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ABSTRACT

The present invention provides a refrigerator capable of supplying hot and cold drinking water to a user. The refrigerator includes a cold water tank and a hot water tank and a Peltier effect thermoelectric element disposed between the tanks. When a unidirectional current is supplied to the thermoelectric element, its heat absorption portion can absorb heat from the cold water tank and cool down the water stored therein; and its heat generation portion can release to the hot water tank and heat up the water stored therein. The cold water tank can further be cooled by the cold air in the refrigerator; while the hot water tank can further be heated by the heat in the machine room.

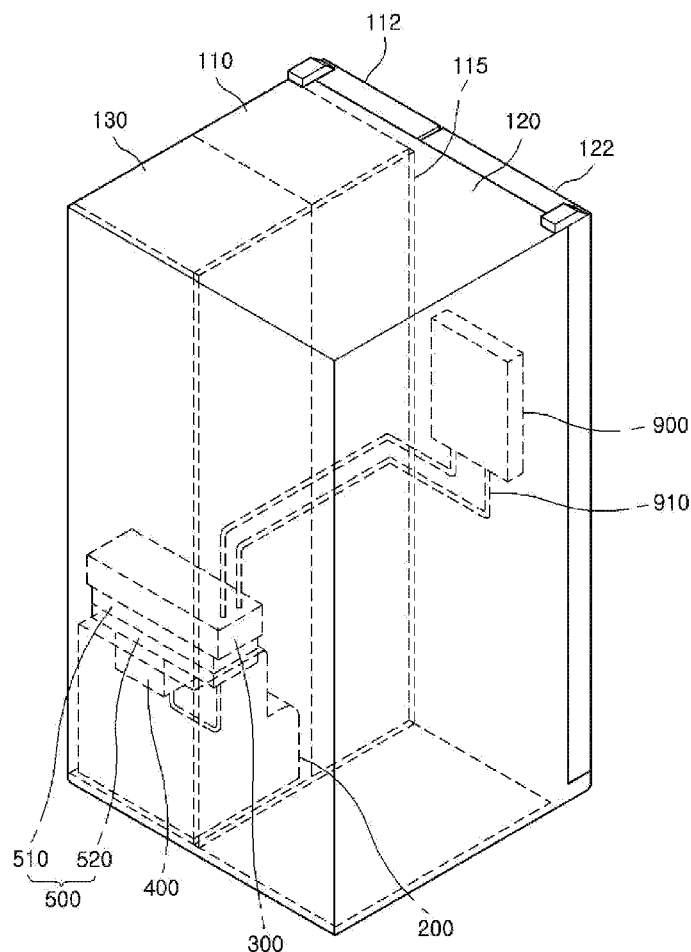


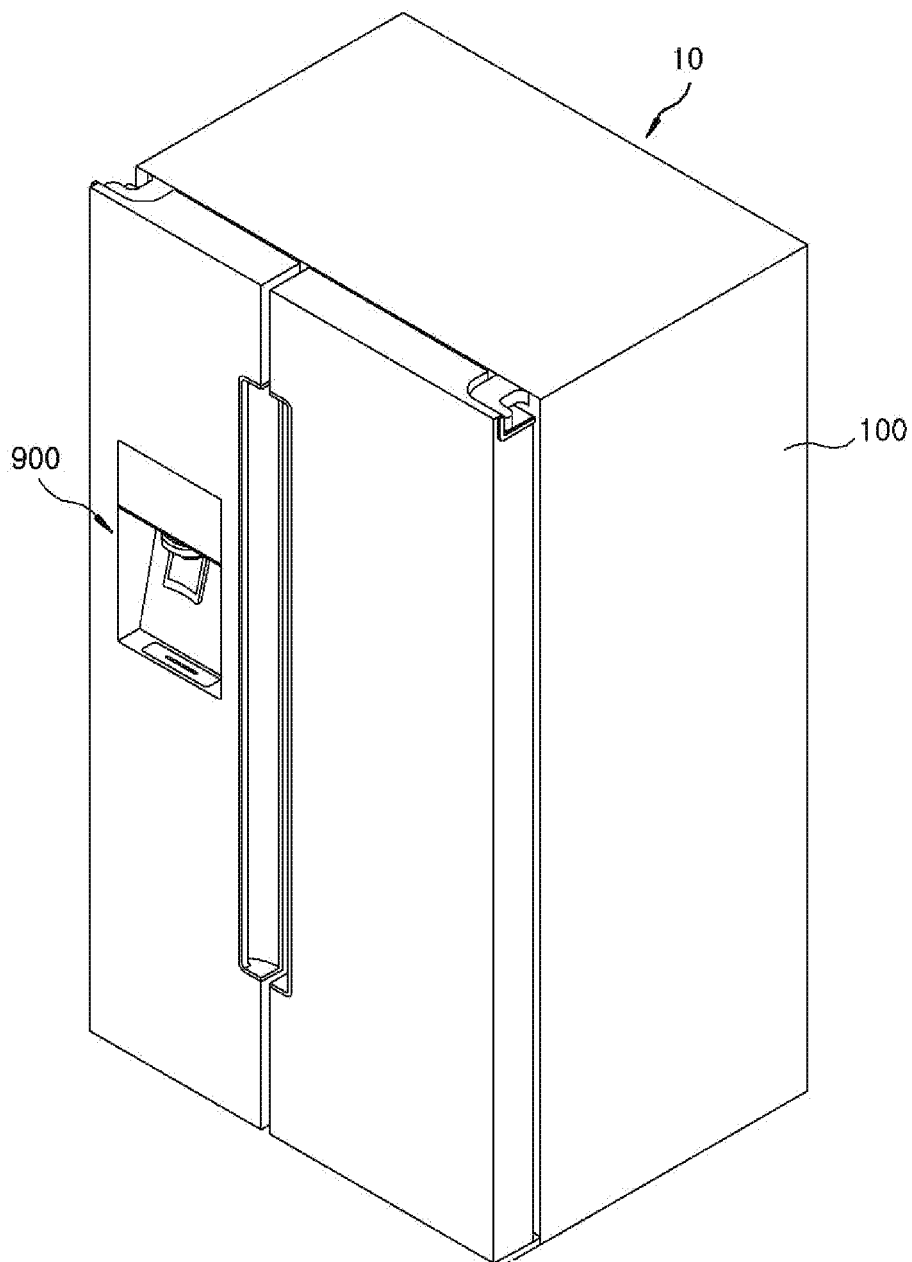
FIG. 1

FIG. 2

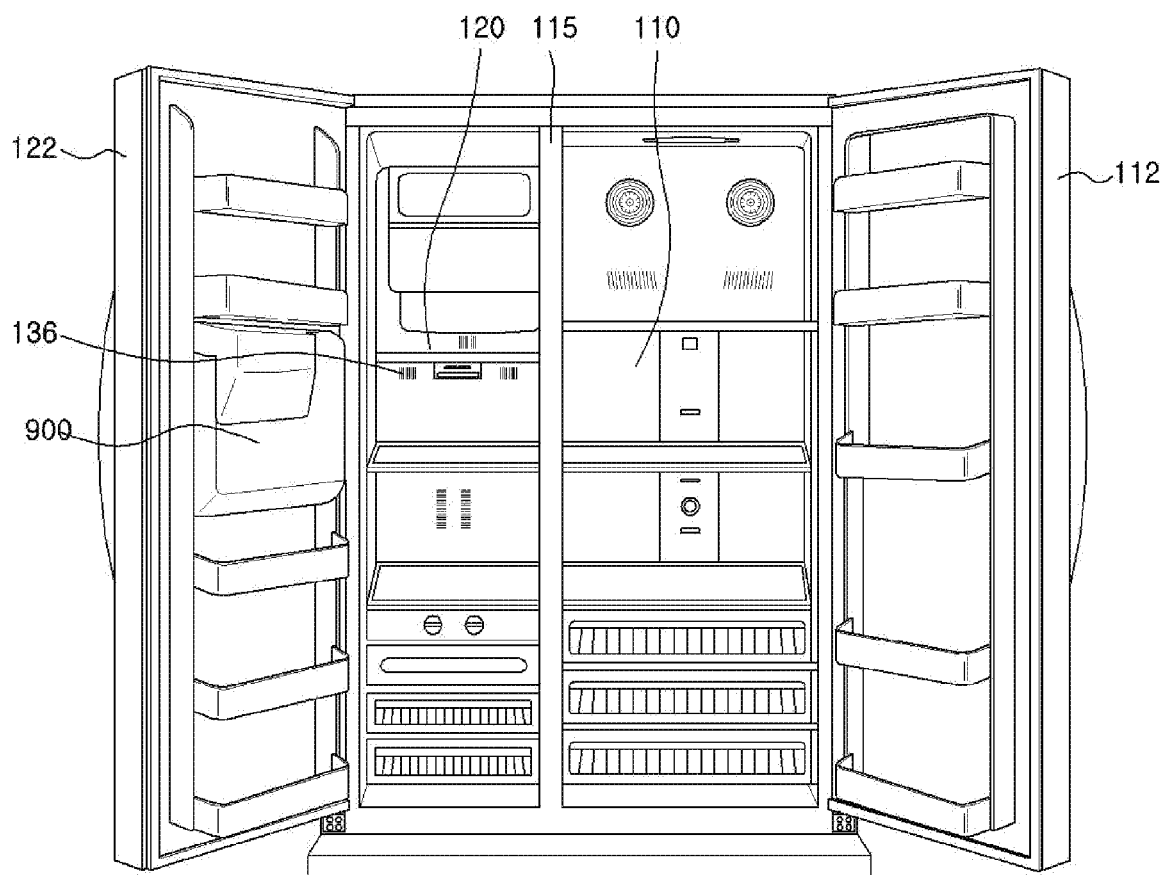


FIG. 3

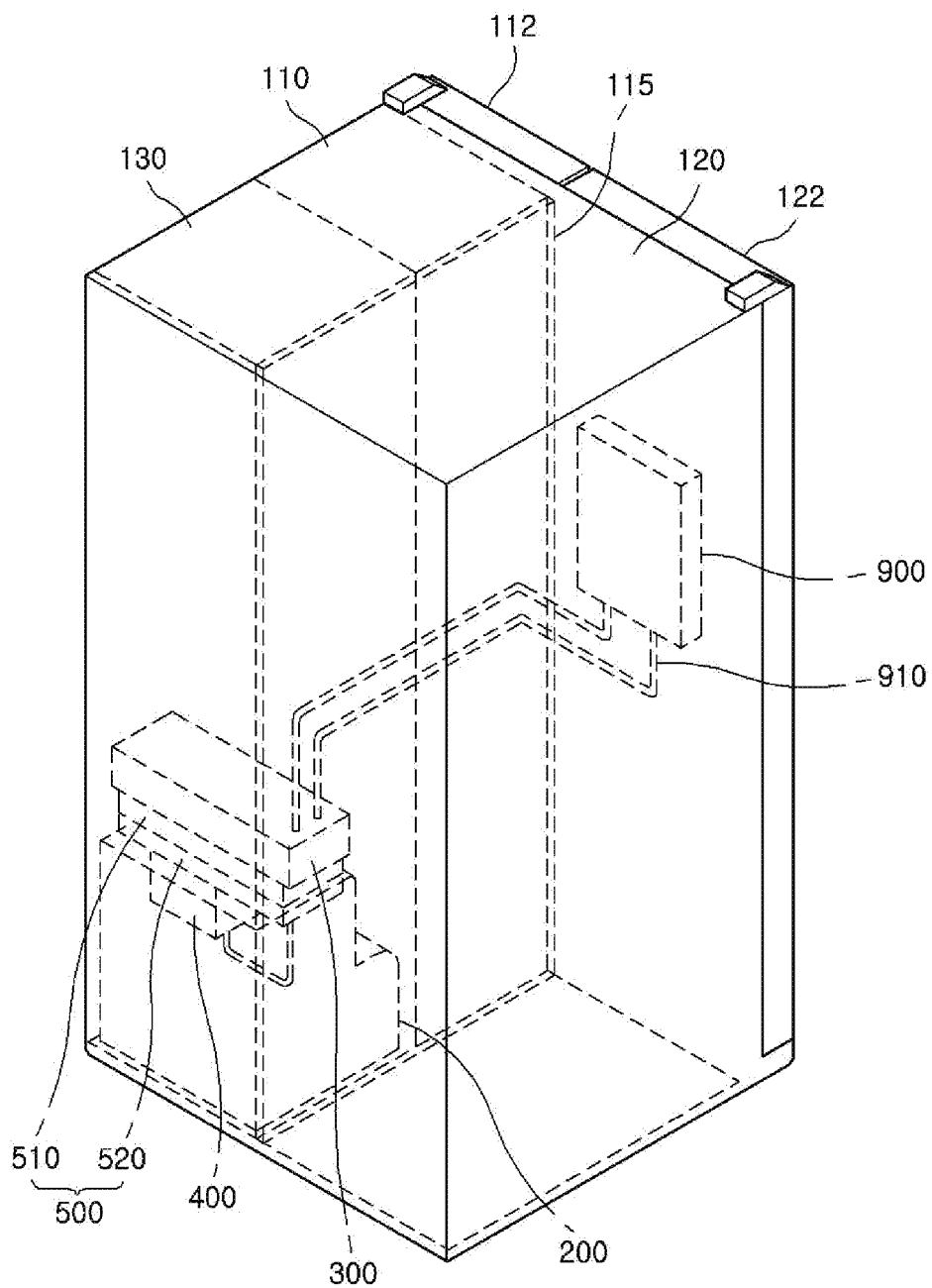


FIG. 4

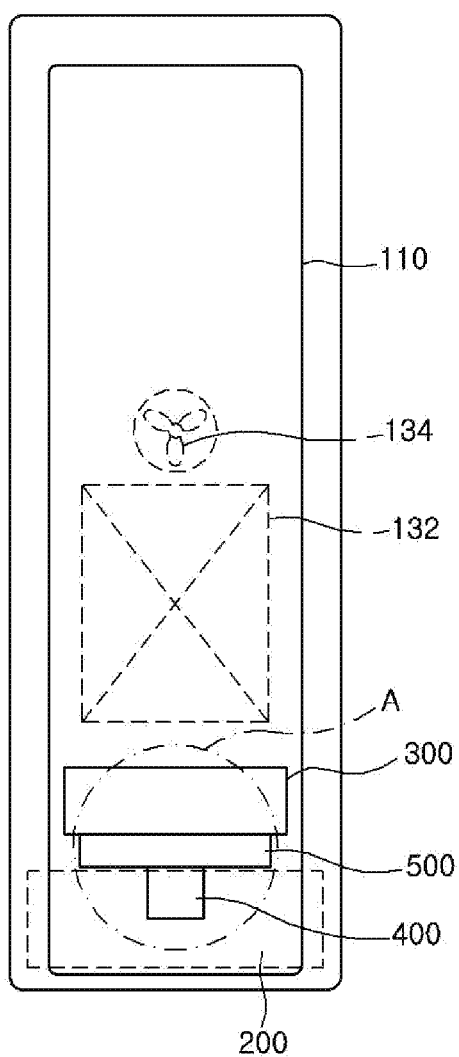
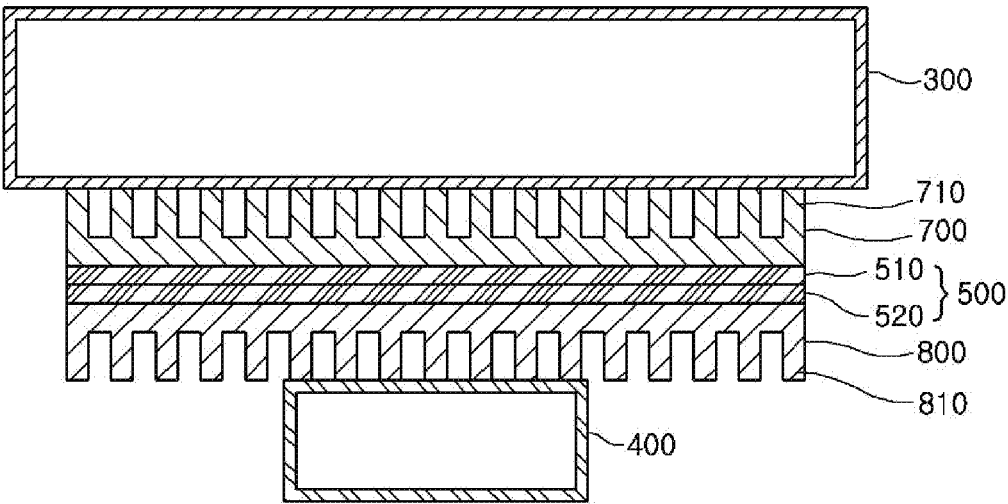


FIG. 5



REFRIGERATOR

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is based on and Claims priority from Korean Patent Application No. 10-2016-0043558, filed on Apr. 8, 2016, the disclosure of which is incorporated herein in its entirety by reference for all purposes.

TECHNICAL FIELD

[0002] The present disclosure relates to refrigerators, and more specifically to beverage dispensing mechanisms of refrigerators.

