heat reductions of only about 15-38J/ml of beverage. All of the examples of embodiments also require reactants having a total volume exceeding 33% of the beverage volume. Further, all of the reactions proposed in the above-mentioned document are considered as reversible, since the reaction may be reversed by simply removing the water from the solution. By removing the water, the dissolved salt ions will recombine and form the original reactants.

The applicant has committed significant resources in researching a more space efficient cooling device which would be able to cool a larger amount of beverage using a smaller volume of the cooling device. Examples of such devices are described in the international applications WO 2011/157735, WO 2010/066775 and WO 2010/066772

5 which relate to a beverage container including a cooling device having a housing defining a housing volume. The cooling device includes at least two separate, substantially non-toxic reactants causing an entropy-increasing reaction producing substantially non-toxic products in a stoichiometric number. The at least two separate substantially non-toxic reactants initially being included in the cooling device are

10 separated from one another and causing an entropy-increasing reaction and a heat reduction of the beverage of at least 50 Joules/ml beverage. The cooling device further includes an actuator for initiating the reaction between the at least two separate, substantially non-toxic reactants.

15 The above-mentioned documents describe technologies for generating cooling via dissolution of salts, chemical reaction, or via vaporization. For using such technologies as described above, an instant cooling can be provided to a beverage and the need of pre-cooling and consumption of electrical energy is avoided. However, there is always the risk that the cooling device ruptures and that the salts enter the beverage which

20 evidently will ruin the beverage.

The expression "instant cooling" should in the present context be understood to be a cooling process in which the beverage is chilled from the storage temperature such as room temperature to the lower consumption temperature in a short time period such as

25 a few minutes or even shorter such as less than one minute.

WO 00/43274 discloses a heat exchange unit for incorporation internally of a beverage container. The heat exchange unit contains a refrigerant medium which functions to conduct the heat contained within the beverage out of the beverage and into the

30 atmosphere as the refrigerant escapes. The refrigerant medium comprises an adsorbent, such as activated carbon, capable of adsorbing under pressure a significant amount of gas, such as carbon dioxide, for later release. The carbon dioxide will experience a significant drop in temperature when released to the atmosphere thereby chilling the beverage.

US5331817 discloses a portable self-contained heating or cooling apparatus for a beverage can which uses a vortex tube for supplying the needed heating or cooling.

Further relevant prior art includes WO94/28362, WO00/47936, US5692391,
5 US5655384, US5606866, EP1200318, WO00/47346, EP1164341, EP1200781,
WO96/37743, WO00/41832, WO97/38271, WO96/37742, WO96/27110.

One problem experienced using the above cooling devices located within the beverage container is that under some circumstances, the cooling effect of the cooling device is sufficient for creating beverage ice crusts adjacent the cooling device. Such
10 ice crusts may prevent a correct dispensation of the beverage and further the user has to wait until the ice crust melts in order to consume the part of the beverage which has been converted to ice. Further, some beverages, such as carbonated beverages, will deteriorate when solidified. A further problem is the activation of the cooling device within the beverage container. The cooling device must either detect the opening of
15 the beverage container or alternatively a pass through mechanism must be made in the container such that the cooling device may be activated from outside the beverage container.

The German utility model DE 299 11 156 U1 discloses a beverage can having an
20 external cooling element. The cooling element may be activated by applying pressure to mix two chemicals located therein. The document only describes a single chemical reaction including dissolving and disassociation of potassium chloride, saltpeter and ammonium chloride in water, which is stated to reach a temperature of 0°C or even -16°C of the cooling element, although the description is silent about the starting
25 temperature of the cooling element and the efficiency of such external cooling. The description is also silent about any thermal losses to the surroundings which may occur using an external cooling device.

WO02/03820 discloses a vending machine to store a plurality of items to be vended
30 and to dispense individual chilled items without the use of electrical power. The machine includes a cooling chamber for receiving one of the items. The item is subjected to a cooling liquid from a tank having pressurized cooling liquid before being transported to a retrieval tray.

35 An object of the present invention is to provide a cooling device which may be used outside the beverage container in order to cool the beverage in a more controlled and

safe way. Further, it is an object of the present invention to prevent any loss of cooling effect to the surroundings of the cooling system.

Summary of the invention

- The above objects together with numerous other objects, which will be evident from the below detailed description of preferred embodiments according to the present invention are according to a first aspect of the present invention obtained by a system for externally cooling a beverage holder, the beverage holder holding a specific amount of beverage, the system comprising a cooling device defining a cooling space for accommodating the beverage holder and an insulating housing made of a thermally insulating material and enclosing the cooling device opposite the cooling space, the cooling device comprising:
- a canister including a specific amount of a propellant gas, preferably CO₂, at a pressure exceeding the ambient atmospheric pressure at sea level, the canister comprising a valve defining an open state for releasing the propellant gas from the canister and a closed state for keeping the propellant gas within the canister, and
 - a gas channel defining a gas intake for receiving the propellant gas from the valve of the canister and a gas exhaust for expelling the propellant gas outside the insulating housing.
- The system should be able to cool the beverage from outside the beverage holder, i.e. the cooling device should never be immersed within the beverage. The beverage holder is construed to mean storage devices such as a conventional can, container, keg, bottle, glass or other suitable package, which is customary used for storing the beverage during transporting and handling from the production site to the consumer site. The beverage holder may be included in the system when sold, or the system may constitute an accessory sold separately from the beverage holder. Further, the beverage holder is construed to encompass tapping lines, trunks and coils which are used for transporting beverage from a storage device to a dispensing device at which the beverage is dispensed. Small tapping lines may be used in domestic and single use beverage dispensing systems. Larger tapping lines and trunks are used in professional systems, in which the beverage may be transported several meters between the storage device and the tapping device. The beverage holder typically has a cylindrical shape.
- The cooling device may be adapted for circumferentially enclosing and contacting the bottom, the top or the side surface of the beverage holder. The cooling device should

preferably be made of thermal conductive material which should be understood to mean a material that is inherently capable of transmitting heat energy in an efficient way, such as metal, or alternatively, a moderate heat conductor such as plastics may be used, provided the thickness of the material between the propellant gas and the beverage holder is small. In order to achieve a large cooling effect, it is desirable to enclose a large portion of the beverage holder within the cooling device. Preferably, a significant portion such as 70%, 80%, 90% or even 100% of said beverage holder is enclosed by said cooling device; however, in order to merely maintain a low temperature of an already chilled beverage, it may be sufficient to merely contact a small portion of the beverage holder, such as 10% - 20%. The contact surface between the cooling device and the beverage holder should be as large as possible, i.e. any air pockets should if possible be prevented. The propellant gas of the cooling device should be separated from the interior of the beverage holder in order to avoid any accidental contamination of the beverage.

When employing a cooling device externally in relation to the beverage holder, it is contemplated that heat from the outside, e.g. the ambient air or heat originating from the user, may be absorbed by the cooling device and thus reduce the cooling effect of the cooling device relative to the beverage holder. In order to reduce the amount of heat entering the cooling device from the outside, the cooling device should be enclosed by an insulating material. The insulating material should be a material having a thickness and conductivity chosen such that the heat transfer between the cooling device and the outside of the insulating material is lower than the heat transfer between the cooling device and the cooling space adjacent the beverage holder. The insulating material is thus a material having a lower heat transfer coefficient than the material of the cooling device. Alternatively or in addition, the insulating material may be thicker than the material of the cooling device. Thus, a significant amount and preferably the greatest amount of heat absorbed by the cooling device should originate from the beverage holder and not from the surroundings of the system.

The canister is preferably located adjacent the cooling space such that the cooling generated due to the pressure drop within the canister will transport heat from the cooling space. The valve interconnecting the canister and the gas channel should be closed during transport and handling. When the user desires a cool beverage, the user first ensures that a beverage holder is present in the cooling space. Then the user operates the valve from the closed state to the open state thereby allowing the

pressurized gas to enter the intake of the gas channel. The valve is preferably operable from the outside of the insulating housing, however, it is contemplated that the valve may be operated once the beverage holder is inserted into the cooling space.

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The gas channel should be located adjacent the cooling space in order to improve the heat transfer between the propellant gas in the gas channel and the beverage holder. Preferably, the gas channel is covering a significant portion of the cooling space, such as at least 50%, or more preferably 60-70%, or most preferably 80-90% of the cooling
10 space. The valve should preferably constitute the smallest flow area between the canister and the gas channel exhaust such that a large pressure drop occurs at the valve. In this way, the temperature decrease of the out flowing propellant gas will be very large at the valve. The propellant gas present just after the valve will thus have a lower temperature than the gas remaining in the canister. In order for the out flowing
15 propellant gas to absorb as much heat energy as possible from the beverage holder, i.e. increase the heat transfer between the beverage holder and the gas within the gas channel while the gas is flowing between the intake of the gas channel and the exhaust of the gas channel, the gas channel should be located as close to the beverage holder as possible and expose as large surface area as possible towards the
20 beverage container.

The propellant gas preferably constitutes CO₂. CO₂ is preferred since it is a naturally occurring gas which is relatively environmentally friendly and non-toxic. CO₂ further may be efficiently adsorbed by activated carbon. Further, the pressure of the
25 propellant gas is preferably exceeding 1 bar above ambient atmospheric pressure at sea level, more preferably 2bar, most preferably 5bar. In case the pressure within the canister is higher, the pressure drop between the valve and the gas channel will be higher. A higher pressure drop will yield a larger temperature drop, i.e. allow a lower temperature of the gas and thereby a more efficient cooling of the beverage holder.

30

According to a further embodiment of the system, the cooling device further includes a vortex tube (Ranque-Hilsch vortex tube), the vortex tube defining a gas inlet in fluid communication with the valve, a warm gas outlet located outside the insulating housing and a cold gas outlet in fluid communication with the gas intake of the gas
35 channel. A vortex tube, also known as a Ranque-Hilsch vortex tube, is a device capable of separating a warm gas stream and a cold gas stream from an incoming

stream of compressed gas. In the present case, the incoming stream originates from the valve of the canister. The cold gas leaving the valve of the canister will thus be split into an even colder gas flow entering the intake of the gas channel and a warmer gas flow which is led directly to a warm gas outlet outside the system. Ideally, the warm gas is having a temperature equal to or above room temperature. In this way, the cold gas flow entering the conduit may be reduced even further. Since the heat transfer between the beverage holder and the gas in the conduit increases with, among other factors, an increasing temperature difference between the gas and the beverage holder, the lower temperature of the gas will improve the cooling of the beverage in the beverage holder.

According to a further embodiment of the system, the canister includes a particular amount of adsorption material for adsorbing the propellant gas, the adsorption material preferably being activated carbon. An absorbent, such as activated carbon, may be used for adsorbing some of the propellant gas in the canister. In this way, a larger amount of gas may be stored at a lower pressure and the walls of the canister may be made thinner and/or in a less rigid material. Further, the desorption of gas from an adsorbent will cause a reduction in temperature of the gas due to the desorption heat energy. The desorption energy is for the most gases in the same magnitude as the heat energy required for the phase change from liquid to gaseous phase.

According to a further embodiment of the system, the gas channel is located between the canister and the cooling space. Since the gas entering the gas channel has expanded after passing the valve, this gas has experienced a larger temperature drop than the gas remaining in the canister. Thus, the gas in the gas channel will be colder than the gas in the canister. Thus, by locating the gas channel adjacent the cooling space, the temperature difference between the beverage holder and the cold gas in the gas channel will be greater than the temperature difference between the canister and the beverage holder. A larger temperature difference will increase the heat transfer between the gas and the beverage.

According to a further embodiment of the system, the canister and/or the gas channel defines the cooling space. By letting the canister or the gas channel, and preferably both the gas channel and the canister, define the cooling space, the low temperature propellant gas will act directly on the cooling space thereby allowing a more efficient heat transfer between the beverage and the propellant gas.

According to a further embodiment of the system, the propellant gas constitutes a liquefied propellant gas. In order to achieve an even more efficient cooling of the beverage holder, the gas in the canister may be a liquefied gas. In this way, a very large amount of gas may be stored in the canister and the heat required for the phase change from liquid to gaseous phase will cause the temperature in the canister to fall. The low temperature of the canister and the gas/liquefied gas therein will contribute to the cooling of the beverage holder, both directly and due to the fact that the gas entering the gas channel will be much cooler.

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According to a further embodiment of the system, the gas channel defines a spiral shape about the cooling space. In order for the conduit to be as long as possible, it may define a spiral shape about the cooling space. A long gas channel will allow a longer distance at which heat transfer may take place before the gas leaves the gas channel through the exhaust. The temperature difference between the gas at the intake of the gas channel and the exhaust of the gas channel represents the heat energy absorbed from the beverage in the beverage holder.

According to a further embodiment of the system, the cooling device defines a groove at the cooling space, the gas channel being established by the groove between the cooling device and the beverage holder. In order to ensure that the cold gas flow transports as much heat away from the beverage holder as possible, the gas channel should be located as close to the beverage holder as possible. Typically, the gas channel will be made as a gas conduit, i.e. an enclosed tube adjacent the cooling space. However, it will be particular advantageous in case the gas channel is formed by means of the beverage holder, i.e. in case the boundary of the gas channel is formed partially by a groove in a wall of the cooling device at the cooling space and partially by the wall of the beverage holder. In case the wall of the cooling device at the cooling space includes a groove such that an enclosed gas channel is formed when the beverage holder is inserted into the cooling space, the cool gas will be flowing as close to the beverage holder as possible, i.e. immediately adjacent the beverage holder. In this way, the heat transfer between the beverage holder and the cold gas will be improved.

According to a further embodiment of the system, the gas channel has a length exceeding 0,1m, preferably 0,5m more preferably 1m, most preferably 2m. By having

a gas channel extending more than 0.1m will allow a sufficient distance for the heat exchange between the beverage holder and the gas flow in the gas channel. In case longer gas channel is used, each gas particle will remain a longer time within the gas channel and will thereby have a longer time to absorb energy from the beverage holder.

