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RAPID CHILLING WATER DISPENSER

Abstract

A rapid water-chilling system for a water dispenser that can quickly replenish cold water in the water dispenser when water has been dispensed or the water rises above a pre-set limit; so that when a user requests cold water, the user does not get ambient or warm water dispensed instead of the requested cold water or has to wait for the water to be chilled back to the requested temperature.

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Background/Summary

REFERENCE TO RELATED APPLICATION [0001] This application is a continuation of, and claims priority from, U.S. application Ser. No. 18/583,669 filed on Feb. 21, 2024.

BACKGROUND

[0002] Current methods for chilling water dispensed from a water dispenser are inadequate for maintaining the water temperature at a fairly consistent cold temperature for the consumer when multiple users dispense cold water in a short timeframe. Present water dispensers, for the most part, rely on the traditional cold-tank technology and the ice bath method to keep water cool. Both of these methods have significant limitations in maintaining the water in the dispenser at the coldness consumers desire when cold water is dispensed in quick succession. Specifically, both of these methods cannot recover quickly enough to maintain the dispensable water at a coolness that consumers want.

[0003] The long used cold-tank method of chilling water is a straightforward way to chill water. With this method, the water dispenser has a large metal water holding tank that holds ambient water. The holding tank is wrapped with copper tubing coils that are, in turn, filled with refrigerant that chills the tank the water is held in; thereby making the water cold for dispensing. As the water in the tank is depleted, the cycle starts again, and if a significant amount of water is used, the user must wait for the water to get cold again. Another approach that tries to combat “the wait to chill” issue is the use of an “ice bath”. With the “ice bath” approach, the water to be chilled and dispensed travels through coiled tubing that sits in a tank with very cold water (i.e. the “ice bath”). The ice bath temperature is maintained by refrigerant coils on the outside of the “ice bath” tank. The issue with the “ice bath” approach is that the “ice bath” water medium in the tank takes a long time to get cold, and this approach also requires the dispensed water to travel as slow as is acceptable to allow the dispensed water to get cold. So, in heavy demand situations, the consumer of the water from the “ice bath” dispenser still has to wait a significant amount of time to get water at the temperature he desires.

[0004] Accordingly, there is a need for a rapid chilling water dispenser that keeps cold water in a water dispenser at a temperature coolness below a pre-set limit, which is a temperature desired by the consumer and, if the water temperature rises above the pre-set desired temperature, is capable of rapidly chilling the water in the dispenser to get it below the pre-set limit.

SUMMARY

[0005] According to one aspect of the present invention, a rapid water-chilling system for use in a water dispenser may include a fast-chilling refrigerant pump; a refrigerant chilling system including a refrigerant; a rapid chill refrigerant circulation tank, wherein disposed within the rapid chill refrigerant circulation tank which includes a cold water storage tank; a fast-chilling refrigerant; a number of refrigerant coils; a number of water inlet coils, where the refrigerant coils are separated from the cold water storage tank inside the rapid chill refrigerant circulation tank; wherein the fast-chilling refrigerant pump is in fluid communication with the fast-chilling refrigerant and the outside of the cold water storage tank and the outside of the water coils; and where the refrigerant in the refrigerant chilling system is in fluid communication with the refrigerant coils disposed within the rapid chill refrigerant circulation tank.

[0006] According to another aspect of the present invention, a water dispenser in fluid communication with a water supply may include a water dispensing nozzle and a rapid water-chilling system, where the rapid water-chilling system may include a fast-chilling refrigerant pump;