BACKGROUND OF THE INVENTION

[0003] In general, a refrigerator is an electrical appliance having a storage space that can be maintained at low temperature for storing food or other objects. During operation, cool or cold air is generated through heat exchange between air and a refrigerant and circulated through the storage space.

[0004] There have been increasing consumer demands for refrigerators with the capacity of dispensing ice, cold water, hot water and the like.

[0005] In a refrigerator that can dispense hot water, water supplied from an external water source is heated by a heater and then stored in a hot water tank. The stored hot water can be provided to a user through a dispenser located on the refrigerator.

[0006] However, heating water requires high power consumption. Also, heating and storing hot water tend to interfere with the cooling process of the refrigerator, which contributes to additional power consumption to maintain a low temperature environment of the refrigerator.

PRIOR ART DOCUMENTS

Patent Documents

[0007] Patent Document 1: Korean Patent Application Publication No. 10-2013-0009055 (published on Jan. 23, 2013)

SUMMARY OF THE INVENTION

[0008] Embodiments of the present disclosure provide a refrigerator capable of supplying both cold water and hot water through the use of a thermoelectric element.

[0009] According to the embodiments of the present disclosure, a refrigerator is configured to store and supply both cold water and hot water through the use of a thermoelectric element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a perspective view illustrating a refrigerator according to one embodiment of the present disclosure.

[0011] FIG. 2 is a front view of the refrigerator illustrated in FIG. 1.

[0012] FIG. 3 is a rear view of the refrigerator illustrated in FIG. 1.

[0013] FIG. 4 is a view illustrating a refrigeration chamber of the refrigerator illustrated in FIG. 1.

[0014] FIG. 5 is an enlarged view of a region designated by A in FIG. 4.

DETAILED DESCRIPTION

[0015] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. The illustrative embodiments described in the detailed description, drawings, and Claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented here.

[0016] One or more exemplary embodiments of the present disclosure will be described more fully hereinafter with reference to the accompanying drawings, in which one or more exemplary embodiments of the disclosure can be easily determined by those skilled in the art. As those skilled in the art will realize, the described exemplary embodiments may be modified in various different ways, all without departing from the spirit or scope of the present disclosure, which is not limited to the exemplary embodiments described herein.

[0017] It is noted that the drawings are schematic and are not necessarily dimensionally illustrated. Relative sizes and proportions of parts in the drawings may be exaggerated or reduced in size, and a predetermined size is just exemplary and not limiting. The same reference numerals designate the same structures, elements, or parts illustrated in two or more drawings in order to exhibit similar characteristics.

[0018] The exemplary drawings of the present disclosure illustrate ideal exemplary embodiments of the present disclosure in more detail. As a result, various modifications of the drawings are expected. Accordingly, the exemplary embodiments are not limited to a specific form of the illustrated region, and for example, may include modifications of form required by manufacturing.

[0019] The configuration and operation according to one embodiment of the present disclosure will now be described with reference to the accompanying drawings.

[0020] FIG. 1 illustrates an exemplary refrigerator according to one embodiment of the present disclosure. FIG. 2 is a front view of the internal space configuration of the exemplary refrigerator illustrated in FIG. 1. FIG. 3 is a rear view of the exemplary refrigerator illustrated in FIG. 1. FIG. 4 is a view illustrating an exemplary refrigeration chamber of the refrigerator illustrated in FIG. 1. FIG. 5 is an enlarged view of a region designated by "A" in FIG. 4.

[0021] Referring to FIGS. 1 to 5, the refrigerator 10 according to one embodiment of the present disclosure may include a main body 100, a machine room 200 in a lower portion of the main body 100, a cold water tank 300 in the main body 100 and configured to store cold water, a hot water tank 400 in the machine room 200 and configured to store hot water, a thermoelectric element 500 disposed between the cold water tank 300 and the hot water tank 400, and a control unit configured to supply an electrical current to the thermoelectric element 500, e.g., an unidirectional current.

[0022] The main body 100 may include storage chambers for storing food. The main body 100 may include a refrigeration chamber 110 and a freezer 120 partitioned by a wall 115 in a left-right direction, and a cold air generation chamber 130 at the rear side of the refrigeration chamber 110 or the freezer 120.

[0023] The refrigeration chamber 110 may store food in a cold state using cold air generated in the cold air generation chamber 130. The internal space of the refrigeration chamber 110 is covered by a refrigeration chamber door 112. The refrigeration chamber door 112 may be hingedly mounted to the main body 100 at its upper and lower portions.