According to a further embodiment of the system, the gas channel is increasing in width between the intake and the exhaust. By allowing the gas channel to increase in width from the intake to the exhaust, the pressure drop will be distributed within the gas channel. Further, the widening of the gas channel will reduce the velocity of the gas flow which will allow the gas to remain a longer time within the conduit. Preferably, the width of the gas channel is increasing monotonic between the intake and the exhaust.

According to a further embodiment of the system, the cooling device defines a cooling wall made of thermally conductive material for contacting said beverage holder. In case the inwardly oriented wall of the cooling device is made of thermally conductive material such as metal, the heat conduction between the cooling device and the cooling space will be much larger than between the cooling device and the outside of the system.

According to a further embodiment of the system, the gas channel and/or the canister includes conductive fins for increasing the thermal conductivity. By including fins or grids of thermally conductive materials, such as metal, the heat transfer between the cooling device and the cooling space may be increased. Further, such fins may increase turbulence within the gas channel. The increase in turbulence increases the heat transfer between the gas and the beverage holder, since the turbulent boundary layers near the walls of the gas channel transfers heat much more efficient than a corresponding laminar flow.

According to a further embodiment of the system, the cooling device and/or the cooling space includes PCM material. In case the cooling from the cooling device is very intensive and applied to the beverage holder during a short time period, the beverage near the walls may freeze. Freezing will, as discussed above, cause the beverage to deteriorate, in particular in case of carbonated beverage. A PCM material, i.e. a Phase Change Material, may be used in order to prevent freezing of the beverage near the

walls of the beverage holder. The PCM material is liquid in room temperature and has a freezing temperature comparable to that of beverage or slightly higher. The PCM material is then disposed between the beverage space and the canister/gas channel such that the canister/gas channel absorbs the heat from the PCM material and causes the PCM material to freeze instead of the beverage. Water may be used as a suitable PCM material. The freezing temperature of water may be altered by adding additives such as salt.

The PCM material thus causes the cooling of the beverage holder to be less intense but prolonged due to the fact that cooling is maintained even after all of the gas has been released from the canister. Without PCM material, the cooling stops when the gas flow out of the canister stops, i.e. when the gas pressure in the canister is equal to the ambient atmospheric pressure outside the system. With PCM material, the cooling will be maintained until the PCM material is liquefied. The time allowed for chilling the beverage holder may range from about 30s to 2-3 minutes using no PCM material, whereas by including PCM material the cooling may be prolonged to 5-10 minutes or even more. Depending on the properties of the insulating housing, the beverage holder may remain cool for several minutes or even hours.

According to a further embodiment of the system, the canister and/or the gas channel is encircling the cooling space. By allowing the canister and/or the gas channel to encircle the beverage holder, the effective cooling surface between the beverage holder and the system may be increased. In this way, the cooling efficiency is increased.

The above objects together with numerous other objects, which will be evident from the below detailed description of preferred embodiments according to the present invention are according to a second aspect of the present invention obtained by a method of externally cooling a beverage holder, the beverage holder holding a specific amount of beverage, the method comprising providing a cooling device defining a cooling space for accommodating the beverage holder and providing an insulating housing made of a thermally insulating material and enclosing the cooling device opposite the cooling space, the cooling device comprising:

a canister including a specific amount of a propellant gas, preferably CO₂, at a pressure exceeding the ambient atmospheric pressure at sea level, the canister comprising a valve, and

a gas channel defining a gas intake for receiving the propellant gas from the valve of the canister and a gas exhaust for expelling the propellant gas outside the insulating housing,

the method comprising the step of:

- 5 opening the valve of the canister thereby allowing the propellant gas to flow from the canister via the gas intake of the gas channel to the gas exhaust of the gas channel.

It is evident that the method according to the second aspect may be used together
10 with any of the systems described above under the first aspect. Initially the valve is closed and the gas is withheld at a high pressure within the canister. By opening the valve, the gas will flow from the valve via the intake through the gas channel and be expelled to the outside of the system via the exhaust. The gas will flow as long as an overpressure in the canister exists. The expanding gas will provide a cooling effect to
15 the beverage as discussed above. Typically, the system is thereafter disposed of, however, reusable systems are feasible.

Brief description of the figures

- 20 Fig 1 is a beverage cooling system according to the present invention,
Fig 2 is a beverage cooling system having a cooling space,
Fig 3 is a beverage cooling system having a heat transfer wall,
Fig 4 is a beverage cooling system having a semicircular gas channel,
Fig 5 is a beverage cooling system having a rectangular gas channel,
25 Fig 6 is a beverage cooling system having an open groove,
Fig 7 is a beverage cooling system in the form of a cooling block,
Fig 8 is a beverage cooling system in the form of a cooling can,
Fig 9 is a beverage cooling system in the alternative form of a cooling can,
Fig 10 is a beverage cooling system in the form of a beverage coaster,
30 Fig 11 is a beverage cooling system in the form of a Self cooling glass,
Fig 12 is a beverage cooling system in the form of a cooling box,
Fig 13 is a beverage cooling system in the form of a cooling insert,
Fig 14 is a beverage cooling system in the form of a dispenser,
Fig 15 is a beverage cooling system in the form of a dispenser when in use,
35 Fig 16 is a beverage cooling system in the form of a cooling container.

Detailed description of the figures

Fig 1A shows a side cut-out view of a first embodiment of a beverage cooling system 10 according to the present invention. The beverage cooling system 10 comprise a cooling device 12. The cooling device 12 is enclosed by an insulating housing 14. The insulating housing 14 is made of thermally insulating materials such as Styrofoam or paperboard or the like. The cooling device 12 comprises a canister 16 including a pressurized propellant gas, typically pressurized CO₂. The pressure is preferably at least 3 bar above the atmospheric pressure. The canister 16 comprises a valve 18 controlling the flow of gas from the interior space of the canister 16 to a gas channel 20. The valve 18 may define a closed state in which the gas is kept within the canister 16 and an open state in which the gas may flow from the interior space of the canister 16 to a gas channel 20. The gas exits the gas channel via an exhaust 28 leading to the outside of the beverage cooling system 10.

When the propellant gas flows from the canister 16 through the gas channel 20, the pressure will drop in the canister 16. The gas flowing through the gas channel 20 will be even colder since the gas will drop from 3 bar above atmospheric pressure to almost atmospheric pressure. The cold gas in the canister 16 and gas channel 20 will absorb heat from the beverage in the beverage holder. The insulating housing 14 substantially prevents any heat absorption from the outside of the system 10.

The valve 16 is controlled via a handle 22 which is accessible from the outside of the insulating housing 14. The interior space of the canister 16 is filled with adsorption material 24, typically activated carbon, in order to adsorb the CO₂ in the canister 16 and thereby lower the pressure in the canister 16 while still allowing a large amount of CO₂ to be stored in the canister 16. The gas channel 20 and the canister 16 are located adjacent an optional heat transfer wall 26 which is defining a cooling space. The cooling space includes a beverage holder 20 in the form of a beverage container 30 containing beverage 32.

The heat transfer wall 26 may be made of metal in order to distribute the cooling equally within the cooling space. Alternatively, the heat transfer wall 26 is made of a PCM material such as water. When the water gradually freezes, the temperature in the cooling space is limited to 0 degrees and in this way, the beverage will not freeze until after all of the PCM material is frozen. When the pressure within the canister is equal

to the atmospheric pressure and the cooling thereby is completed, the PCM material will start to melt and keep the cooling space at 0 degrees for a long time period until all of the PCM material is melted.

- 5 Fig 1B shows a side cut-out view of an alternative embodiment of a beverage cooling system 10^I which is identical to the cooling system 10 of fig 1A except that the canister 16 does not include any adsorption material but only propellant gas, designated the reference numeral 34. Thus, the pressure in the canister 16 should be higher than the pressure in the canister of the previous embodiment, such as 5 bar, in order to be able
10 to accommodate the same amount of propellant gas 34.

Fig 1C shows a side cut-out view of yet another embodiment of a beverage cooling system 10^{II} which is identical to the cooling system 10 of fig 1B except that the canister 16 includes liquefied propellant gas 34'. The pressure in the canister must thus be
15 higher, e.g. over 5 bar. In this way, the required heat of phase change from liquid to gaseous phase will contribute to an even more efficient cooling of the beverage.

Fig 1D shows a side cut-out view of yet another embodiment of a beverage cooling system 10^{III} which is identical to the cooling system 10 of fig 1C except that the
20 canister 16 includes heat transfer fins 36. The heat transfer fins 36 will transport heat from the beverage directly into the canister 16 and thus contribute to an even more efficient cooling of the beverage.

Fig 1E shows a side cut-out view of yet another embodiment of a beverage cooling
25 system 10^{IV} which is similar to the cooling system 10 of fig 1A. The difference between the cooling system 10 of fig 1A and the present cooling system 10^{IV} is that the gas channel 22 is located adjacent the beverage holder 30 and that the canister 16 is located outside the gas channel 22, i.e. the gas channel 22 is located between the beverage holder 30 and the canister 16. This will yield a more efficient cooling since
30 the cold gas in the gas channel 22 will be colder than the gas inside the canister 16 due to the lower pressure. The temperature of the cold gas in the gas channel 22 is further reduced by the use of a vortex tube (Ranque-Hilsch vortex tube), which will be explained in connection with the following fig 1F.

35 Fig 1F shows a side cut-out view of yet another embodiment of a vortex tube 38 (Ranque-Hilsch vortex tube). The vortex tube 38 defines a gas inlet 40, a warm gas

outlet 42 and a cold gas outlet 44. The gas inlet 40 is connected to the valve 18 of the canister 16 (not shown). The gas inlet 40 is located at a cylindrical wall 44 of the vortex tube 38 and it is oriented in a tangential direction relative to the cylindrical wall 44 such that when the valve 18 is opened and the propellant gas flows into the vortex tube 38 via the gas inlet 40, the propellant gas will form a vortex inside the vortex tube 38 as shown by the arrows. Within the propellant gas vortex, the colder gas is separated from the warmer gas. The warmer gas will remain adjacent the cylindrical wall 46 and exit the vortex tube at the warm gas outlet 42 located opposite the gas inlet 40. The warm gas outlet is formed at one end of the vortex tube 38 as a conical nozzle allowing only the warm gas layer adjacent the cylindrical wall 46 to leave through the warm gas outlet 42. The warm gas outlet 42 is located outside the insulating housing 14 such that the warm gas will not heat the beverage 32.

The cold gas located near the center of the vortex tube will return through the vortex tube 38 towards the gas inlet 40 and exit the vortex tube 44 at the cold gas outlet 44 centrally located at the opposite end of the vortex tube 44 in relation to the warm gas outlet 42. The cold gas outlet 44 is connected to the gas channel 20. Since the gas entering the gas inlet 40 of the vortex tube 38 is already chilled as described in connection with fig 1A, the gas leaving the cold gas outlet 44 will be even colder. Since the heat transfer between the beverage holder (not shown) and the propellant gas increases with increasing temperature difference between the propellant gas and the beverage, there is an advantage of allowing the gas to have a very low temperature. The temperature of the warm propellant gas leaving through the gas outlet 42 should preferably be above the temperature of the beverage.

Fig 2A shows a side cut-out view of a further embodiment of a beverage cooling system 10^V. The inner wall 26 between the canister 16 and the beverage holder 30 forms a cooling space 48 which is shaped to conform with the beverage holder 30. In this way, any air pockets between the beverage and the cooling device 12 are avoided.

Fig 2B shows a top view of the beverage cooling system 10^V. The cooling space 48 is cylindrically shaped.

Fig 2C shows a side cut-out view of the beverage cooling system 10^V when the beverage holder 30 has been inserted. The present embodiment is a basic variant in

which the valve 18 allows the pressurized propellant gas to exit the canister 16 directly. In this way, the cold gas is lost and the cooling effect on the beverage is achieved by the pressure reduction in the canister only. It is however contemplated that the present embodiment may be used together with the gas channel as described
5 in the connection with fig 1.

Fig 3A shows a side cut-out view of a further embodiment of a beverage cooling system 10^{VI} being similar to the beverage cooling system 10^V of the previous embodiment except that the cooling device 12 includes fins 50 and a heat transfer wall
10 26' adjacent the cooling space 48. The fins 50 and the heat transfer wall 26' are adapted to moderate the heat transfer between the cooling device 12 and the beverage holder 30. In case an increase of cooling efficiency is desired, i.e. in case a very rapid cooling of the beverage is required, the fins 50 and the heat transfer wall 26' may be made of metal in order to enhance the heat conductivity between the canister
15 16 and the beverage holder 30. The heat transfer wall 26' will conduct heat from the beverage holder 30 to the fins 50. The fins 50 will allow the heat from the heat transfer wall 26' to be conducted and distributed in the interior of the canister 16.

Alternatively, in case the cooling efficiency from the cooling device 12 should be
20 reduced, i.e. in case the cooling results in that the beverage will form an ice crust in the beverage holder 30, the fins 50 and the heat transfer wall 26' may be made of PCM (Phase Change Material) which is a material which exhibits a phase change near the freezing point of beverage. Water is a suitable PCM material since it has a freezing point of 0°C and a high freezing enthalpy. Thus, in case the fins 50 and the heat
25 transfer wall 26' is made of liquid water (stored in a polymeric pouch or the like), the cooling device will, once activated and in case the cooling efficiency is sufficient, freeze the water and thereby prevent freezing of the beverage allow the cooling of the beverage to be prolonged until all of the water has melted.

30 Fig 3B shows a top view of the beverage cooling system 10^{VI}. The fins 50 and the heat transfer wall 26' are clearly visible.

Fig 3C shows a side cut-out view of the beverage cooling system 10^{VI} when the beverage holder 30 has been inserted. The present embodiment is a basic variant in
35 which the valve 18 allows the pressurized propellant gas to exit the canister 16 directly. In this way, the cold gas is lost and the cooling effect on the beverage is

achieved by the pressure reduction in the canister only. It is however contemplated that the present embodiment may be used together with the gas channel as described in the connection with fig 1.

