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(54) **A beverage dispense system**

(57) A beverage dispense system provided with at least one dispense head 10 in a serving area for dispense of a beverage and a product line 14 for transferring beverage from a remote beverage source to the dispense head 10. The product line 14 is contained within a python that contains a cooling circuit 20 for transferring coolant to and from the serving area and a cooling module 22 is provided proximate the dispense head 10 in the serving area for cooling beverage transferred to the dispense head 10 in the product line 14. The cooling module 22 comprises a tank 24 connected to the coolant circuit 20

for circulating coolant through the tank 24 and a tubular product coil 36 within the tank 24 for passing product through the coil 36. The product coil 36 is located in a chamber 28 within the tank 24 and contacts opposed surfaces of the chamber 28 to define therewith a flow path 44 for the coolant to promote heat exchange between the product and the coolant for cooling the product to a desired temperature. Inlet temperature and flow rate of the coolant may be controlled to achieve a reduction of product temperature that is substantially independent of product draw-off rate from the dispense head 10.

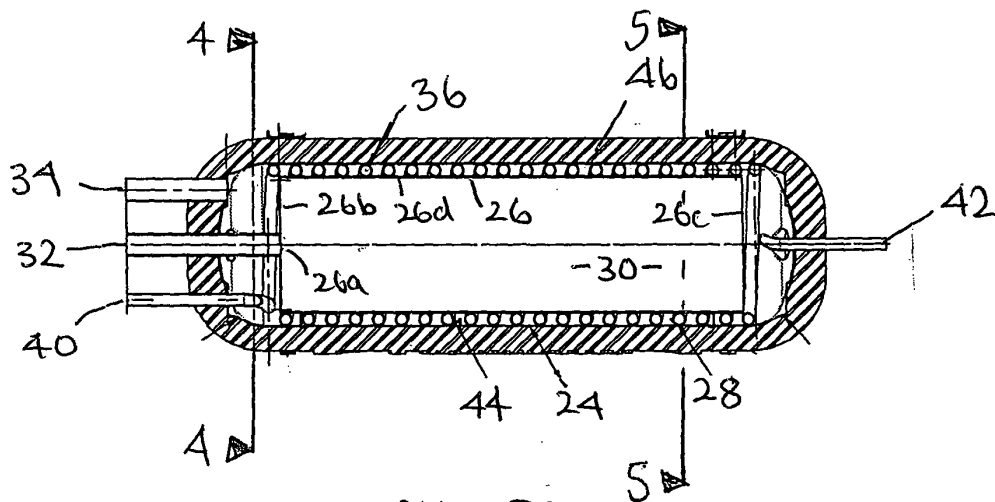


FIGURE 3

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Description

[0001] This invention concerns improvements in or relating to beverage dispense. More specifically, the invention relates to a beverage dispense system and a method of dispensing a beverage.

[0002] Alcoholic draught beverages such as beer, lager, cider etc are typically delivered to a dispense head such as a font mounted on a bar top for dispense from a tap. The beverage is normally stored in a keg at a remote location such as a cellar and is delivered to the dispense head in a product line. The beverage is usually stored at a temperature higher than the dispense temperature and is cooled to the desired dispense temperature by one or more coolers located between the keg and the dispense tap.

[0003] Typically a cooler such as an ice bank cooler is provided at the remote location through which product lines from several kegs may pass to cool the beverages and the product lines are then bundled together in a so-called "python" extending from the remote location to the bar area for connection to the appropriate dispense taps. The python is usually insulated and contains a coolant re-circulation loop for circulating coolant from the cooler at the remote location to prevent the beverages in the product lines warming up.

[0004] The beverages in the product lines leaving the python in the bar area have substantially the same temperature and it is common to provide additional cooling in the bar area such as thermoelectric coolers or plate heat exchangers to allow the beverage in each product line to be cooled to the desired dispense temperature.

[0005] This additional cooling allows the dispense temperature of the beverage to be more accurately controlled according to the type of beverage and/or customer preference. For example, lager is typically dispensed at lower temperatures than beer or cider.