a refrigerant chilling system including a refrigerant; a rapid chill refrigerant circulation tank, where disposed within the rapid chill refrigerant circulation tank may include: a cold water storage tank, disposed in the top of the rapid chill refrigerant circulation tank, in fluid communication with the water dispensing nozzle; a number of water inlet coils in fluid communication with the water supply and the cold water storage tank, where a portion of the plurality of water inlet coils are disposed around the circumference of the outside of the cold water storage tank; a number of refrigerant coils disposed in the bottom of the rapid chill refrigerant circulation tank, where the refrigerant coils are separated from the cold water storage tank inside the rapid chill refrigerant circulation tank; a fast-chilling refrigerant disposed in the bottom of the rapid chill refrigerant circulation tank around the refrigerant coils; the fast-chilling refrigerant pump is in fluid communication with the fast-chilling refrigerant and the outside of the cold water storage tank and the outside of the water coils and where the refrigerant in the refrigerant chilling system is in fluid communication with the refrigerant coils disposed within the rapid chill refrigerant circulation tank.
[0007] According to yet another embodiment of the invention, a method for delivering sustained cold water from a water dispenser may include the steps of providing a water pump in fluid communication with a water supply; providing a water dispensing nozzle; providing a rapid water-chilling system, which may include a fast-chilling refrigerant pump; a refrigerant chilling system including a refrigerant; a rapid chill refrigerant circulation tank, wherein disposed within the rapid chill refrigerant circulation tank includes: a cold water storage tank disposed in the top of the rapid chill refrigerant circulation tank and in fluid communication with the water dispensing nozzle; a number of water inlet coils in fluid communication with the water pump and the cold water storage tank, where a portion of the water inlet coils are disposed around the circumference of the outside of the cold water storage tank; a number of refrigerant coils disposed in the bottom of the rapid chill refrigerant circulation tank, wherein the refrigerant coils are separated from the cold water storage tank inside the rapid chill refrigerant circulation tank; a fast-chilling refrigerant disposed in the bottom of the rapid chill refrigerant circulation tank around the refrigerant coils; where the fast-chilling refrigerant pump is in fluid communication with the fast-chilling refrigerant and the outside of the cold water storage tank and the outside of the water coils; where the refrigerant in the refrigerant chilling system is in fluid communication with the refrigerant coils disposed within the rapid chill refrigerant circulation tank; monitoring the temperature of the water in the cold water storage tank; if the temperature of the water in the cold water storage tank rises above a lower temperature limit, energizing the refrigerant chilling system to cool the refrigerant; circulating the cooled refrigerant through the refrigerant coils in the bottom of the rapid chill refrigerant circulation tank, where the refrigerant coils chill the fast-chilling refrigerant disposed in the bottom of the rapid chill refrigerant circulation tank; energizing the fast-chill refrigerant pump to pump the chilled fast-chilling refrigerant disposed in the bottom of the rapid chill refrigerant circulation tank to the top of the rapid chill refrigerant circulation tank, wherein the fast-chilling refrigerant flows inside the rapid chill refrigerant circulation tank and down the outside of, and in contact with, the water inlet coils and down the outside of, and in contact with, the outside of the cold water storage tank, where the chilled fast-chilling refrigerant cools any water inside the water inlet coils and the water inside the cold water storage tank.

Description

DRAWINGS
[0008] Objects, features, and advantages of the present invention will become apparent upon reading the following description in conjunction with the drawing figures, in which:
[0009] FIG. **1** is a front perspective view of a water dispenser utilizing an embodiment of a rapid water-chilling system of the present invention;