- 5 Fig 4A shows a side cut-out view of a further embodiment of a beverage cooling system 10^{VII} being similar to the beverage cooling system 10^V of the previous embodiment except that the cooling device 12 includes a gas channel 20. The gas channel 20 is formed as a spiral shaped conduit encircling the cooling space 48. The gas channel 20 has an intake receiving propellant gas from the canister 16 via the
- 10 valve 18 and an exhaust 28 for allowing the propellant gas to leave to the outside of the beverage cooling system 10^{VII} . The propellant gas has a very low temperature when leaving the canister 16 and the propellant gas will thus absorb heat from the beverage 32. The gas channel 20 is increasing in width between the valve 18 and the exhaust 28 in order to allow the propellant gas to expand slowly in the gas channel 20.
- 15 The gas channel 20 preferably has a semicircular cross section in order to be able to exhibit a large area towards the beverage holder 30 while minimizing the area towards the insulating housing 14.

Fig 4B shows a top view of the beverage cooling system 10^{VII} . The cooling space 48 is

20 similar to the previous embodiments cylindrically shaped.

Fig 4C shows a side cut-out view of the beverage cooling system 10^{VII} when the beverage holder 30 has been inserted. The gas channel 20 is located adjacent the beverage holder 30.

25

Fig 5A shows a side cut-out view of a further embodiment of a beverage cooling system 10^{VIII} being similar to the beverage cooling system 10^V of the previous embodiment except that the gas channel 20' has a rectangular cross section and is partially defined by the insulating housing 14 and partially by the heat transfer wall 26''.

30

Fig 5B shows a top view of the beverage cooling system 10^{VIII} . The cooling space 48 is similar to the previous embodiments cylindrically shaped.

Fig 5C shows a side cut-out view of the beverage cooling system 10^{VIII} when the beverage holder 30 has been inserted. The gas channel 20 is located adjacent the

35 heat transfer wall 26''.

Fig 6A shows a side cut-out view of a further embodiment of a beverage cooling system 10^{IV} being similar to the beverage cooling system 10^V of the previous embodiment except that the gas channel 20'' has a rectangular cross section and is
5 partially defined by the heat transfer wall 26''' and partially by the beverage holder 30. Thus, when no beverage holder 30'' is inserted into the cooling space 48, the gas channel 20'' merely constitutes an open groove.

Fig 6B shows a top view of the beverage cooling system 10^{IV}. The cooling space 48 is
10 similar to the previous embodiments cylindrically shaped.

Fig 6C shows a side cut-out view of the beverage cooling system 10^{IV} when the beverage holder 30 has been inserted. The gas channel 20 is established between the heat transfer wall 26''' and the beverage holder 30 when the beverage holder 30 is
15 inserted into the cooling space 48. The heat transfer wall 26''' includes lips 52 which seal against the beverage holder 32.

Fig 7A shows a perspective view of a plurality of cooling blocks 54 are shown, each defining a cooling space 48' and an outer quadratic portion 56. In the present
20 embodiment, a total of eight such cooling blocks 54 are provided, each cooling block 54 capable of enclosing substantially one fourth of the circumference of a cylindrical beverage holder 30.

Each cooling block 54 includes a propellant gas which may be released through an
25 exhaust 28 by operating a handle 22 of a valve 18. It is evident that the cooling block 54 may include any of the features of the previously described beverage cooling systems.

Fig 7B shows a perspective view of eight cooling blocks 54 located within an insulating
30 cardboard box 58 together with two beverage holders 30.

Fig 8A shows a perspective view of a cooling can 60 constituting a normal beverage holder having a propellant gas filled cooling device instead of beverage. The figure further shows an insulating carrier 62 being made of rigid insulating material, such as
35 Styrofoam or the like. The insulating carrier 62 has a cavity 64 defining a cooling space suitable for accommodating six standard beverage holders 30 in the form of

typically sized beverage cans having a shape corresponding to the cooling can 60, however exclusive of the cooling device. The inner cavity 64 defines a flat bottom surface and an inner continuous sidewall which has bulges 66 for defining a plurality of interconnected arcs corresponding to the outer surface of six beverage cans defining
5 positions for individual placement of the beverage holders 30 when placed in the well known 3x2 "sixpack" configuration so that a stable and secure positioning is achieved.

The inner cavity 64 is thus configured for accommodating six beverage holders in two rows with three beverage holders 30 in each row. A spacer 68 is provided for filling up
10 the inner space between the six beverage holders 30 for added stability. The spacer 68 is preferably made in a non-thermal insulating or weakly thermal insulating material such as plastics, metal or cardboard. The cooling can 60 has an activation handle 22, which is pressed for releasing the pressurized propellant gas within the cooling can.

15 Fig 8B shows a top view of the cooling can 60 and the insulating carrier 62 accommodating the five beverage holders 30. The cooling can 60 may be stored in room temperature. When the beverage in the beverage holders 30 is about to be consumed, the activation handle 22 on the cooling can 60 is pressed and the propellant gas is released via the valve 18, the gas channel 20 and the exhaust 28. An
20 optional cover (not shown) on the insulation carrier 62 may be provided as an additional insulation.

Fig 9A shows a cooling can 60 in an alternative configuration. The cooling can 60, corresponding to the cooling can 60 of fig 8, is accommodated in a centrally located
25 spacer 68' and 6 beverage holders 30 are accommodated in an insulation carrier 62 surrounding the spacer 68'. The insulation carrier 62' has a rounded outer shape and an inner cavity 64' having bulges 66' for accommodating the six beverage holders 30 in a circumferential configuration around the centrally located spacer 68'.

30 Figs 9B and C show a perspective view and a top view, respectively, of the self-cooling can 60, the beverage holders 30 and the insulating carrier 62.

Fig 10A is a perspective view of a beverage coaster 70. The beverage coaster 70 contacts the bottom of a beverage holder 30' in the form of an ordinary beverage
35 glass. The beverage coaster 70 may maintain the beverage 32 within the beverage holder 30' at a low temperature for a longer time compared with using a normal

passive beverage coaster of e.g. paper material as provided in most bars and restaurants. The present beverage coaster 70 is active in the sense that it provides cooling to the bottom of the beverage holder 30' via a cooling device as previously described within the beverage coaster 70 for allowing the temperature of the beverage
5 coaster 730 to fall below room temperature, even to a temperature below 0°C.

Fig 10B is a cross sectional view of the beverage coaster 70. The beverage coaster 70 comprises a canister 16 which is contacting the bottom of the beverage holder 30', and an insulating housing 14. The insulation housing 14 prevents any heat from the
10 surroundings, e.g. the table, from entering the beverage 32. The beverage coaster 32 further comprises a handle 22. The handle 22 is connected to a valve 18. By pressing the handle 22, the pressurized propellant gas stored within the canister 16 is released via the valve 18, the gas channel 20 and the exhaust 28 to the outside of the beverage coaster 30, thereby generating cooling.

15

Fig 11 shows a cut-out view of a self cooling glass 72 including a beverage 32. The beverage glass 72 comprises a canister 16 defining an inner wall located adjacent the beverage 16. The canister 16 is covered by an insulating housing 14. In this way, the beverage may be maintained chilled for a longer time due to the active cooling
20 provided by the gas exiting the canister 16 via the valve 18, the gas channel 20 and the exhaust, after the handle 22 has been pressed.

Fig 12 shows a cut-out view of a cooling box 74. The cooling box 74 comprises a lower section 76 and a lid 78. The lower section 76 of the cooling box 74 includes a
25 beverage holder 30 in the form of a beverage glass. The cooling box 74, i.e. both the lower section 76 and the lid 78, comprises an insulating layer 12. The beverage holder 30 may be stored within the cooling box 74 in order to provide a cool holder 30. The lower section 76 of the cooling box 74 includes a canister 16 filled by propellant gas. The propellant gas may be released via the valve 18, the gas channel 20 and the
30 exhaust 28 by pressing the handle 22.

Fig 13 shows a cut-out view of a beverage holder 30' in the form of a beverage glass and a cooling insert 80. The cooling insert 80 defines a canister 16 which fits inside a beverage holder 30 for chilling the beverage holder to a lower temperature. The
35 beverage may be filled directly into the beverage holder 30' once the cooling insert 80 has been removed. The beverage holder 30' may be of insulating material. The

propellant gas may be released from the canister 16 via the valve 18, the gas channel 20 and the exhaust 28 by pressing the handle 22.

Fig 14A shows a perspective view of a dispenser 82 and a beverage holder 30 in the form of a can. The beverage dispenser 82 comprises a hollow piercing element 84 and a tap 86 for tapping the beverage.

Fig 14B shows a cut-out view of the beverage holder 30 and the dispenser 82. The dispenser 64 comprises an insulating housing 14 and a cooling device 12 in the form of a canister 16. In between the cooling device 12 and the insulating housing 14, a beverage space 88 is located. The canister 16 includes a pressurized propellant gas. The piercing element 84 may be inserted through the bottom of the beverage holder 30 in order for the beverage 32 within the beverage holder 30 to flow via the piercing element 84 into the beverage space 88 and being tapped through the tap 86. When the beverage holder 30 is placed in the dispenser 82, the handle 22 will automatically be pressed, which causes the valve 18 to open and release the propellant gas via the gas channel 20 and the exhaust 28 to the outside. Optionally, a sealing gasket 90 may be used for preventing leakage.

Fig 14C shows an alternative embodiment of the dispenser 82' resembling the dispenser 82 of fig 14B, except that a dispensing line 90 is provided between the piercing element 84 and the tap 86. The propellant gas is located in the space between the insulating housing 14 and the dispensing line 90.

Fig 15 shows a perspective view of the beverage holder 30 and any of the dispensers 64, 64' when in use. When the piercing element has pierced the bottom of the beverage holder 30, the tap 92 of the beverage holder 30 may be operated in order to allow air to enter the beverage holder 30 and allow the beverage 32 to flow out of the tap 86 by gravity pull. The beverage is cooled between the piercing element and the tap 86 due to the heat transfer occurring when the pressurized propellant gas leaves the canister 16.

Fig 16A shows a perspective view of a larger beverage holder 30 and a cooling container 94. The bottom of the beverage holder 30 may be pierced by a piercing element 84'. The piercing element 84' is connected via a dispensing line 90' to tap 86'. The tap 86' includes a tapping device 98 for controlled tapping of the beverage

contained in the beverage holder 30. The cooling container 94 comprises a cavity 96 for the dispensing line 90'.

Fig 16B shows a perspective cut out view of the larger beverage holder 30 within the
5 cooling container 94. The cooling container 94 is preferably covered by an insulation layer. The cooling container 94 comprises a canister 16 filled by pressurized propellant gas. The beverage in the beverage holder 30 will be chilled within a few minutes and the beverage may be dispensed by opening the tab 92. The beverage is cooled
10 via the valve 18, the gas channel 20 and the exhaust 28.

Although the present invention has been described above with reference to specific embodiments of the beverage cooling system, it is evident that numerous modifications and combinations of the above embodiments are possible using the
15 knowledge of the person skilled in the art. For instance, it is evident that the described beverage coolers suitable for beverage holders in the form of cans may be easily scaled up to accommodate larger containers such as kegs or casks.

List of parts with reference to the figures

10. Beverage cooling system	56. Quadratic wall
12. Cooling device	58. Cardboard box (insulating)
14. Insulating housing	60. Cooling can
16. Canister	62. Carrier
18. Valve	64. Cavity
20. Gas channel	66. Bulges
22. Handle	68. Spacer
24. Activated carbon	70. Coaster
26. Heat transfer wall	72. Self cooling glass
28. Gas exhaust	74. Cooling box
30. Beverage holder	76. Lower section
32. Beverage	78. Lid
34. Pressurized gas / Liquefied gas	80. Cooling insert
36. Heat transfer fins	82. Dispenser
38. Vortex tube (Ranque Hilsch)	84. Piercing element
40. Gas inlet	86. Tap
42. Warm gas outlet	88. Beverage space
44. Cold gas outlet	90. Dispensing line
46. Cylindrical wall	92. Tab
48. Cooling space	94. Cooling container
50. Fins	96. Cavity
52. Lips	98. Tapping device
54. Cooling block	

Claims

1. A system for externally cooling a beverage holder, said beverage holder holding a specific amount of beverage, said system comprising a cooling device
5 defining a cooling space for accommodating said beverage holder and an insulating housing made of a thermally insulating material and enclosing said cooling device opposite said cooling space, said cooling device comprising:
- a canister including a specific amount of a propellant gas, preferably CO₂, at a pressure exceeding the ambient atmospheric pressure at sea level, said
10 canister comprising a valve defining an open state for releasing said propellant gas from said canister and a closed state for keeping said propellant gas within said canister, and
- a gas channel defining a gas intake for receiving said propellant gas from said valve of said canister and a gas exhaust for expelling said propellant gas outside
15 said insulating housing.
2. The system according to claim 1, wherein said cooling device further includes a vortex tube (Ranque-Hilsch vortex tube), said vortex tube defining a gas inlet in fluid communication with said valve, a warm gas outlet located outside said
20 insulating housing and a cold gas outlet in fluid communication with said gas intake of said gas channel.
3. The system according to any of the preceding claims, wherein said canister includes a particular amount of adsorption material for adsorbing said
25 propellant gas, said adsorption material preferably being activated carbon.
4. The system according to any of the preceding claims, wherein said gas channel is located between said canister and said cooling space.
- 30 5. The system according to any of the preceding claims, wherein said canister and/or said gas channel defines said cooling space.
6. The system according to any of the preceding claims, wherein said propellant gas constitutes a liquefied propellant gas.