[0006] Thermoelectric coolers are inefficient and generate disproportionate amounts of heat that needs to be dissipated, for example by water cooling while plate heat exchangers are expensive to manufacture and can be difficult to clean effectively.

[0007] The present invention has been made from a consideration of the foregoing and seeks to provide heat exchange apparatus for a beverage that is efficient, compact and does not generate a lot of heat within the bar area.

[0008] According to a first aspect of the present invention, there is provided a beverage dispense system comprising a serving area provided with at least one dispense head for dispense of a beverage, a source of beverage remote from the serving area, a product line for transferring beverage from the beverage source to the dispense head, the product line being contained within a python extending to the serving area, a cooling circuit contained within the python for transferring coolant to and from the serving area, and a cooling module proximate the dispense head in the serving area for cooling beverage

transferred to the dispense head in the product line, the cooling module comprising a tank having a coolant inlet and a coolant outlet connected to the coolant circuit for circulating coolant through the tank, a tubular product coil within the tank, the coil having a product inlet and a product outlet connected to the product line for passing product through the coil, and a baffle within the tank for directing coolant flow between the coolant inlet and coolant outlet, wherein the product coil is located in a chamber within the tank and contacts opposed surfaces of the chamber to define therewith a flow path for the coolant to promote heat exchange between the product and the coolant for cooling the product to a desired temperature.

[0009] Preferably, the baffle is configured to direct flow of coolant over the product coil in a direction opposite to the flow of product through the coil, i.e. contra-flow of product and coolant.

[0010] Preferably, the tank and baffle are cylindrical and the baffle separates an annular outer chamber surrounding the baffle from a cylindrical inner chamber within the baffle.

[0011] Preferably, the product coil comprises a helical coil arranged in the outer chamber and defining with the opposed surfaces of the baffle and tank a helical flow path for coolant between turns of the coil within the outer chamber.

[0012] Preferably, the turns are uniformly spaced apart in the axial direction. The number and/or spacing of the turns may be chosen as necessary according to cooling requirements.

[0013] Preferably, the coolant inlet is connected to the inner chamber and the coolant outlet is connected to the outer chamber. In this way, the inner chamber provides a thermal reserve that provides a high level of thermal stability and thermal reserve for all cooling requirements.

[0014] Preferably, the coolant circuit is connected to a cooler located remotely from the serving area and the product is cooled by heat exchange with coolant in the remote cooler. For example, the beverage source and remote cooler may be located in a storage area remote from the serving area.

[0015] Preferably, the flow rate and inlet temperature of the coolant supplied to the cooling module is selected to achieve a desired reduction in temperature of the beverage passing through the cooling module. In a particularly preferred arrangement, the flow rate and inlet temperature of the coolant are such that the reduction in temperature of the beverage is substantially independent of the draw-off rate of the beverage from the dispense head. In this way, variations in the dispense temperature of the beverage can be avoided producing a substantially constant dispense temperature.

[0016] According to a second aspect of the present invention, there is provided a beverage dispense system comprising a serving area provided with at least one dispense head for dispense of a beverage, a source of beverage remote from the serving area, a product line for transferring beverage from the beverage source to the

dispense head, the product line being contained within a python extending to the serving area, a cooling circuit contained within the python for transferring coolant to and from the serving area, and a cooling module proximate the dispense head in the serving area for cooling beverage transferred to the dispense head in the product line, the cooling module comprising a tank having a coolant inlet and a coolant outlet connected to the coolant circuit for circulating coolant through the tank, a tubular product coil within the tank, the coil having a product inlet and a product outlet connected to the product line for passing product through the coil, wherein the product coil is located in a chamber within the tank and contacts opposed surfaces of the chamber to define therewith a flow path for the coolant to promote heat exchange between the product and the coolant for cooling the product to a desired temperature wherein inlet temperature and flow rate of coolant are controlled such that the reduction in temperature of beverage flowing through the cooling module is substantially independent of the draw-off rate of product from the dispense head..