[0010] FIG. **2** illustrates a functional block diagram an embodiment of a rapid water-chilling system of the present invention disposed in a water dispenser;
[0011] FIG. **3** is a partial front view of a water dispenser utilizing an embodiment of a rapid water-chilling system of the present invention showing some of the interior components of the water dispenser;
[0012] FIG. **4** is a partial right side perspective view of a water dispenser utilizing an embodiment of a rapid water-chilling system of the present invention showing some of the interior components of the water dispenser;
[0013] FIG. **5** is a left side view of a water dispenser utilizing an embodiment of a rapid water-chilling system of the present invention showing the interior components of the water dispenser;
[0014] FIG. **6** is a sectional view of a rapid chill refrigerant circulation tank; and
[0015] FIG. **7** is a flowchart illustrating an embodiment of a process of the present invention to maintain water in a rapid chill refrigerant circulation tank at a pre-set temperature;
[0016] FIG. **8** is a sectional view of a rapid chill refrigerant circulation tank illustrating the flow of water through water inlet coils into the rapid chill refrigerant circulation tank;
[0017] FIG. **9** is a sectional view of a rapid chill refrigerant circulation tank illustrating the flow of fast-chilling refrigerant through around the water inlet coils and the rapid chill refrigerant circulation tank of the present invention; and.
[0018] FIG. **10** is a chart illustrating the water chilling performance of a water dispenser utilizing an exemplary embodiment of a rapid water-chilling system of the present invention compared to four chilled water systems on the market.
DESCRIPTION
[0019] Referring to FIGS. **1**-**2**, an exemplary water dispenser **20** utilizing an embodiment of the rapid water-chilling system **30** of the present invention is depicted. In this exemplary water dispenser **20**, the water dispenser **20** has, among other things, a user interface **22** for the user to select what temperature is desired and to dispense water, and a water dispensing nozzle **24**. Referring now to FIG. **2**, a functional block diagram of an embodiment of the rapid water-chilling system **30** of the present invention, housed in the water dispenser **20**, is depicted. This exemplary description discusses use of the rapid water-chilling system **30** with water in a water dispenser, but it should be understood that the rapid water-chilling system **30** of the present invention could be used with any appropriate fluid in any needed context. It is not limited to use just with water in a water dispenser. The rapid water-chilling system **30** in this embodiment includes a rapid chill refrigerant circulation tank **32** having refrigerant coils **34** (shown in cross-section) disposed in the bottom of the rapid chill refrigerant circulation tank **32**. The refrigerant coils **34** carry a refrigerant **36** that, as described below, circulates through the refrigerant coils **34** when the rapid water-chilling system **30** is in use. (The fluid directional arrows in FIG. **2** are included to show the direction of flow of fluids in those pipes, coils or tubing when the fluid is flowing through those pipes, coils or tubing. Fluid, as described in detail below, is not always flowing through the pipes, coils or tubing depicted.) The refrigerant **36** in this embodiment is R290 due to the cooling capacity needed in a small size footprint, but it is envisioned that other refrigerants could be used as well. The refrigerant coils **34** in this embodiment are made from copper because of copper's highly efficient thermal transfer properties, but, as one of ordinary skill in the art would understand, any suitable tubing material could be used for the refrigerant coils **34**. At the bottom of the rapid chill refrigerant circulation tank **32**, in addition to the refrigerant coils **34**, the rapid chill refrigerant circulation tank **32** holds fast-chilling refrigerant **38**. The fast-chilling refrigerant **38** is disposed outside of the refrigerant coils **34** and flows freely around the refrigerant coils **34**. The fast-chilling refrigerant **38** in this embodiment is propylene glycol because it is food-grade safe and can still flow at minus 50 degrees below zero Celsius. It is envisioned though that other refrigerants with the properties of a low freezing point; a high latent heat of vaporization; good thermal conductivity and specific heat capacity characteristics; and chemically stable could also be used for the fast-chilling refrigerant

38.

[0020] Also located within the rapid chill refrigerant circulation tank **32** is a cold water storage tank **40** that, in use, holds water **56**. In this embodiment, the cold water storage tank **40** is disposed above the refrigerant coils **34**, and a permeable plate **42** separates the cold water storage tank **40** from the refrigerant coils **34** and provides support to the cold water storage tank **40**. Although a plate **42** is utilized in this embodiment, the use of a plate **42** is not required. Disposed around the entire outside of the cold water storage tank **40** are water inlet coils **44** (shown in cross-section). The water inlet coils **44**, on the intake side, connect to a water supply **54** for the water dispenser **20**, such as a tap water source, and on the discharge side, the water inlet coils **44** dispense into the top of the cold water storage tank **40** (FIG. **8**). The water inlet coils **44** in this embodiment are made from stainless steel because of stainless steel's sterility properties since they are carrying water for human consumption. One of ordinary skill in the art, though, would understand that any suitable tubing material could be used for the water inlet coils **44**. Further, in this embodiment, the water from the water supply **54** goes through a filtration system **52** before a water pump **50** pumps the water through the water inlet coils **44**.