7. The system according to any of the preceding claims, wherein said gas channel defines a spiral shape about said cooling space.
8. The system according to any of the preceding claims, wherein said
5 cooling device defines a groove at said cooling space, said gas channel being established by said groove between said cooling device and said beverage holder.
9. The system according to any of the preceding claims, wherein said gas channel has a length exceeding 0,1m, preferably 0,5m more preferably 1m, most
10 preferably 2m.
10. The system according to any of the preceding claims, wherein said gas channel is increasing in width between said intake and said exhaust.
- 15 11. The system according to any of the preceding claims, wherein said cooling device defines a cooling wall made of thermally conductive material for contacting said beverage holder.
12. The system according to any of the preceding claims, wherein said gas
20 channel and/or said canister includes conductive fins for increasing the thermal conductivity.
13. The system according to any of the preceding claims, wherein said cooling device and/or said cooling space includes PCM material.
- 25 14. The system according to any of the preceding claims, wherein said canister and/or said gas channel is encircling said cooling space.
15. A method of externally cooling a beverage holder, said beverage holder
30 holding a specific amount of beverage, said method comprising providing a cooling device defining a cooling space for accommodating said beverage holder and providing an insulating housing made of a thermally insulating material and enclosing said cooling device opposite said cooling space, said cooling device comprising:
- 35 a canister including a specific amount of a propellant gas, preferably CO₂, at a pressure exceeding said ambient atmospheric pressure at sea level, said canister comprising a valve, and

a gas channel defining a gas intake for receiving said propellant gas from said valve of said canister and a gas exhaust for expelling said propellant gas outside said insulating housing,

said method comprising the step of:

- 5 opening said valve of said canister thereby allowing said propellant gas to flow from said canister via said gas intake of said gas channel to said gas exhaust of said gas channel.

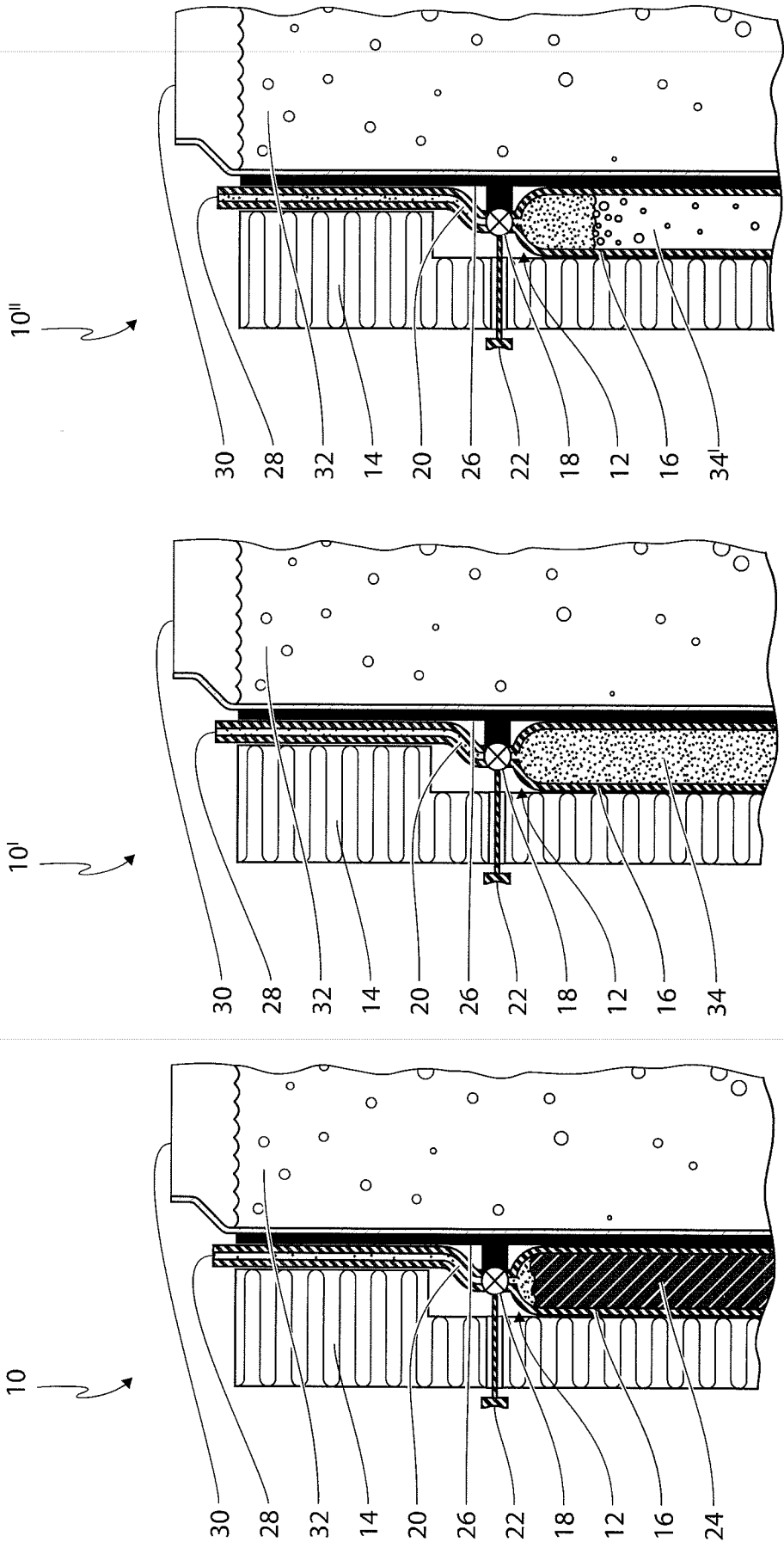


FIG. 1C

FIG. 1B

FIG. 1A

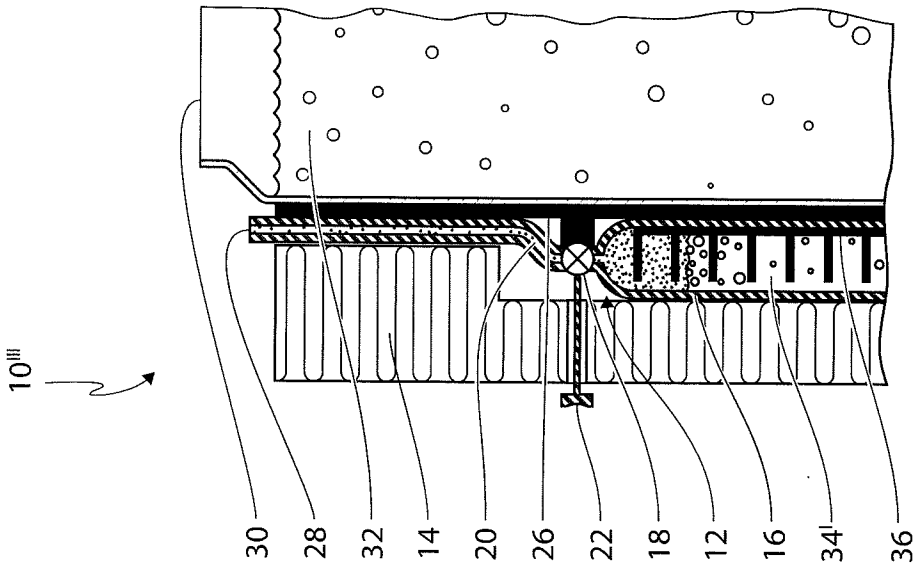


FIG. 1D

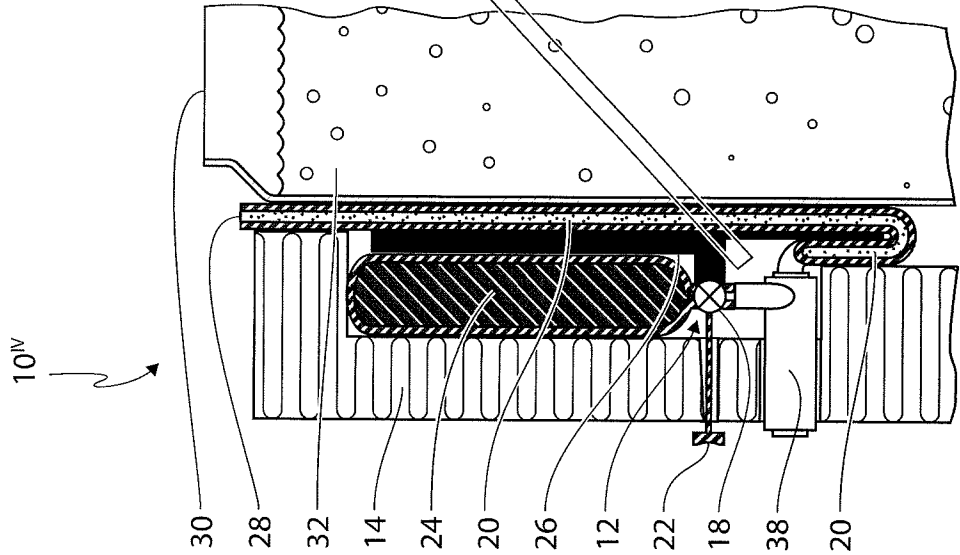


FIG. 1E

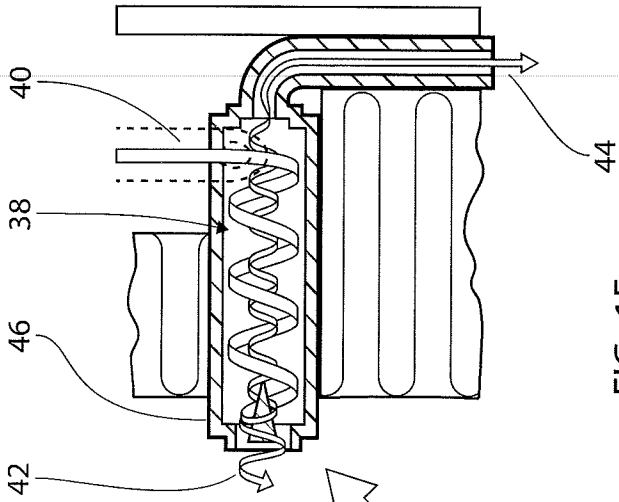


FIG. 1F

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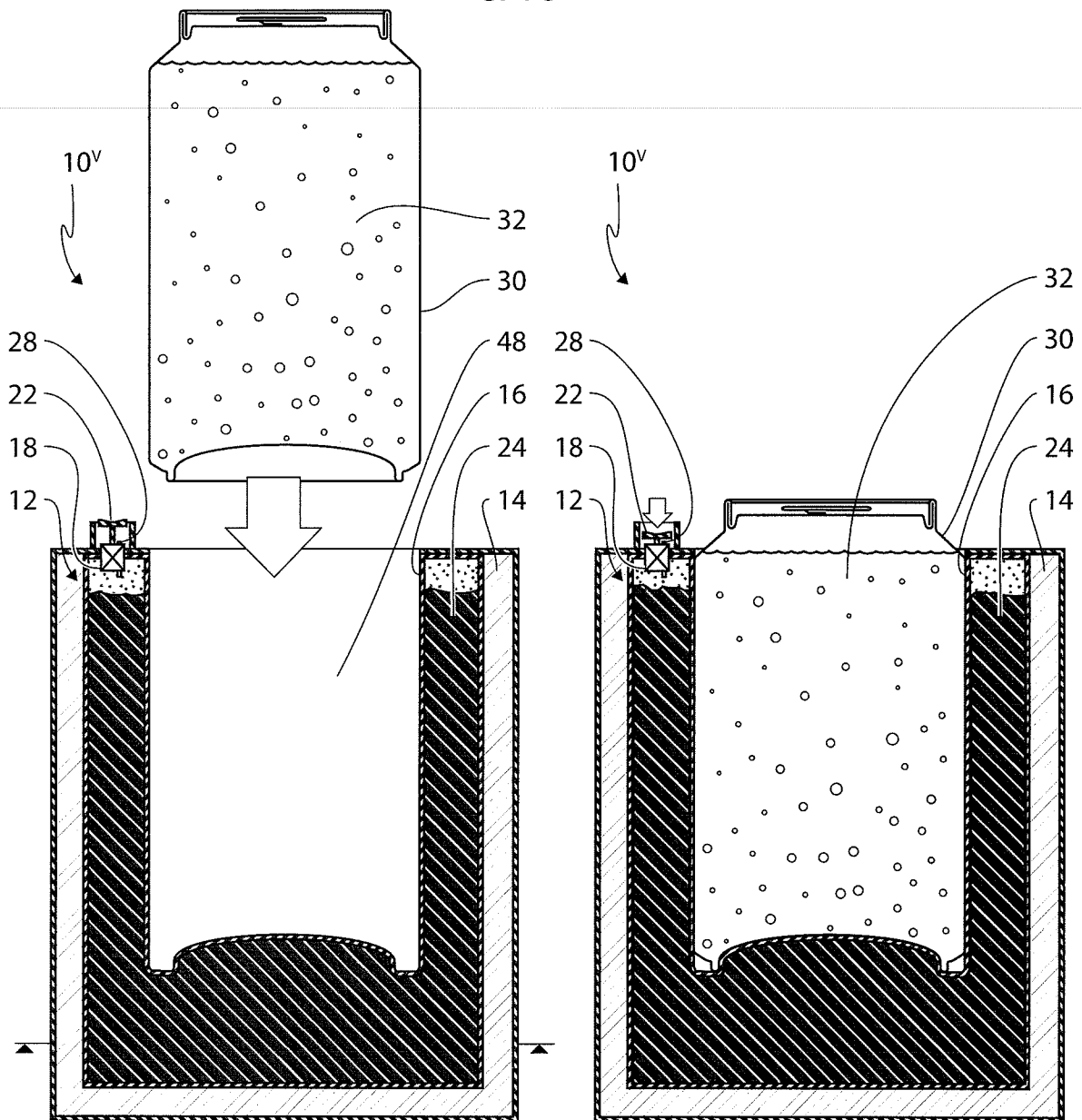