[0017] According to a third aspect of the present invention, there is provided a cooling module for a beverage, the cooling module having a coolant inlet, a coolant outlet, and a plurality of chambers between the inlet and outlet, a tubular product coil within at least one of the chambers, the coil having a product inlet and a product outlet for passing product through the coil and contacting opposed walls of said at least one chamber to define therewith a flow path for coolant flowing through the module between the coolant inlet and coolant outlet, and at least one other chamber defining a reservoir for coolant within the module to provide a thermal store.

[0018] According to a fourth aspect of the present invention, there is provided a cooling module comprising a tank having a coolant inlet and a coolant outlet for circulating coolant through the tank, a tubular product coil within the tank, the coil having a product inlet and a product outlet for passing product through the coil, and a baffle within the tank for directing coolant flow between the coolant inlet and coolant outlet.

[0019] According to a fifth aspect of the present invention, there is provided a method of controlling beverage temperature prior to dispense including the steps of providing a dispense head for dispense of beverage, connecting the dispense head to a remote source of beverage via a product line, connecting the product line to a cooling module located proximate the dispense head, passing beverage and coolant through the cooling module in heat exchange relationship for cooling the beverage, and controlling the inlet temperature and flow rate of the coolant such that the reduction in temperature of beverage flowing through the cooling module is substantially independent of the draw-off rate of the beverage from the dispense head.

[0020] The invention will now be described in more detail by way of example only with reference to the accompanying drawings wherein:

Figure 1 is a schematic view of a beverage dispense system embodying the invention;

Figure 2 is a side view of a cooling module employed in the beverage dispense system shown in Figure 1;

Figure 3 is a sectional view of the cooling module shown in Figure 2;

Figure 4 is a section on the line 4-4 of Figure 3; and

Figure 5 is a section on the line 5-5 of Figure 3.

[0021] Referring first to Figure 1 of the drawings, there is depicted a beverage dispense system for dispensing draught alcoholic beverages, for example beer, lager or cider. The system includes a dispense head 10 located in a serving area such as bar. For example, the dispense head 10 may be positioned on a counter top within the serving area.

[0022] The dispense head 10 is provided with a dispense tap 12 to which a product line 14 is connected for delivery of product to the dispense head 10 from a beverage source 16 located in a storage area such as a cellar remote from the serving area. For example the beverage source 16 may be keg to which a source of pressurised gas such as carbon dioxide is connected to propel beverage from the keg through the product line 14 to the dispense head 10 when the dispense tap 12 is opened to dispense beverage from the tap 12 into a vessel such as a glass positioned under the tap 12.

[0023] The product line 14 passes through a cooler 18 such as an ice bank cooler or glycol cooler located in the storage area remote from the serving area to cool the beverage. The product line 14 is contained in a python (not shown) that extends between the storage area to the serving area and contains a coolant circuit 20 for circulating coolant from the cooler 18 to the serving area and back to the cooler 18 in the storage area. The product line 14 is arranged in heat exchange relationship with the coolant circuit 20 so that the beverage in the product line 14 is cooled by the coolant circulating in the coolant circuit 20 to prevent the beverage warming up to any appreciable extent by heat exchange with the environment between the storage area and the serving area.

[0024] The python may contain several product lines for connection to one or more dispense heads in the serving area and typically has an insulated sleeve or jacket to reduce heat exchange with the environment. The product line 14 and cooling circuit 20 are connected to a cooling module 22 located in the serving area adjacent to the dispense head 10 to cool further the beverage to a desired temperature for dispense by heat exchange between the beverage and coolant within the cooling module 22. For example, the cooling module 22 may be positioned on a shelf under the counter top within the serving area.

[0025] Referring now to Figures 2 to 5 of the drawings,

the cooling module 22 is shown in more detail and comprises a cylindrical tank 24 having a coaxial, internal cylindrical baffle 26 separating an annular outer chamber 28 surrounding the baffle 26 from a cylindrical inner chamber 30 within the baffle 26. The elongate cylindrical form of the cooling module 22 allows use of available space under the counter for locating the cooling module 22 to be optimised.