[0021] Further, in this embodiment, to refrigerate the refrigerant **36**, the rapid water-chilling system **30** includes refrigerant chilling system components needed to complete a refrigeration cycle, namely a condenser **60**, a compressor **62** and refrigerant cycle tubing **64**. The refrigerant cycle tubing **64** carries the refrigerant **36** and is connected to the refrigerant coils **34**. The refrigerant cycle tubing **64** is the section of tubing disposed outside of the rapid chill refrigerant circulation tank **32** which connects the refrigeration cycle components (i.e. the condenser **60** and the compressor **62**). To circulate the fast-chilling refrigerant **38**, the rapid water-chilling system **30** also has tubing **72** that runs from the bottom of the rapid chill refrigerant circulation tank **32** to the top of it, where it discharges fast-chilling refrigerant **38**. The fast-chilling refrigerant **38** is pumped through the tubing **72** by a fast-chilling refrigerant pump **70**.

[0022] Disposed within the cold water storage tank **40**, in this embodiment, are a water temperature sensor **80**, a high water level sensor **82** and a low water level sensor **84**. At the bottom of the cold water storage tank **40** is a discharge tube **88** that flows into a cold water compressor pump **90** that pumps the cold water **56** to a cold water solenoid **92** that controls the dispense rate of the cold water **56** into a mixing chamber **94**, from where the water **56** is ultimately dispensed through the water dispensing nozzle **24**. In addition to the components of the rapid water-chilling system **30**, the water dispenser **20** of this embodiment includes, among other things, a hot water solenoid **98** which connects to a hot water tank (not shown) and an ambient water solenoid **96** which connects an ambient water tank (not shown). The hot water solenoid **98** and an ambient water solenoid **96** control the flow rates of hot and ambient water.

[0023] The rapid water-chilling system **30** of this embodiment of the present invention further includes a processor **100** which receives input signals from and sends output signals to the components of the water dispenser **20** (e.g. user interface **22**, fast-chilling refrigerant pump **70**, cold water solenoid **92**, hot water solenoid **98**, ambient water solenoid **96**, cold water compressor pump **90**, compressor **62**, water pump **50**, filtration system **52**, water temperature sensor **80**, high water level sensor **82** and low water level sensor **84**). The processor **100** further has other functions, including storing data; making computations and issuing component commands to control and keep the rapid water-chilling system **30** and, generally, the water dispenser **20** operating.

[0024] FIGS. **3-5** illustrate an embodiment of a water dispenser **20** utilizing a rapid water-chilling system **30** of the present invention. Referring now to FIGS. **6-9**, the process of how the rapid water-chilling system **30** of the present invention functions is illustrated and described. In FIG. **7**, at step **200**, the processor **100** of the water dispenser **20** continuously monitors the water level and temperature of the water **56** in the cold water storage tank **40** at steps **202** and **210**. At step **210** and referring to FIG. **8**, the processor **100**, using the water level sensors **82**, **84**, continuously checks to see if the water level of the water **56** in the cold water storage tank **40** is within pre-set high and low limits. If the water level of the water **56** is outside the pre-set limits, at step **212**, the processor **212** adjusts the water level in the cold water storage tank **40** to bring in within pre-set high and low limits. As illustrated in FIG. **8**, if the water level is too low, the processor **100** pumps water through the water inlet coils **44** and into the top of the cold water storage tank **40**.

[0025] At step **202**, the processor **100**, using the water temperature sensor **80**, continuously checks to see if the water temperature of the water **56** in the cold water storage tank **40** is below a pre-set lower limit. If it is above this pre-set lower limit, that means the water **56** is too warm and needs to be chilled. The water **56** may get warm for a number of reasons, including the water **56** has been sitting for a while or a numbers of users of the water dispenser **20** have depleted the water in the tank and it has been re-filled with ambient water **56**. Also, in another embodiment, the process in FIG. **7** may also include a step for checking to see if the water **56** in the cold water storage tank **40** is too cold to ensure that the water **56** in the tank does not freeze.