FIG. 2A

FIG. 2C

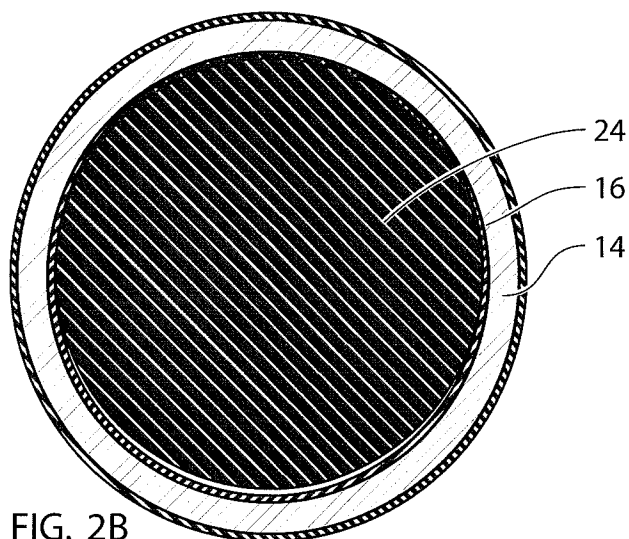


FIG. 2B

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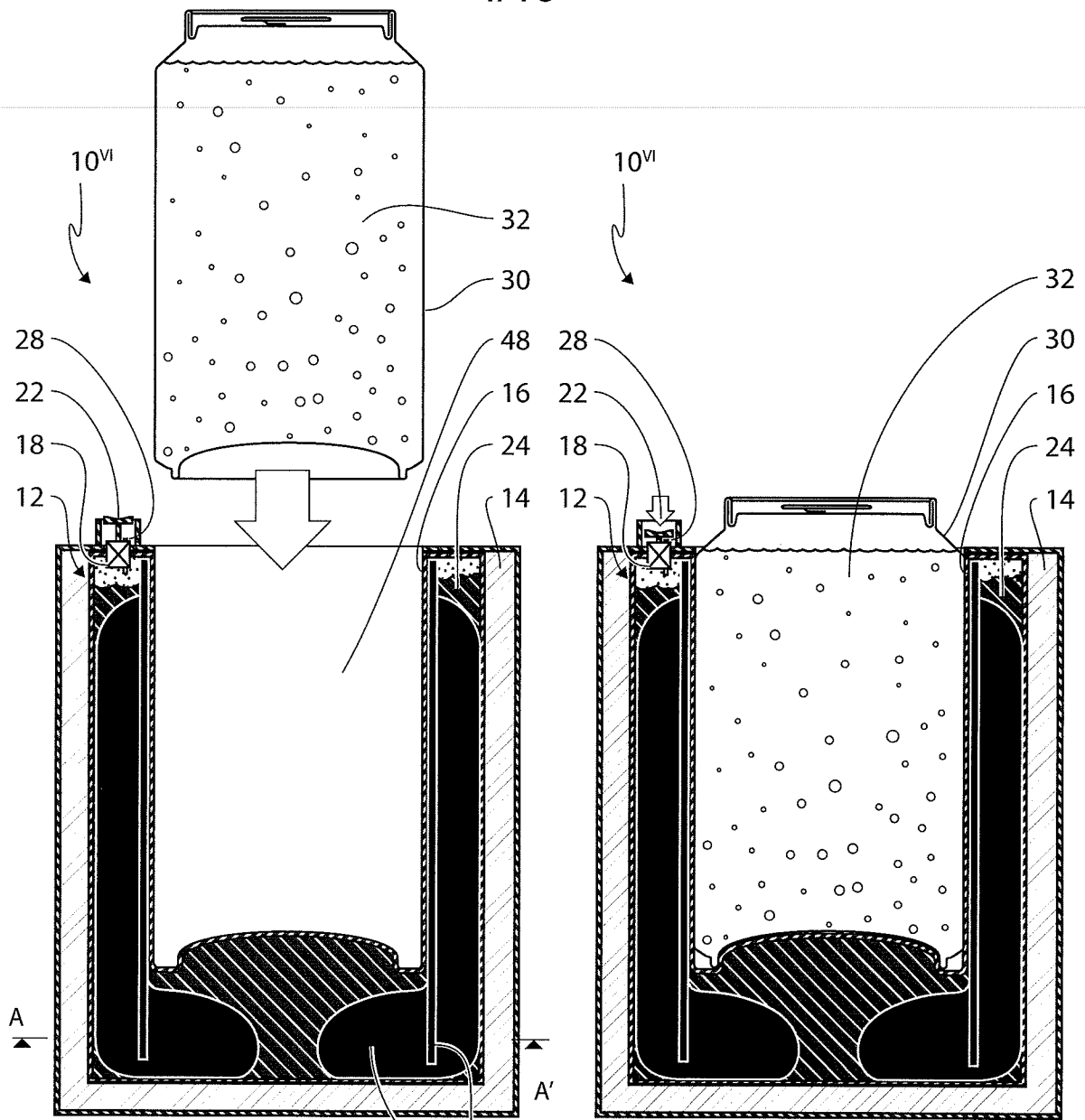


FIG. 3A

FIG. 3C

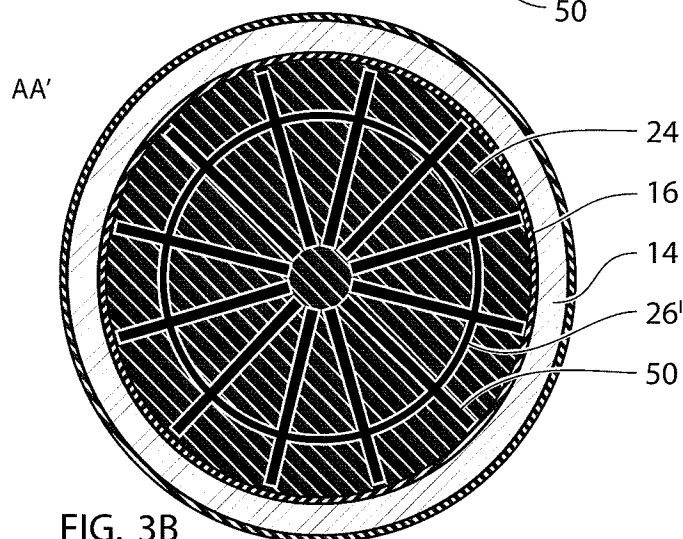
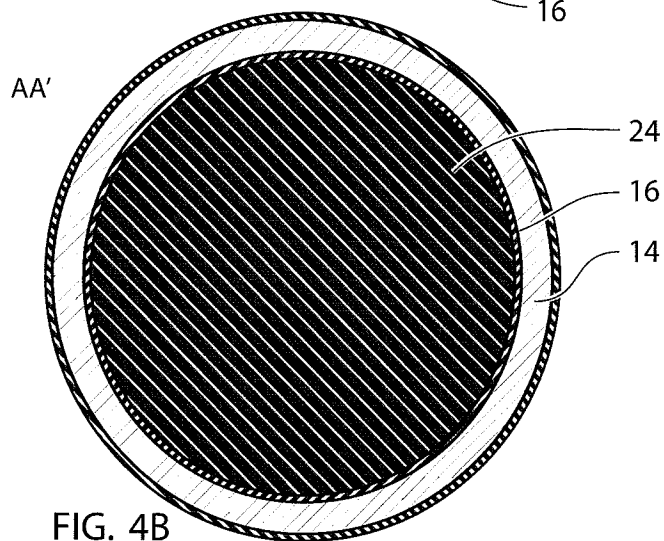
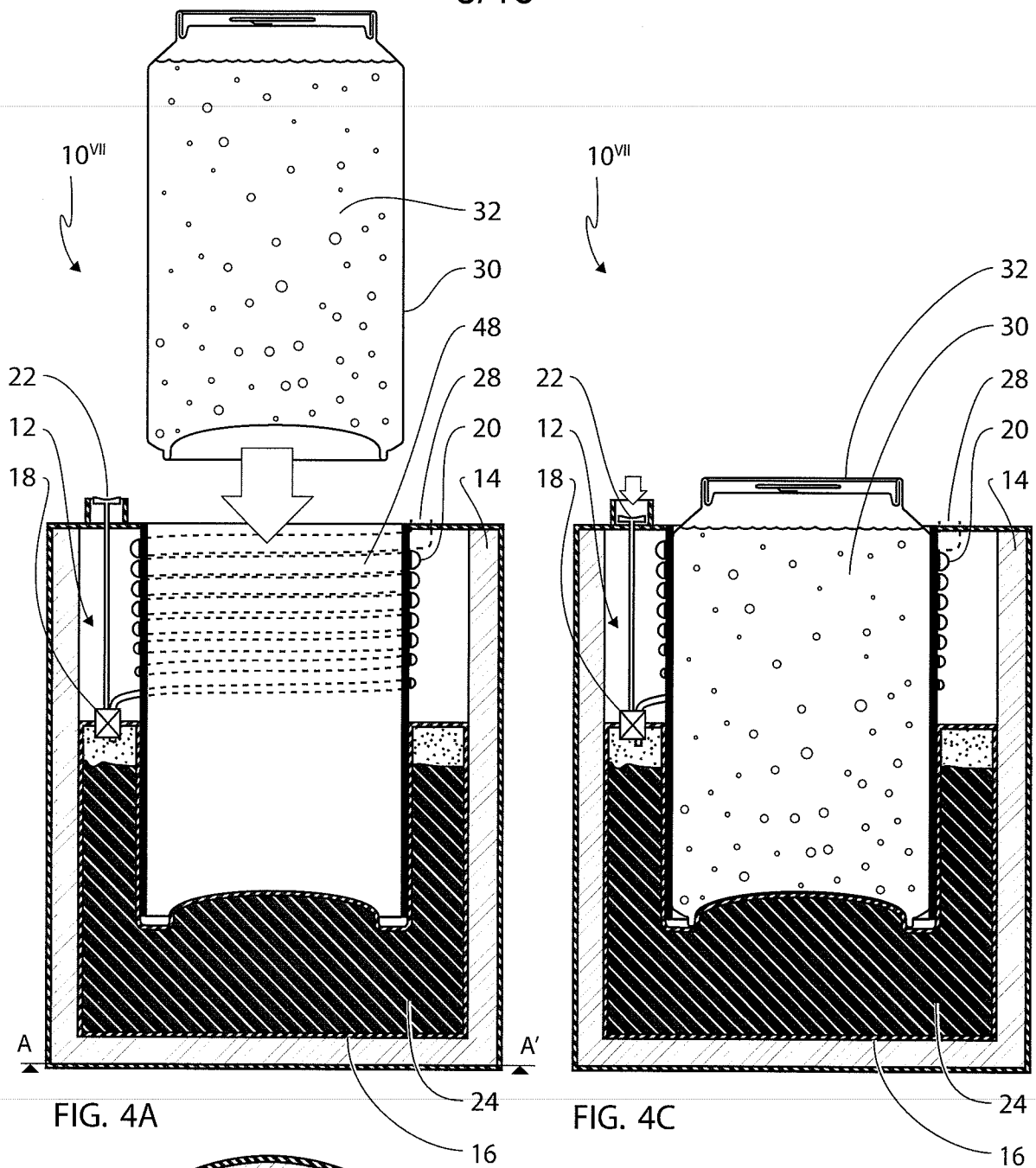
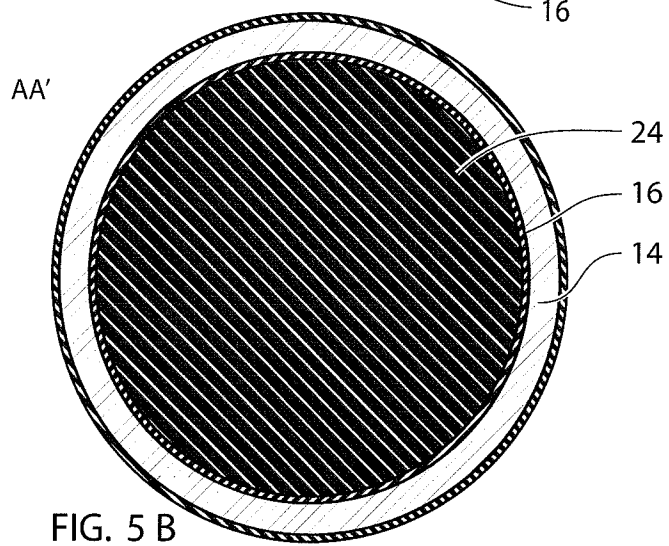
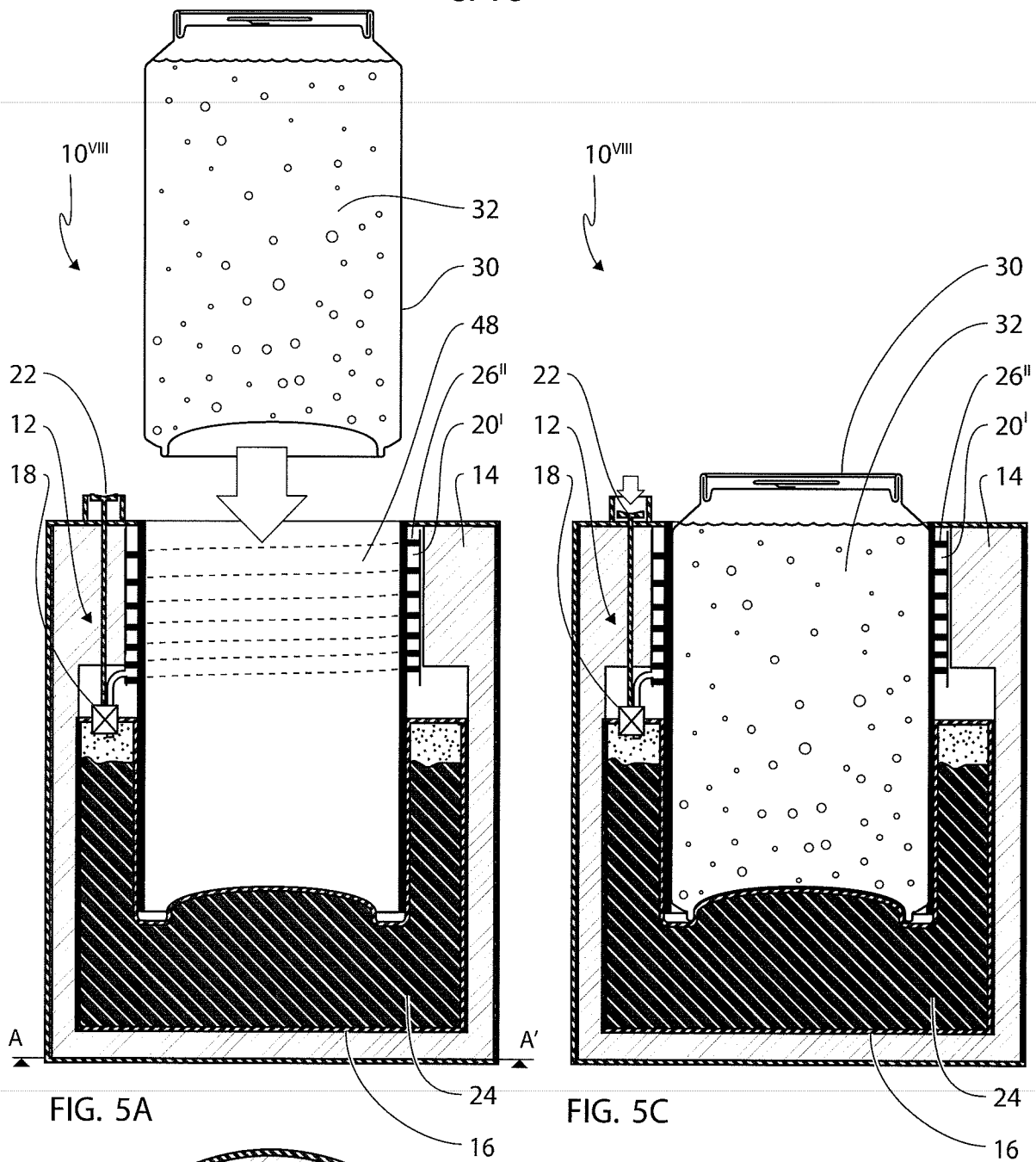