[0026] The cooling module 22 is provided at one end with a coolant inlet 32 connected to the inner chamber 30 and a coolant outlet 34 connected to the outer chamber 28. The tank 24 and baffle 26 are made of materials compatible with the coolant. In this embodiment, the tank and baffle are made of stainless steel having a high thermal conductivity but it will be understood that other metals or alloys or even plastics may be employed for one or both parts.

[0027] In use, the fluid inlet 32 and fluid outlet 34 are connected to coolant lines (not shown) for circulating coolant from the cooling circuit 20 through the cooling module 22 back to the cooling circuit 20 for return to the remote cooler 18 in the storage area. The coolant may be chilled water, an aqueous ethylene glycol mixture or any other suitable coolant as will be familiar to those skilled in the art.

[0028] A helical product coil 36 is located in the outer chamber 28 and has a product inlet 40 at one end of the cooling module 22 and a product outlet 42 at the other end. In use, the fluid inlet 40 is connected to the product line 14 from the python for passing beverage through the coil 36 within the cooling module 22 and the fluid outlet 42 is connected to the product line 14 leading to the dispense tap 12. The coil 36 is made of a food grade tubular material having a high thermal conductivity such as stainless steel to avoid contamination of the product and enhance heat transfer between the product and coolant.

[0029] In this embodiment, the turns of the coil 36 are uniformly spaced apart. It will be understood, however that the spacing of the turns may be uniform or non-uniform and/or that the number of turns may be increased or reduced from that shown, The coil 36, tank 24 and baffle 26 are configured so that the coil 36 is a close fit in the outer chamber 28 and the turns of the coil 36 contact the opposed surfaces of the tank 24 and baffle 26 and defines therewith a helical flow path 44 extending from one end of the outer chamber 28 to the other end.

[0030] The inlet 32 is connected to a fluid inlet 26a in an end plate 26b at one end of the baffle 26 and the other end of the baffle 26 is open and defines a fluid outlet 26c leading to the helical flow path 44. In this embodiment, the fluid inlet 26a is arranged on the central longitudinal axis of the baffle 26 but it will be understood that other positions of the inlet 26a may be employed. The baffle 26 is provided at the closed end with a plurality of circumferentially spaced apart air bleed holes (not shown) of approximately 1 mm diameter at the junction between the end plates 26b and the cylindrical wall 26d of the baffle 26.

[0031] In this embodiment, four holes are provided uniformly spaced apart in a circumferential direction although it will be understood that the number and/or position of the bleed holes may be altered. The arrangement of the bleed holes at the closed end of the baffle 26 with the other end of the baffle 26 being open prevents air contained in the coolant collecting in the baffle 26. Thus, the air can escape and is purged from within the baffle in any installed orientation of the cooling module 22. As a result, the volume of coolant within the baffle 26 and flow of coolant through the baffle 26 is not reduced by air trapped inside the baffle 26. In this way, cooling efficiency of the cooling module 22 is maintained.

[0032] In use, coolant delivered from the cooling circuit 20 to the inlet 32 flows through the inner chamber 30 within the baffle 26 from the closed end to the open end where it passes into the outer chamber 28 and is confined to flow along the helical path 44 between the coil 36 and the opposed surfaces of the tank 24 and baffle 26 to the outlet 34 for return to the cooling circuit 20. Product, for example beverage such as a beer, lager or cider delivered from the product line 14 to the inlet 40 passes through the coil 36 to the outlet 42 for delivery to the dispense head 10 in product line 14. The beverage flows through the coil 36 in the opposite direction to the coolant flowing through the helical flow path 44 between the turns of the coil 36 in the outer chamber 28 and is cooled by heat exchange with the coolant to the desired temperature for dispense.

[0033] The arrangement of the cooling coil 36 in the outer chamber 28 provides a large surface area for efficient heat transfer between the product and coolant for cooling the product. Furthermore, heat transfer is enhanced by the counterflow of coolant and product such that a temperature differential can be maintained between the coolant and product along the length of the heat exchanger.