[0024] The freezer 120 may store food in a frozen state using cold air generated in the cold air generation chamber 130. The freezer 120 may be separated from the refrigeration chamber 110 by the barrier 115. The internal space of the freezer 120 may be covered by a freezer door 122. The freezer door 122 may be hingedly mounted to the main body 100 at its upper and lower portions.

[0025] The cold air generation chamber 130 may be disposed at the rear side of the storage spaces (in the refrigeration chamber 110 or the freezer 120).

[0026] Cold air generated in the cold air generation chamber 130 may be injected into the freezer 120 through a cold air injection port 136 disposed in a rear wall of the refrigeration chamber 110 or the freezer 120. The cold air is circulated through the storage space to maintain a low temperature. Furthermore, the cold air may also be used to cool the cold water tank 300 disposed in the refrigeration chamber 110 or the freezer 120, as described in greater detail below.

[0027] A refrigerant pipe (not shown) may be disposed in the cold air generation chamber 130 with refrigerant flowing therein. An evaporator 132 is coupled to the refrigerant pipe and can generate cold air by evaporating the refrigerant flowing through the refrigerant pipe.

[0028] The evaporator 132 is one of the functional components that act to generate cold air in a cooling cycle. The refrigerant pipe provides a flow path for liquid refrigerant to circulate during a cooling cycle which includes compressing, condensing, expanding and evaporating the refrigerant. Cold air is generated as the refrigerant continuously circulates in the cooling cycle.

[0029] More specifically, a gaseous refrigerant having a low temperature and a low pressure is compressed by a compressor (not shown). This compression process increases the temperature and pressure of the refrigerant while it still remains in a gaseous state. A condenser (not shown) causes the gaseous refrigerant to condense into a liquid with a high temperature and a high pressure. In an expander (not shown), the liquid refrigerant is then expanded and thereby its temperature and pressure are both lowered. The liquid refrigerant is then sent to the evaporator 132 where it can be evaporated by absorbing heat from ambient air. As a result, the ambient air is further cooled and becomes cold air.

[0030] Cold air generated through this process may be pushed into the freezer 120 through a cooling fan 134 installed at the upper side of the evaporator 132 through a cold air injection port 136. Cold air flows through the freezer 120 can return to the cold air generation chamber 130 through a cold air return duct (not shown) installed in the lower portion of the main body 100.

[0031] The cold air flow returned through the cold air return duct exchanges heat with the refrigerant in the evaporator 132 again, which can lower the temperature of the air flow. The cold air flow is then supplied back into the freezer 120 by the cooling fan 134 through the cold air injection port 136. As the cold air flow circulates between the freezer and

the evaporator, the freezer 120 may be maintained at a predetermined low temperature.

[0032] The machine room 200 may be located at the lower rear side of the storage spaces (the refrigeration chamber 110 or the freezer 120). The machine room 200 is an enclosed space. The compressor, the condenser, the expander and the like may be located in the machine room 200. As described above, the compressor is configured to compress a gaseous refrigerant, causing its temperature and pressure to increase. Heat is generated and released from the refrigerant due to compression. The gaseous refrigerant then passes through the condenser where it is condensed to liquid phase. During condensation, heat is released from the refrigerant. Due to the heat-release, the temperature in the machine room 200 is relatively high.

[0033] The cold water tank 300 may be disposed in the main body 100. Water can be supplied from an external water supply source (not shown) via a cold water valve (not shown) and a cold water filter (not shown) and stored in the cold water tank 300. Since the cold water tank 300 is disposed within the refrigeration chamber 110 or the freezer 120, water stored in the cold water tank 300 can be maintained at low temperature by cold air.

[0034] In the present embodiment, the cold water tank 300 is disposed in the refrigeration chamber 110 and water stored therein remains liquid.

[0035] For example, the cold water tank 300 may be disposed on the rear side of a storage compartment (e.g., a "vegetable room" (not shown)) in the refrigeration chamber 110. The cold water tank 300 may be cooled by cold air supplied from the cold air generation chamber 130 through the cold air injection port 136. Thus, water stored in the cold water tank 300 can be cooled to the temperature in the refrigeration chamber 110 and then supplied to a user.

[0036] In addition, a heat absorption portion 510 of the thermoelectric element 500 can further cool the water in the cold water tank 300 by its endothermic function.