FIG. 3B

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7/15

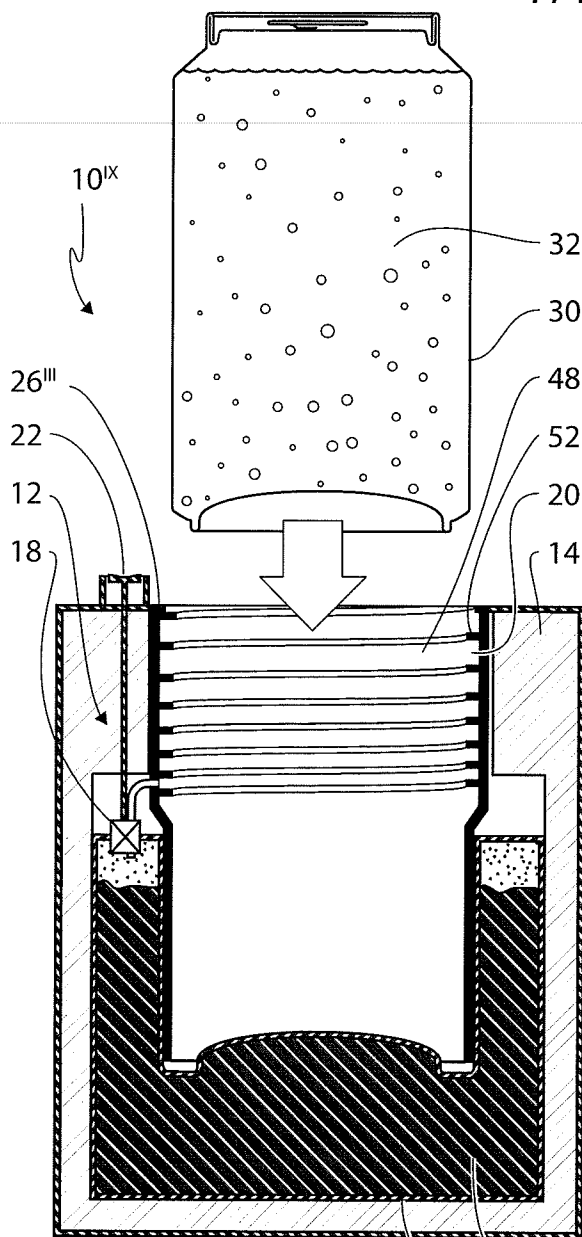


FIG. 6A

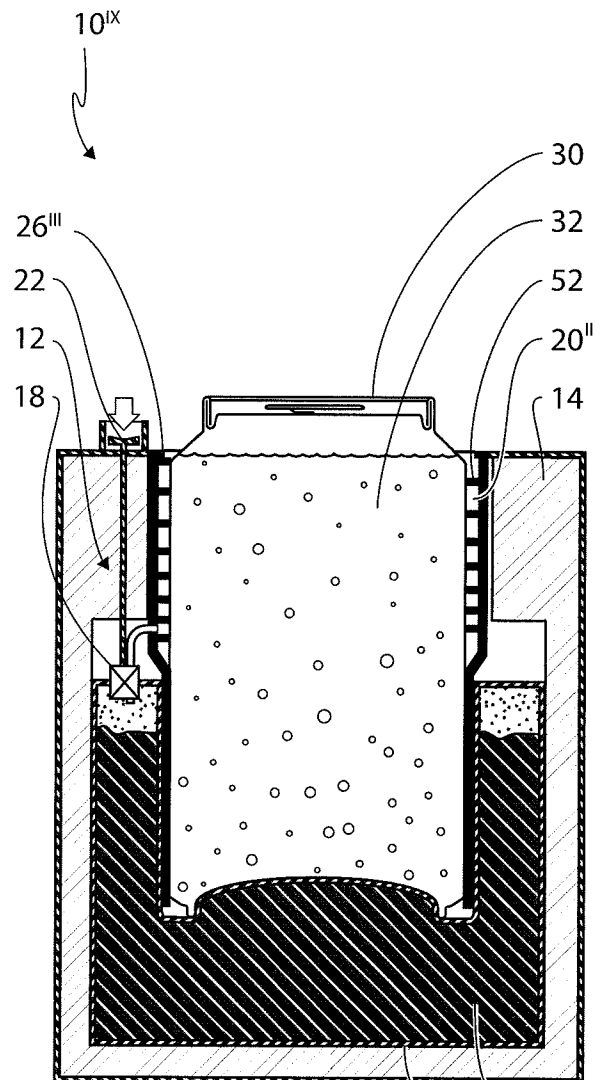


FIG. 6C

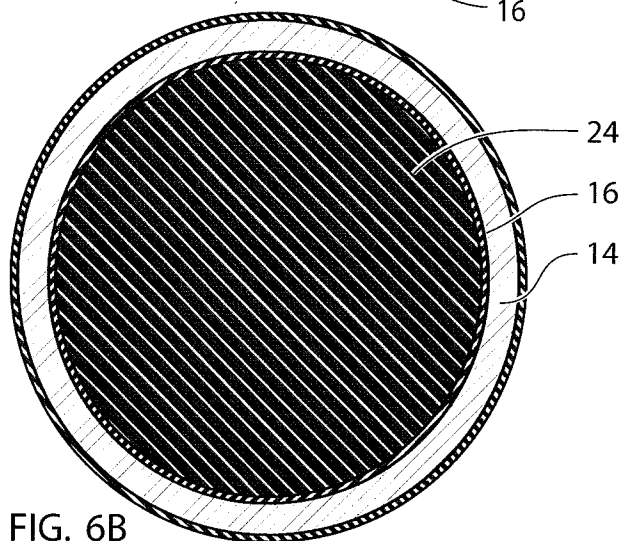


FIG. 6B

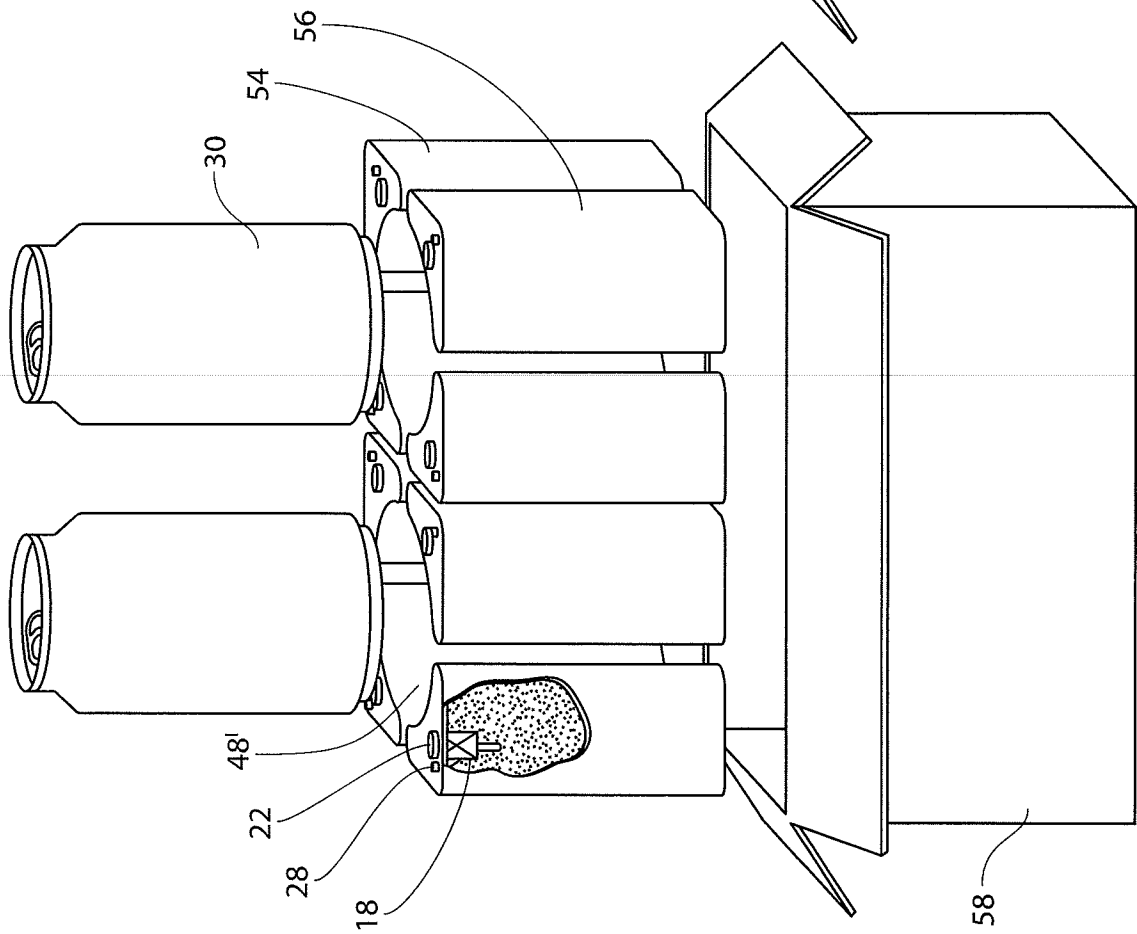


FIG. 7A

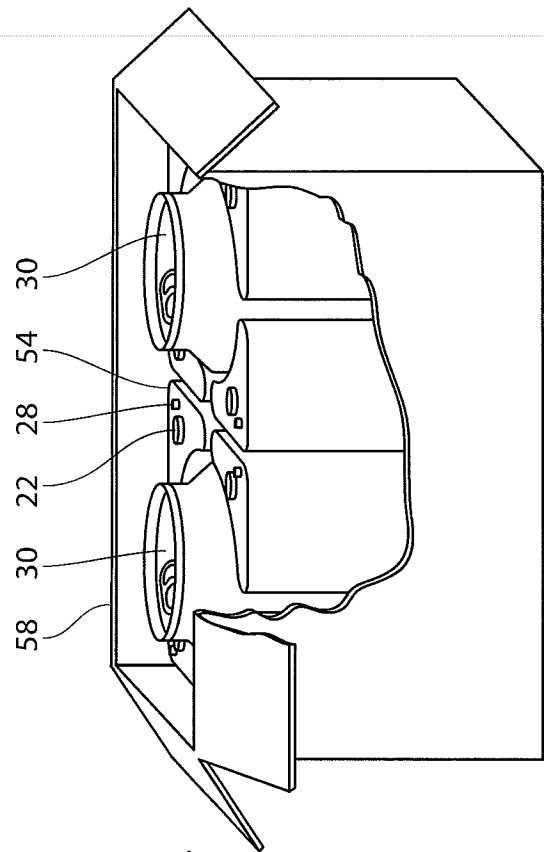
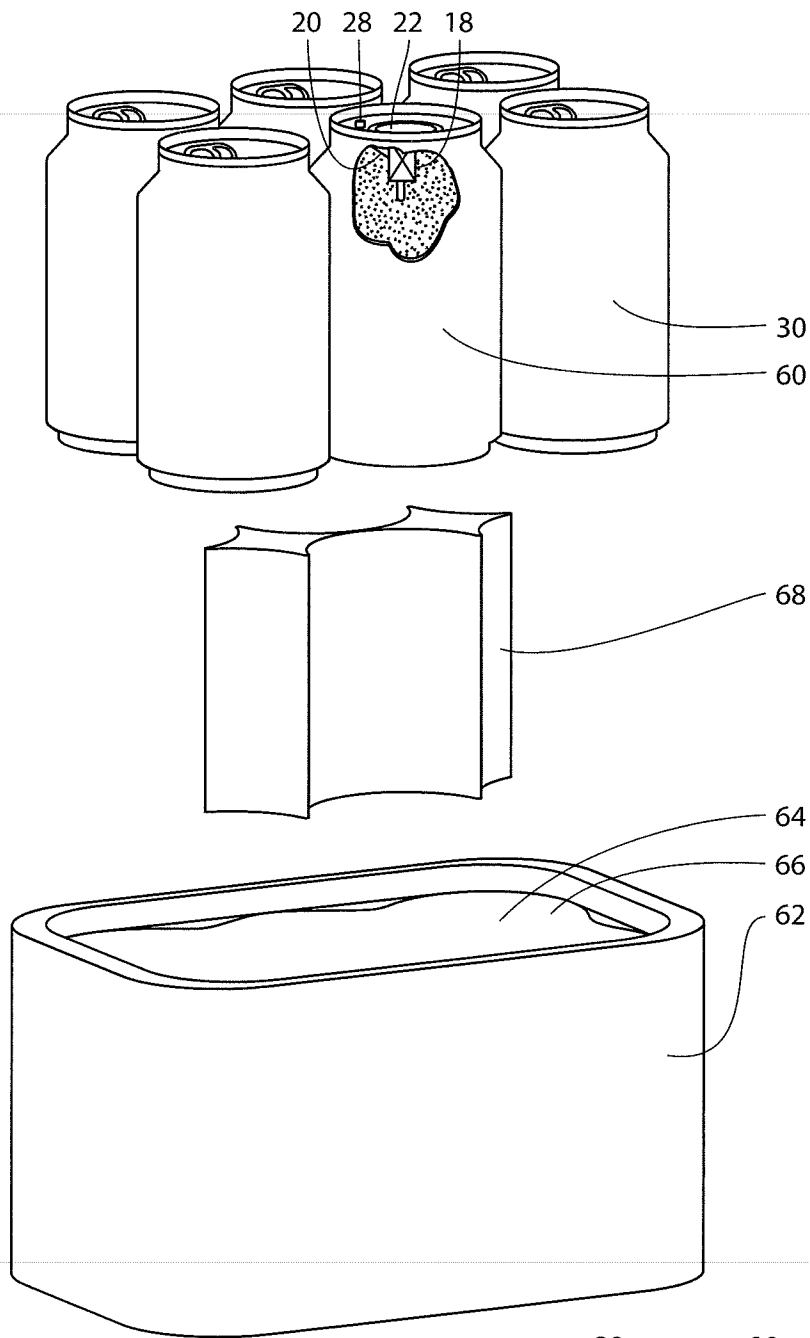