[0034] We have found that for a given nominal temperatures of coolant and product delivered to the cooling module 22, the flow rate of the coolant can be adjusted to achieve a desired reduction in temperature (ΔT) of the product flowing through the cooling module 22 for dispense of the product. Furthermore, we have found that for a given inlet temperature and flow rate of coolant the reduction in temperature (ΔT) of the product is substantially independent of the draw-off rate of the product at the dispense head 10. In other words, we can achieve a substantially constant dispense temperature for any draw-off rate of the product. This is particularly beneficial in avoiding any warming up of the product that is dispensed.

[0035] This advantage is believed to result from the construction of the cooling module. Thus, the product and coolant are confined to flow in flow paths providing a large surface area to volume ratio for heat transfer within the module such that a high heat exchange efficiency is obtained that maintains the required reduction in temperature during periods of high draw-off rates such as

the dispense of several drinks one after another. In addition, the inner chamber provides a reservoir of coolant where the coolant mixes to form a homogeneous thermal reserve which ensures a high level of temperature stability and thermal store required for periods of low draw-off rates such as the dispense of casual drinks. In this embodiment, the baffle and coil are made of stainless steel or other heat conducting materials that assists heat transfer between the coolant in the inner chamber and the product in the coil that further assists in controlling and maintaining a desired product temperature

[0036] The cooling module 22 is provided with a jacket 46 made of thermally insulating material to reduce heat exchange with the environment and prevent cold bridging and formation of condensation on the outer surface of the cooling module 22 that could create problems in the bar area. The insulation jacket 46 may comprise a layer of foam, for example polyurethane foam, secured by fastening straps 48. The foam may be formed in situ.

[0037] During serving periods, coolant may be circulated through the cooling module 22 on a continuous basis whether or not product is being dispensed so as to prevent product remaining in the module 22 between dispenses warming up to any appreciable extent. Alternatively, coolant may be circulated an intermittent basis according to when dispense of product is initiated. For example, a valve may be provided in the inlet 32 or outlet 34 that is closed between dispenses to prevent circulation of coolant and opened in response to a dispense to allow circulation of coolant to cool beverage to the required dispense temperature. Between dispenses, the volume of coolant in the inner chamber 30 provides a thermal reserve that may be sufficient to prevent the product warming up to any appreciable extent in the cooling module 22. Alternatively or additionally, a timer may be provided to open the valve periodically to provide a trickle flow of coolant when no dispense occurs for a predetermined period of time to prevent the product warming up in the cooling module 22. Between serving periods, for example overnight, coolant may be circulated intermittently to prevent product remaining in the cooling module 22 warming up. Alternatively, at the start of a dispense period, coolant may be circulated through the cooling module 22 to cool any product in the cooling module 22 to the dispense temperature before a dispense can be initiated.

[0038] The flow rate of coolant through the cooling module 22 may be adjustable to vary the temperature of the product being dispensed. For example a flow control valve may be provided in the coolant inlet or outlet lines to the cooling module 22. The flow control valve may be adjusted manually, for example with a rotatable knob or the like, to vary cooling according to requirements. Alternatively, the flow control valve may be adjusted automatically in response to detection of the inlet or outlet temperatures of the product and/or coolant to provide a desired product temperature. In this way, we may adapt the cooling module 22 to vary the dispense temperature for

different types of products and/or maintain a desired dispense temperature.

[0039] The product line 14 from the python to the dispense tap 12 may include a branch line (not shown) by-passing the cooling module 22 allowing product to be delivered to the dispense tap 12 without passing through the cooling module 22. In this way, product may be dispensed with or without additional cooling by the cooling module 22 according to product requirements and/or customer choice.

[0040] In a modification (not shown), the product coil may be in the form a plurality of concentric helices arranged in series with at least one helix located between the baffle 26 and the tank 24 and at least one helix located within the baffle 26. In this way, the cooling capacity of the cooling module 22 may be increased. Where a helix is provided inside the baffle 26, the baffle 26 may be configured to direct the flow of coolant over the or each additional helix to improve efficiency.