[0026] At step **202**, if it is determined that the water **56** in the cold water storage tank **40** is above a pre-set lower limit (i.e. too warm), at step **206** and referring to FIGS. **2**, **6** and **9**, the condenser **60**, the compressor **62** and the fast-chill refrigerant pump **70** are energized. The energized condenser **60** and compressor **62** chill the refrigerant **36** in the refrigerant cycle tubing **64**. The chilled refrigerant **36** flows through the refrigerant cycle tubing **64** into the refrigerant coils **34**. The refrigerant **36**, flowing through the refrigerant coils **34**, chills the fast-chilling refrigerant **38** (i.e. glycol in this embodiment) that is flowing freely around the refrigerant coils **34**. At the same time, the fast-chilling refrigerant pump **70** pumps the fast-chilling refrigerant **38** to the top of rapid chill refrigerant circulation tank **32**, where the fast-chilling refrigerant **38** flows down the outside of the cold water storage tank **40** and around the water inlet coils **44** back to the bottom of the rapid chill refrigerant circulation tank **32**. The super cold temperature of the fast-chilling refrigerant **38** super chills the water **56** in the water inlet coils **44** and the water **56** in the cold water storage tank **40**, since the fast-chilling refrigerant **38** surrounds the water inlet coils **44** and the cold water storage tank **40**. The fast-chilling refrigerant **38** never comes in contact with the water **56**. Also, by only temporarily exposing the water **56** to the fast-chilling refrigerant **38**, it keeps the water **56** from freezing, which is what would happen if the water **56** was exposed to the fast-chilling refrigerant **38** for an extended period. The process of this invention strikes a balance between exposing water **56** to fast-chilling refrigerant **38** for a short period of time to get the water **56** chilled quickly versus exposing the water **56** for too long, where the water **56** would freeze. In one embodiment of a rapid water-chilling system **30** of the present invention, at time of use, the refrigerant **36** is around minus 21 degrees Celsius; the fast-chilling refrigerant is between minus 20 degrees Celsius and minus 5 degrees Celsius; the water **56** in the water inlet coils **44** and the cold water storage tank **40** is between minus 5 degrees Celsius and zero degrees Celsius and the resulting drinking water dispensed is between 2 degrees Celsius to 10 degrees Celsius.

[0027] This cycle continues until at step **202**, the processor **100** determines that the temperature of the water **56** in the cold water storage tank is below the lower limit (i.e. it is cold enough). Then, at step **204**, the processor **100** de-energizes the condenser **60**, the compressor **62** and the fast-chilling refrigerant pump **70**. At step **214**, the processor **100** determines that the water **56** in the cold water storage tank **40** is at the appropriate water level and below the pre-determined water temperature. The rapid water-chilling system **30** goes back to steady-state, depicted in FIG. **6**, until the water chilling cycle is activated again.

[0028] Referring now to FIG. **10**, a performance comparison chart is illustrated. For this chart, the water chilling performance of a water dispenser **20** utilizing an exemplary embodiment of the rapid water-chilling system **30** of the present invention (FIGS. **5** and **6**) was compared to four chilled water systems on the market. The test performed on the five water dispensing systems was a 24 ounce serving size stress test. For this test, 24 ounces of water was continually dispensed from each cooler, with a 1-minute recovery period between each 24 ounce dispensing. The temperature in the 24 ounce dispensed water container was measured for each 24 ounces that was dispensed. This test is designed to see how well the cold water storage tank can hold water at a cold temperature with repeated, back-to-back use of the water dispenser to address the problem of later users in a repeated use cycle not getting cold water, or cold enough water, from the water dispenser. As illustrated in the chart in FIG. **10**, the exemplary embodiment of the rapid water-chilling system **30** of the present invention performed exceptionally well. The exemplary embodiment of the rapid water-chilling system **30** of the present invention was still dispensing water at temperature below 8° C. after ten 24 ounce servings. Three of the comparative systems, on the other hand, were dispensing water over 15° C., essentially the temperature of cold tap water, which is not especially desirable, after 8 or less 24 ounce servings.

[0029] Although certain embodiments and features of a rapid water-chilling system have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all embodiments of the teachings of the disclosure that fairly fall within the scope of permissible equivalents.