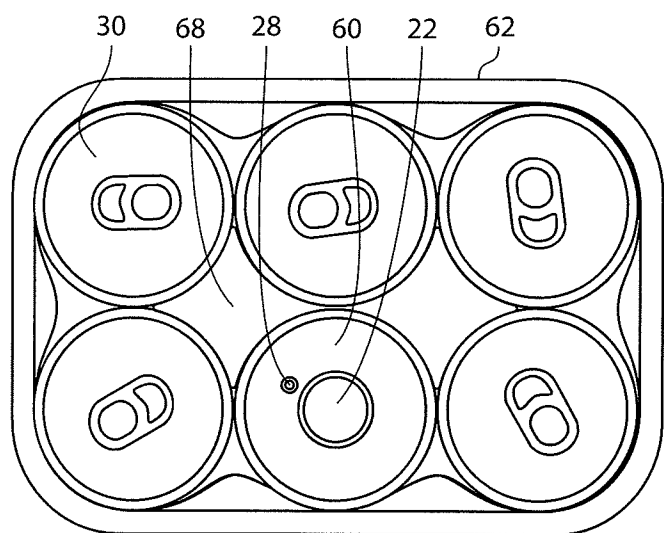
FIG. 7B

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10^{XVI}

FIG 8B



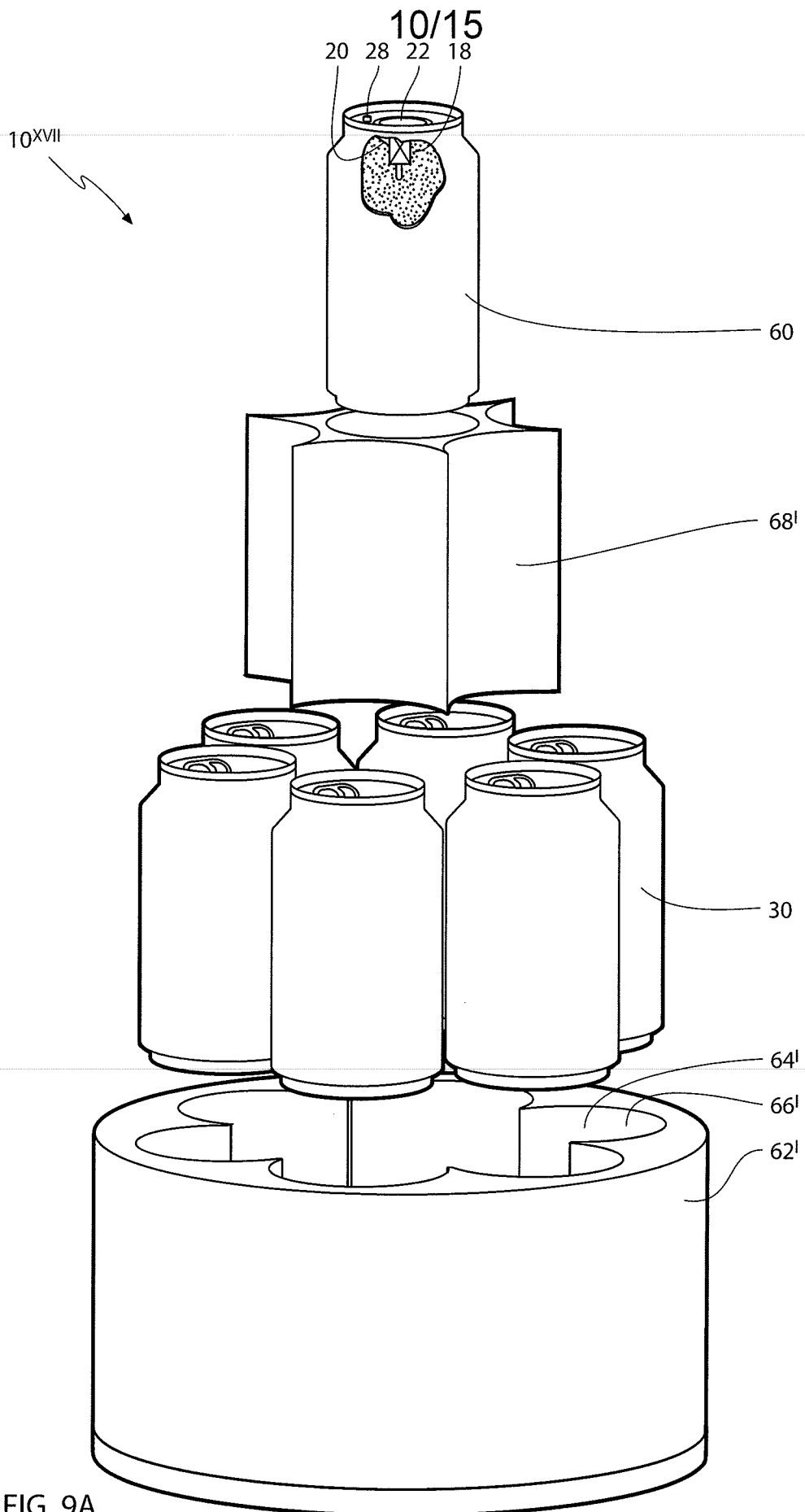


FIG 9A

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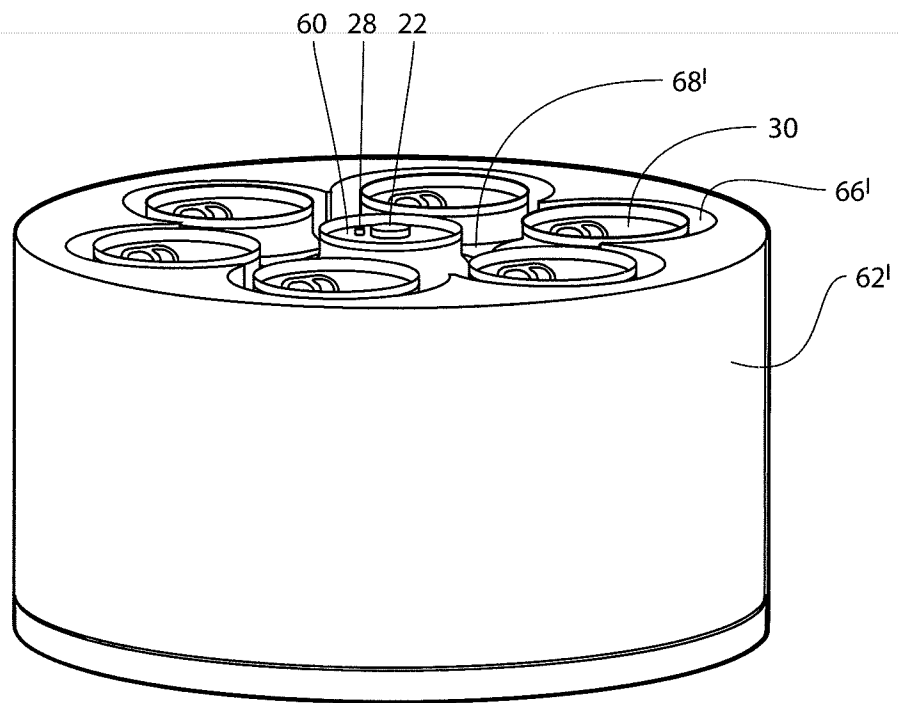