[0041] In another modification (not shown), the baffle 26 may contain a heater such as an electric heating element to heat the product flowing through the cooling module 22. The heating element may be connected to a control unit responsive to the inlet or outlet temperature of the product to control operation of the heating element and/or coolant flow to achieve a desired product temperature out of the cooling module 22 for dispense.

[0042] While the cooling module 22 has been described for dispense of alcoholic beverages such as beer, lager and cider, it will be understood that the invention is not limited to such use and that the cooling module 22 can be used for dispense of non-alcoholic beverages such as colas and lemonade. The cooling module 22 can also be used for dispense of carbonated or non-carbonated beverages.

[0043] It will also be understood that the invention is not limited to the embodiments above-described and various modifications can be made as will be apparent to those skilled in the art. For example, while the cylindrical form of the tank and baffle is preferred, other shapes can be employed, for example oval or rectangular, with the product coil adapted to fit the space between the tank and baffle. Furthermore, while the arrangement of the product coil in the outer chamber is preferred, the product coil may be located in the inner chamber with the coolant inlet connected to the outer chamber and the coolant outlet connected to the inner chamber. Additionally, the heat exchanger may comprise more than one product coil. Moreover, while the helical form of the product coil is preferred, other shapes can be employed, for example a serpentine or other convoluted form of coil positioned between and contacting opposed wall surfaces of the module to define therewith a flow path for the coolant producing a large surface area for heat exchange between the product and the coolant can be employed.

[0044] Other benefits and advantages of the cooling module include stable and efficient heat transfer for temperature control by combining the direct heat exchange

with a thermal reserve. A reduction in fobbing that enhances drink quality and consumer experience and also reduces product waste due to excessive fobbing. Low pressure drop for maximum product flow rates and optimal coolant re-circulation. A fully welded construction for leak-free reliability & maintenance free life. A compact design with flexible mounting options to maximise valuable shelf space in the serving area. Insulation that minimises condensation problems and reduces heat transfer to the environment leading to improved working conditions for staff in the serving area.

Claims

1. A beverage dispense system comprising a serving area provided with at least one dispense head for dispense of a beverage, a source of beverage remote from the serving area, a product line for transferring beverage from the beverage source to the dispense head, the product line being contained within a python extending to the serving area, a cooling circuit contained within the python for transferring coolant to and from the serving area, and a cooling module proximate the dispense head in the serving area for cooling beverage transferred to the dispense head in the product line, the cooling module comprising a tank having a coolant inlet and a coolant outlet connected to the coolant circuit for circulating coolant through the tank, a tubular product coil within the tank, the coil having a product inlet and a product outlet connected to the product line for passing product through the coil, and a baffle within the tank for directing coolant flow between the coolant inlet and coolant outlet, wherein the product coil is located in a chamber within the tank and contacts opposed surfaces of the chamber to define therewith a flow path for the coolant to promote heat exchange between the product and the coolant for cooling the product to a desired temperature.
 2. A beverage dispense system according to claim 1 wherein, the tank and baffle are cylindrical and the baffle separates an annular outer chamber surrounding the baffle from a cylindrical inner chamber within the baffle, and the coolant inlet is connected to the inner chamber and the coolant outlet is connected to the outer chamber.
 3. A beverage dispense system according to claim 2 wherein, the product coil comprises a helical coil arranged in the outer chamber with turns of the coil uniformly spaced and contacting opposed surfaces of the outer chamber to define therewith a helical flow path for coolant between the turns of the coil.
 4. A beverage dispense system according to any of the preceding claims including air bleed means for re-
- moving/purging air from within the baffle in any orientation of the cooling module.
 5. A beverage dispense system according to any preceding claim wherein the coolant circuit is connected to a cooler located remotely from the serving area and the product is cooled by heat exchange with coolant in the remote cooler.
 6. A beverage dispense system according to any preceding claim wherein, the flow rate and inlet temperature of the coolant supplied to the cooling module is selected to achieve a desired reduction in temperature of the beverage passing through the cooling module.
 7. A beverage dispense system according to claim 6 wherein the flow rate and inlet temperature of the coolant are such that the reduction in temperature of the beverage is substantially independent of the draw-off rate of the beverage from the dispense head.
 8. A beverage dispense system according to claim 6 or claim 7 wherein, a substantially constant dispense temperature is provided.
 9. A beverage dispense system comprising a serving area provided with at least one dispense head for dispense of a beverage, a source of beverage remote from the serving area, a product line for transferring beverage from the beverage source to the dispense head, the product line being contained within a python extending to the serving area, a cooling circuit contained within the python for transferring coolant to and from the serving area, and a cooling module proximate the dispense head in the serving area for cooling beverage transferred to the dispense head in the product line, the cooling module comprising a tank having a coolant inlet and a coolant outlet connected to the coolant circuit for circulating coolant through the tank, a tubular product coil within the tank, the coil having a product inlet and a product outlet connected to the product line for passing product through the coil, wherein the product coil is located in a chamber within the tank and contacts opposed surfaces of the chamber to define therewith a flow path for the coolant to promote heat exchange between the product and the coolant for cooling the product to a desired temperature wherein inlet temperature and flow rate of coolant are controlled such that the reduction in temperature of beverage flowing through the cooling module is substantially independent of the draw-off rate of product from the dispense head..
 10. A method of controlling beverage temperature prior to dispense including the steps of providing a dis-