Claims

1. A rapid water-chilling system for use in a water dispenser, comprising: a closed-cycle refrigeration system for a first refrigerant, wherein the closed-cycle refrigeration system includes a set of first refrigerant tubing that carries the first refrigerant, and the first refrigerant changes states between a liquid and a gas in the closed-cycle refrigeration system; a chilling tank having a first chamber and a second chamber that are in fluid communication with one another, wherein: disposed within the first chamber of the chilling tank are: a second refrigerant that exists solely in a liquid state in the chilling tank; and a plurality of first refrigerant coils formed from a portion of the set of first refrigerant tubing that carry the first refrigerant inside the chilling tank; wherein, in use, the plurality of first refrigerant coils refrigerates the second refrigerant; disposed within the second chamber of the chilling tank are: a cold water storage tank, having disposed within the cold water storage tank, a temperature sensor that monitors the temperature of water in the cold water storage tank for a designated low temperature, a high water level sensor and a low water level sensor; and a plurality of water inlet coils; a circulation pump for pumping the second refrigerant; wherein the circulation pump is in fluid communication with the first chamber of the chilling tank and the second chamber of the chilling tank for circulating the second refrigerant from the first chamber to the second chamber; wherein, in use, the high water level sensor and the low level water level senor monitor the level of water in the cold water storage tank, and when activated by the temperature sensor because of the water in the cold water storage tank being at or above the designated low temperature, the first refrigerant chills the second refrigerant, and the circulation pump pumps the second refrigerant from the first chamber to the second chamber of the chilling tank to put the second refrigerant in contact with an outside of the cold water storage tank and an outside of the plurality of water coils to chill water contained within each; wherein, after contacting the outside of the cold water storage tank and the outside of the plurality of water coils, the second refrigerant returns to the first chamber of the chilling tank.

2. The rapid water-chilling system for use in a water dispenser of claim 1, wherein the second refrigerant is propylene glycol.

3. The rapid water-chilling system for use in a water dispenser of claim 1, wherein the first refrigerant is R290.

4. The rapid water-chilling system for use in a water dispenser of claim 1, wherein a portion of the plurality of water inlet coils are disposed around the circumference of the outside of the cold water storage tank.

5. The rapid water-chilling system for use in a water dispenser of claim 1, wherein the second chamber is disposed above the first chamber in the chilling tank.

6. The rapid water-chilling system for use in a water dispenser of claim 5, wherein gravity is used

to return the second refrigerant to the first chamber from the second chamber.
7. The rapid water-chilling system for use in a water dispenser of claim 1, further comprising a permeable plate disposed between the first chamber and the second chamber of the chilling tank.
8. A water dispenser in fluid communication with a water supply, comprising: a water dispensing nozzle; and a rapid water-chilling system in fluid communication with the water dispensing nozzle, comprising: a closed-cycle refrigeration system for a first refrigerant, wherein the closed-cycle refrigeration system includes a set of first refrigerant tubing that carries the first refrigerant, and the first refrigerant changes states between a liquid and a gas in the closed-cycle refrigeration system; a chilling tank having a first chamber and a second chamber that are in fluid communication with one another, wherein: disposed within the first chamber of the chilling tank are: a second refrigerant that exists solely in a liquid state in the chilling tank; and a plurality of first refrigerant coils formed from a portion of the set of first refrigerant tubing that carry the first refrigerant inside the chilling tank; wherein, in use, the plurality of first refrigerant coils refrigerates the second refrigerant; disposed within the second chamber of the chilling tank are: a cold water storage tank, having disposed within the cold water storage tank, a temperature sensor that monitors the temperature of water in the cold water storage tank for a designated low temperature, a high water level sensor and a low water level sensor; and a plurality of water inlet coils; a circulation pump for pumping the second refrigerant; wherein the circulation pump is in fluid communication with the first chamber of the chilling tank and the second chamber of the chilling tank for circulating the second refrigerant from the first chamber to the second; wherein, in use, the high water level sensor and the low level water level senor monitor the level of water in the cold water storage tank, and when activated by the temperature sensor because of the water in the cold water storage tank being at or above the designated low temperature, the first refrigerant chills the second refrigerant, and the circulation pump pumps the second refrigerant from the first chamber to the second chamber of the chilling tank to put the second refrigerant in contact with an outside of the cold water storage tank and an outside of the plurality of water coils to chill water contained within each; wherein, after contacting the outside of the cold water storage tank and the outside of the plurality of water coils, the second refrigerant returns to the first chamber of the chilling tank.
9. The water dispenser in fluid communication with a water supply of claim 8, the second refrigerant is propylene glycol.
10. The water dispenser in fluid communication with a water supply of claim 8, wherein the refrigerant in the refrigerant chilling system is R290.
11. The water dispenser in fluid communication with a water supply of claim 8, further comprising a permeable plate disposed between the cold water storage tank and the plurality of refrigerant coils.
12. A method for delivering a sustained supply of cold water supply from a water dispenser, comprising the steps of: providing a water dispenser; comprising: a water pump in fluid communication with a water supply; a processor, storing a cold water tank lower temperature limit; a water dispensing nozzle for dispensing water when activated; a rapid water-chilling system in fluid communication with the water pump and the water dispensing nozzle, comprising: a closed-cycle refrigeration system for a first refrigerant, wherein the closed-cycle refrigeration system includes a set of first refrigerant tubing that carries the first refrigerant, and the first refrigerant changes states between a liquid and a gas in the closed-cycle refrigeration system; a chilling tank having a first chamber and a second chamber that are in fluid communication with one another, wherein: disposed within the first chamber of the chilling tank are: a second refrigerant that exists solely in a liquid state in the chilling tank; and a plurality of first refrigerant coils formed from a portion of the set of first refrigerant tubing that carry the first refrigerant inside the chilling tank; wherein, in use, the plurality of first refrigerant coils refrigerates the second refrigerant; disposed within the second chamber of the chilling tank are: a cold water storage tank having disposed within the cold water storage tank, a temperature sensor that monitors the temperature of water in