FIG 9B

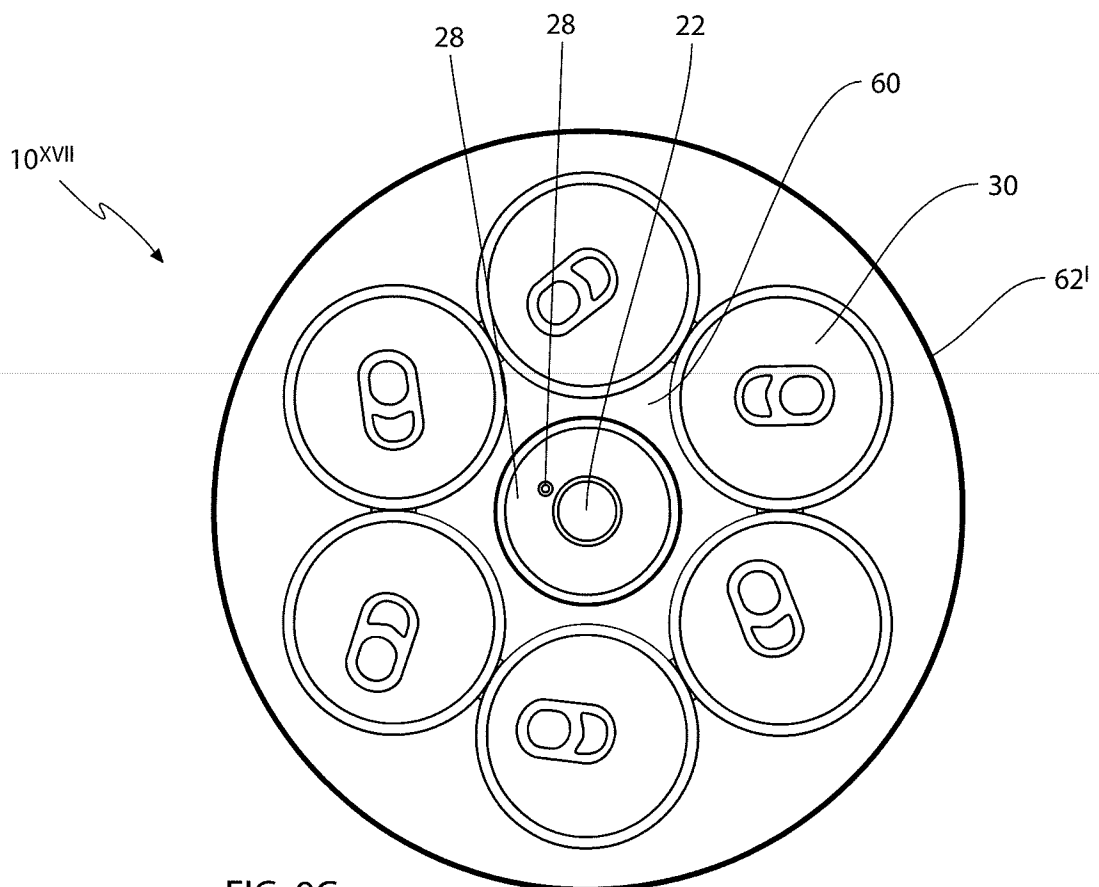


FIG 9C

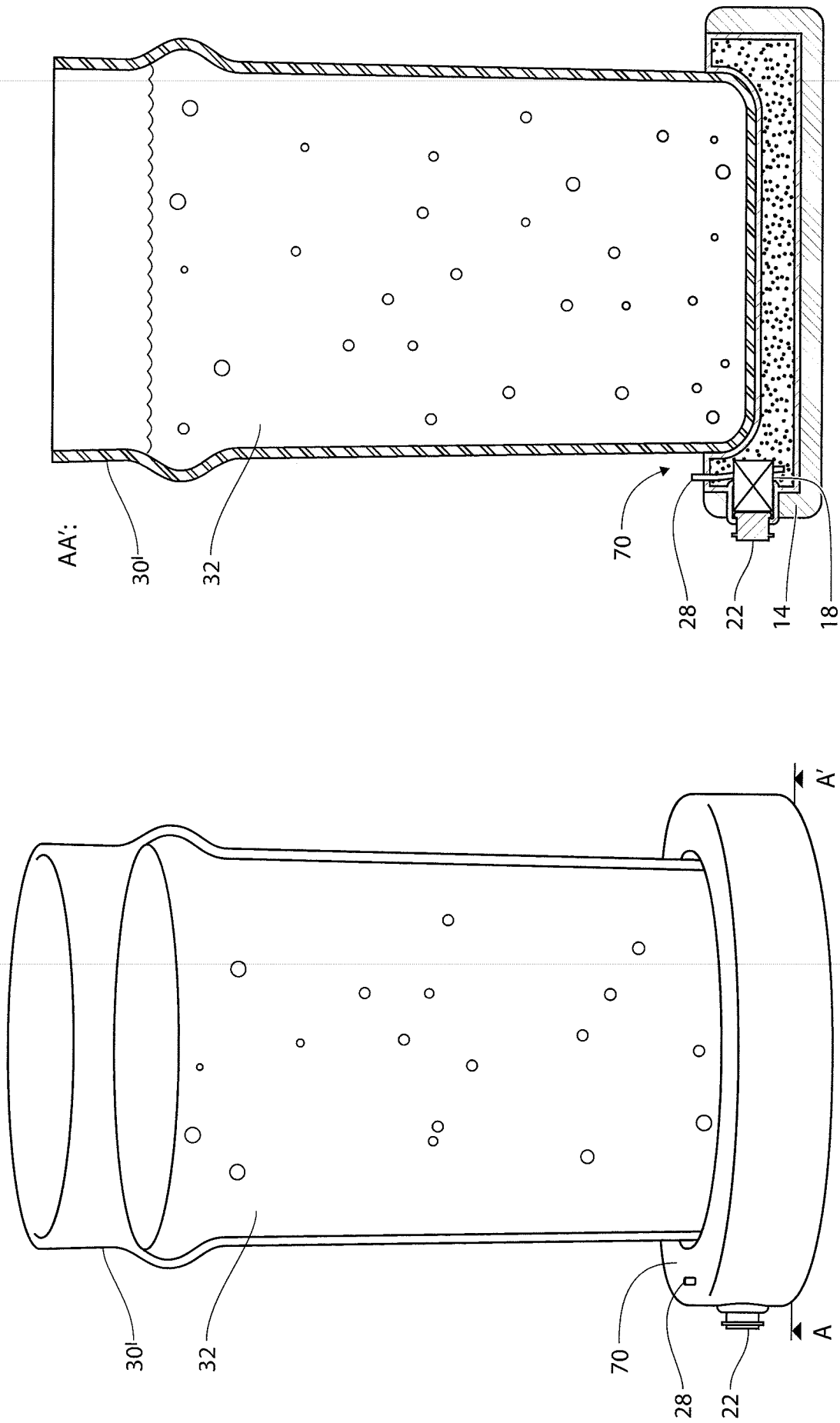


FIG. 10B

FIG. 10A

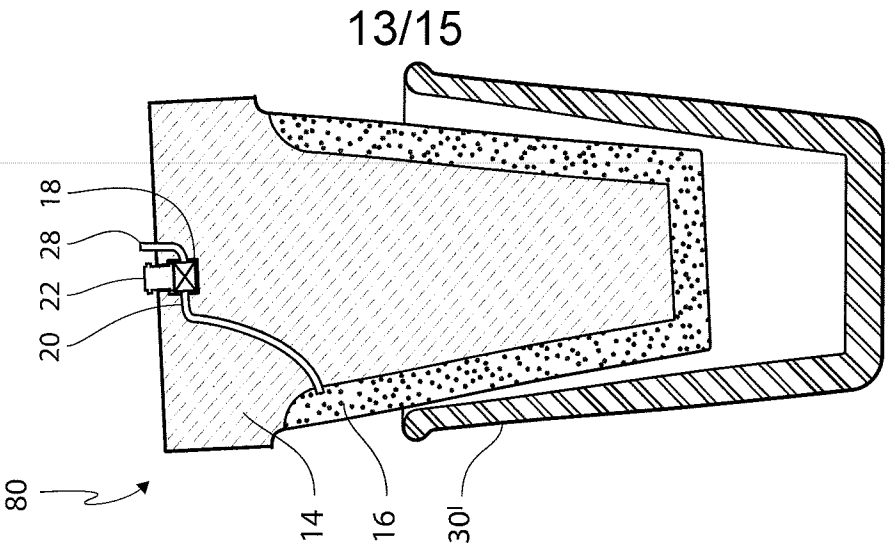


FIG. 13

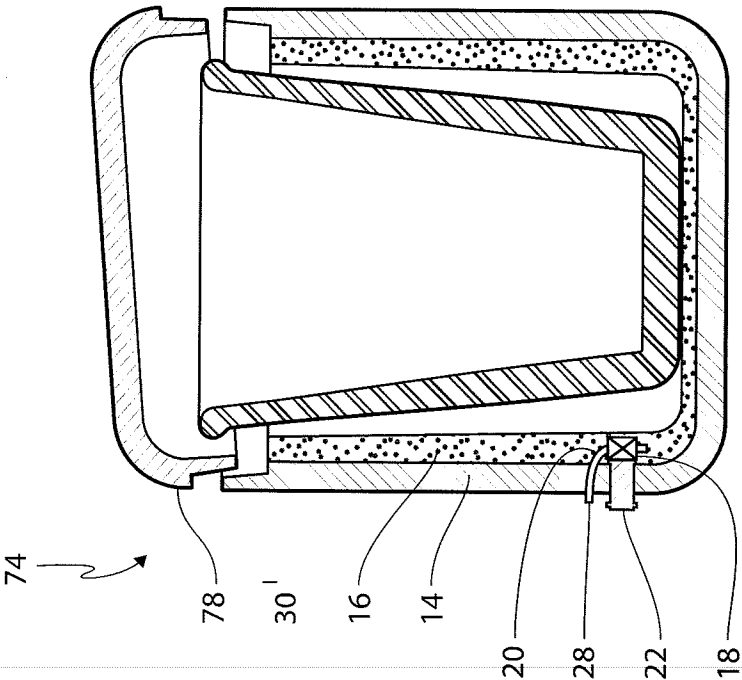


FIG. 12

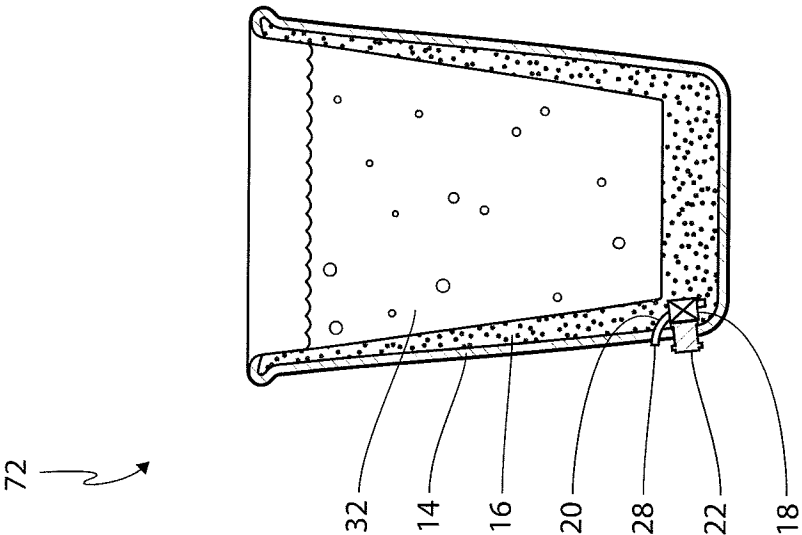
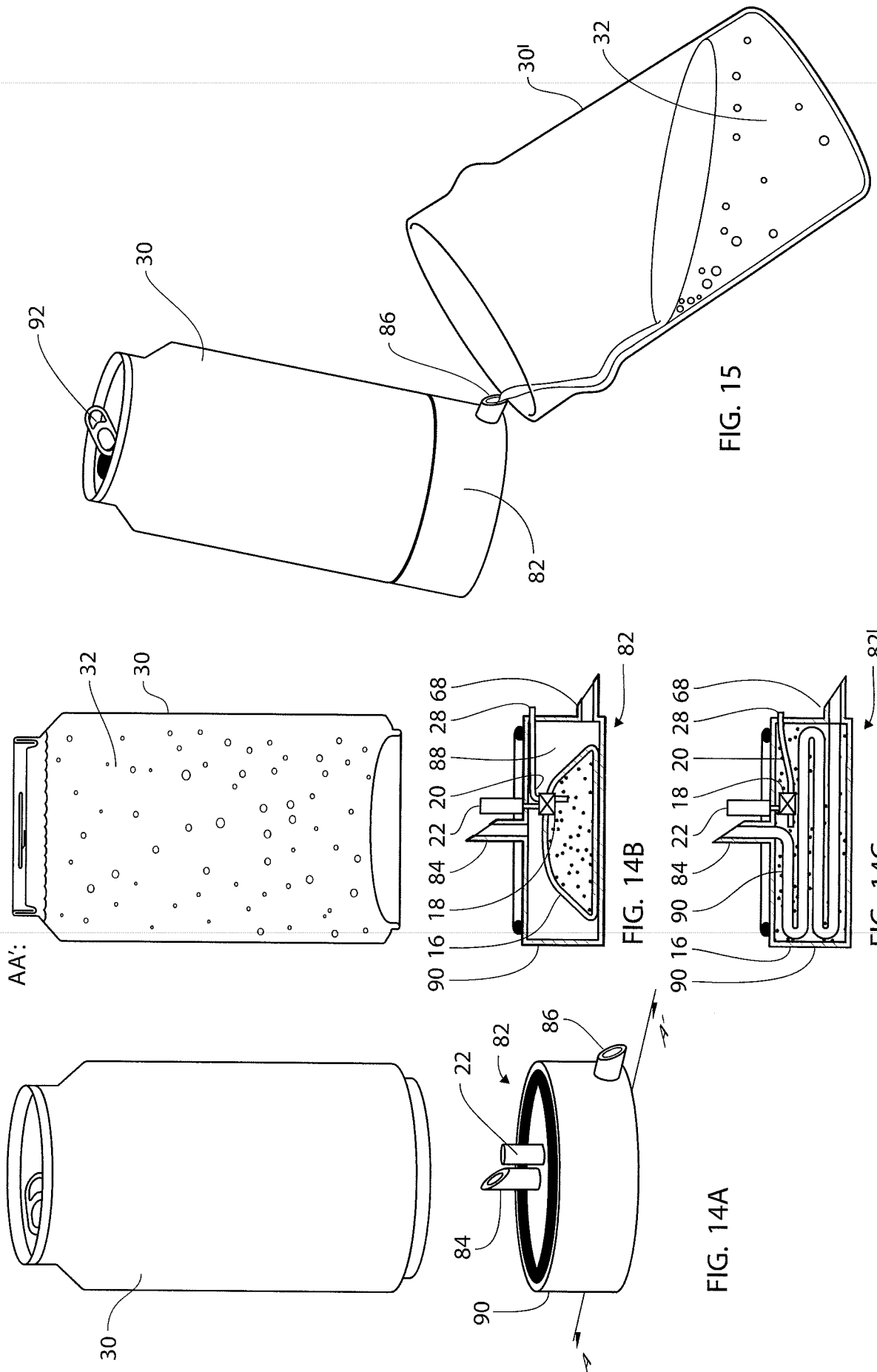


FIG. 11

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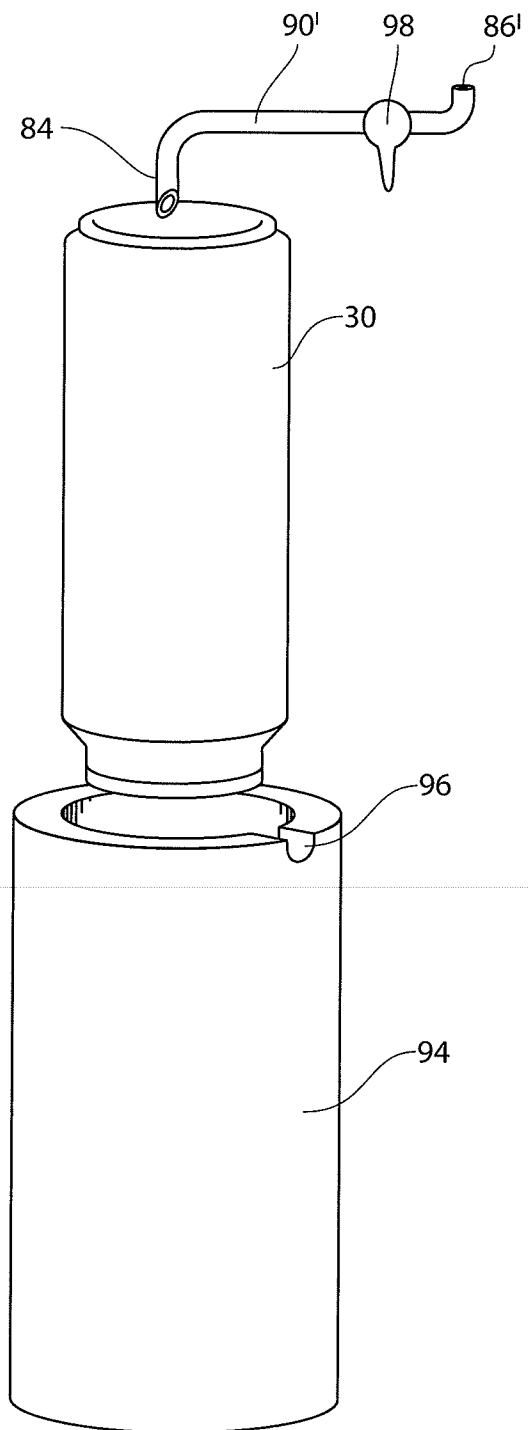


FIG. 16A

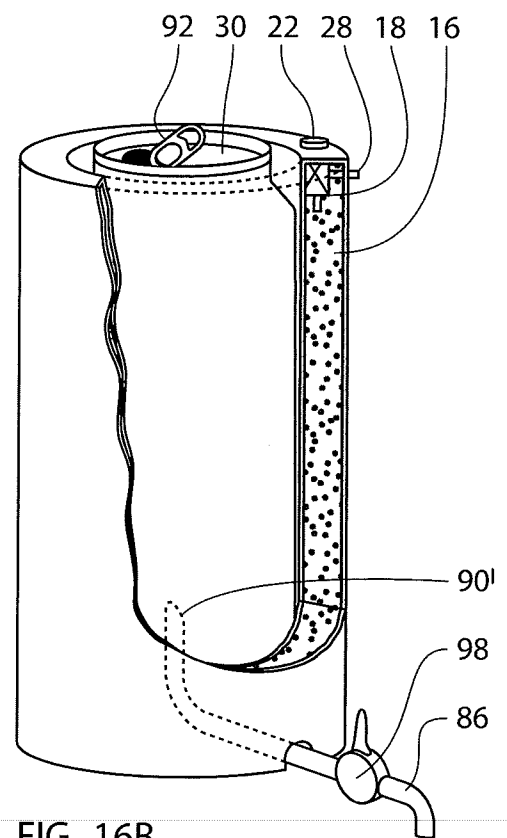


FIG. 16B

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/056926

A. CLASSIFICATION OF SUBJECT MATTER

INV. F25B9/04 F28F13/08 F25D3/10 F25D7/00 F25D31/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D F25B F28F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 20 2005 014967 U1 (MAYR HASSLER RAINER DOMINIK [AT]) 26 October 2006 (2006-10-26) abstract; figures 1-5 paragraphs [0041] - [0044], [0051] - [0056] -----	1,4-8, 11,14,15 2,3,10
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/056926

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