pense head for dispense of beverage, connecting the dispense head to a remote source of beverage via a product line, connecting the product line to a cooling module located proximate the dispense head, passing beverage and coolant through the cooling module in heat exchange relationship for cooling the beverage, and controlling the inlet temperature and flow rate of the coolant such that the reduction in temperature of beverage flowing through the cooling module is substantially independent of the draw-off rate of the beverage from the dispense head.

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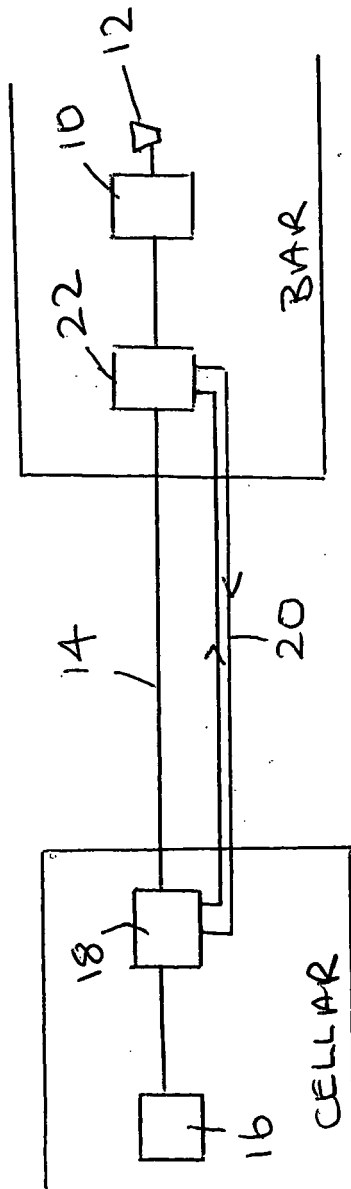