the cold water storage tank for the stored cold water tank lower temperature limit; and a plurality of water inlet coils; a circulation pump for pumping the second refrigerant; wherein the circulation pump is in fluid communication with the first chamber of the chilling tank and the second chamber of the chilling tank for circulating the second refrigerant from the first chamber to the second chamber; wherein, in use, when activated by the temperature sensor because of the water in the cold water storage tank being at or above the cold water tank lower temperature limit, the first refrigerant chills the second refrigerant and the circulation pump pumps the second refrigerant from the first chamber to the second chamber of the chilling tank to put the second refrigerant in contact with an outside of the cold water storage tank and an outside of the plurality of water coils to chill water contained within each for dispensing through the water dispensing nozzle; and wherein, after contacting the outside of the cold water storage tank and the outside of the plurality of water coils, the second refrigerant returns to the first chamber of the chilling tank; monitoring the temperature of the water in the cold water storage tank using the temperature sensor; and when the temperature of the water in the cold water storage tank rises above the cold water storage tank lower temperature limit, energizing the closed-cycle refrigeration system to circulate the first refrigerant; circulating the first refrigerant through the plurality of refrigerant coils in the first chamber of the chilling tank, wherein the first refrigerant in the plurality of refrigerant coils chills the second refrigerant disposed in the first chamber of the chilling tank; energizing the second refrigerant circulation pump to pump the chilled second refrigerant from the first chamber of the chilling tank to the second chamber of the chilling tank, wherein the second refrigerant flows inside the second chamber of the chilling tank, down the outside of, and in contact with, the plurality of water inlet coils and down the outside of, and in contact with, the outside of the cold water storage tank, wherein the second refrigerant chills water contained inside the plurality of water inlet coils and inside the cold water storage tank; and when activated, dispensing cold water from the water dispensing nozzle at a temperature below 8° C.

13. The method for delivering sustained cold water from a water dispenser of claim 12, wherein, the processor further stores cold water tank upper and lower water level limits, further comprising the steps of: providing a plurality of water level sensors disposed within the cold water storage tank; monitoring the water lever within the cold water storage tank using the plurality of water level sensors; and when the level of the water in the cold water storage tank falls outside of the stored cold water tank upper and lower water level limits, adjusting the water level in the cold water storage tank.

14. The method for delivering sustained cold water from a water dispenser of claim 13, wherein of the at the step of monitoring the water lever within the cold water storage tank using the plurality of water level sensors, when the water level falls below the cold water tank lower water level limit, energizing the water pump to pump water through the plurality of water inlet coils and into the cold water storage tank until the water in the cold water storage tank reaches the cold water tank upper water level limit.

15. The method for delivering sustained cold water from a water dispenser of claim 12, wherein, at the step of, when activated, dispensing cold water from the water dispensing nozzle at a temperature below 8° C., dispensing cold water from the water dispensing nozzle at a temperature below 8° C. at a rate of ten 24 ounce glasses or less over a nine-minute period.