FIGURE 1

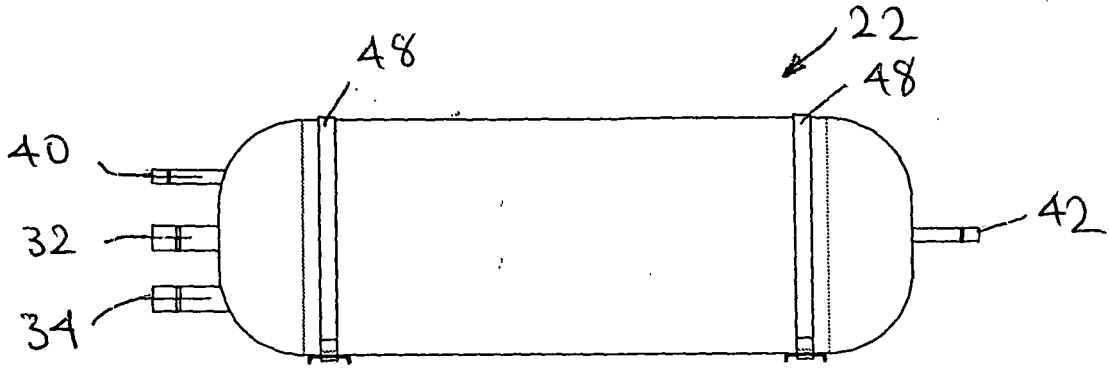


FIGURE 2

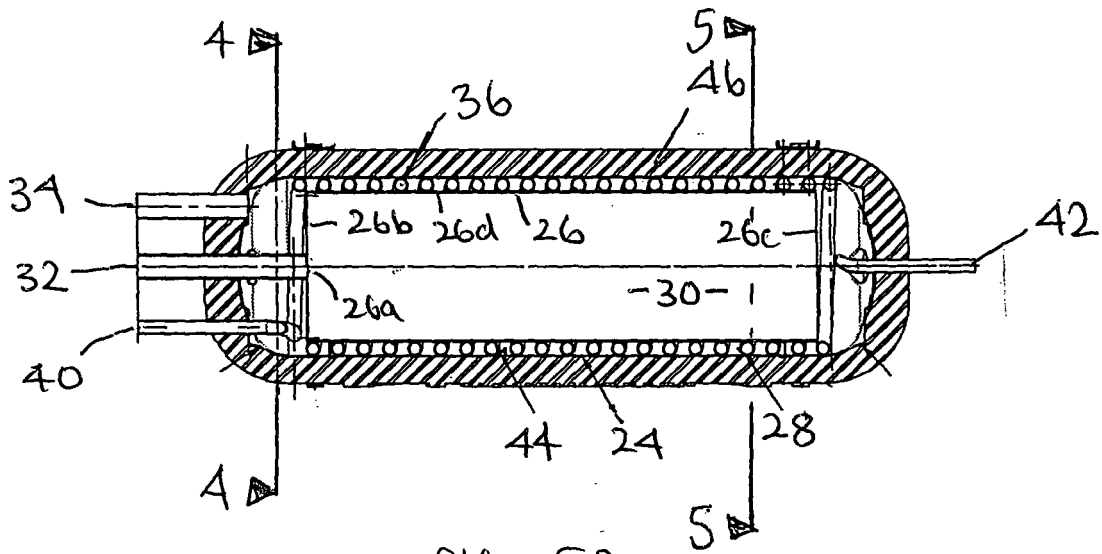


FIGURE 3

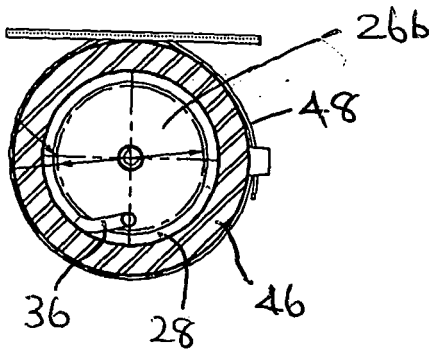


FIGURE 4

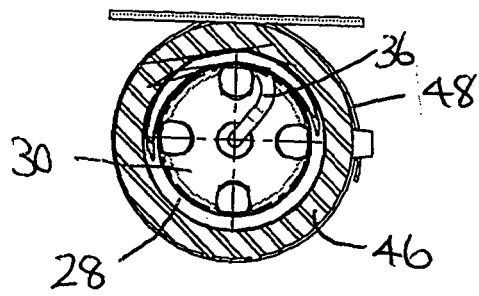


FIGURE 5



DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 2004/016545 A (ICEFLOE TECHNOLOGIES INC [CA]; CHIUSOLO SAM [CA]) 26 February 2004 (2004-02-26) * page 5, line 1 - line 13 * * page 6, line 7 - line 30; figures 1-3 * -----	1-10	INV. B67D1/08 F28D7/02 F28F9/22
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 6 September 2007	Examiner Wartenhorst, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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