[0037] The hot water tank 400 may be installed in the machine room 200. Water may be supplied from an external water supply source via a hot water valve (not shown) and a hot water filter (not shown) and stored in the hot water tank 400. Being in the machine room 200, water stored in the hot water tank 400 can be heated by the heat generated within the machine room 200.

[0038] However, a user may want hot water with a higher temperature than can be heated merely by the heat in the machine room 200. Thus, an exothermic function of a heat generation portion 520 of the thermoelectric element 500 is used in heating the water stored in the hot water tank 400.

[0039] Typically users need hot water less often than cold water, so the hot water tank 400 may have a smaller capacity than the cold water tank 300. However, this discussion is merely exemplary. It is appreciated that the present disclosure is not necessarily limited thereto.

[0040] The thermoelectric element 500 may be disposed between the cold water tank 300 and the hot water tank 400. The thermoelectric element 500 may function (release heat and absorb heat) based on the Peltier effect. Thus, when an electric current is supplied to the opposite ends of the thermoelectric element 500 that have different compositions, an endothermic reaction takes place on one surface and an exothermic reaction takes place on the other surface, depending on the flow direction of the electric current. Thus, when electric current is supplied to the thermoelectric ele-

ment **500** by the control unit, the thermoelectric element **500** may cool the water stored in the cold water tank **300** and may heat the water stored in the hot water tank **400**.

[0041] The thermoelectric element **500** may include a heat absorption portion **510** facing the refrigeration chamber **110** and a heat generation portion **520** facing the machine room **200**. As an example, the thermoelectric element **500** may be formed in a plate or sheet like shape. However, it will be appreciated by those skilled in the art that the present disclosure is not limited by the material composition, geometric shape or dimensions of the thermoelectric element **500**.

[0042] When an electric current is supplied to the thermoelectric element **500** through the control unit, the heat absorption portion **510** may absorb heat from the cold water tank **300** and thereby cool the water in the cold water tank **300**.

[0043] A cooling member **700** may be coupled to the heat absorption portion **510**. The cooling member **700** may have a plate like shape and include a plurality of cooling fins **710** protruding from the front surface of the heat absorption portion **510** in a vertical direction (using the illustrated orientation as reference). The cooling member can increase the contact area between the cold water tank **300** and ambient cold air in the refrigeration chamber and thereby increase the cooling efficiency. While not shown in the drawings, a cold air blow fan (not shown) may be installed to facilitate heat transfer between the cooling fins **710** and the cold water tank **300** by continuously pushing cold air from the cooling fins **710** to the cold water tank **300**.

[0044] Heat absorbed by the heat absorption portion **510** may be released to the hot water tank **400** through the heat generation portion **520**. In addition, when an electric current is supplied to the thermoelectric element **500** through the control unit, heat may be additionally released from the heat generation portion **520** and further contribute to heating up the water in the hot water tank **400**.

[0045] A heat radiation member **800** may be coupled to the heat generation portion **520**. The heat radiation member **800** may have a plate like shape and may include a plurality of heat radiation fins **810** protruding from the front surface of the heat radiation member **800** in a vertical direction (using the illustrated orientation as reference). The heat radiation member **800** can increase the contact area between the hot water tank **400** and ambient hot air in the machine room **200** and thereby increase heating efficiency. While not shown in the drawings, a blow fan (not shown) may be installed to facilitate heat transfer between the radiation fins **810** and the hot water tank **400**.

[0046] Since the functions of the heat absorption portion **510** and the heat generation portion **520** would be switched if the electric current supplied to the thermoelectric element **500** changes direction, a unidirectional current is supplied to the thermoelectric element **500**.

[0047] For this purpose, the control unit may be configured to ensure only a unidirectional current to the thermoelectric element **500**. If the unidirectional current is supplied to the thermoelectric element **500** by the control unit, heat may be absorbed in the heat absorption portion **510**, whereby the temperature of the vicinity of the cold water tank **300** and the temperature of the cold water stored in the cold water tank **300** may be reduced by the cooling member **700**. Simultaneously, heat may be generated in the heat generation portion **520**, whereby the temperature of the

vicinity of the hot water tank **400** and the temperature of the hot water stored in the hot water tank **400** may be increased by the heat radiation member **800**.

[0048] A dispenser **900** may be provided on the front surface of the freezer door **122**. The dispenser **900** is provided to enable a user to receive cold water and hot water from the cold water tank **300** and the hot water tank **400** respectively. The dispenser **900** may be formed in a depressed shape on the front surface of the freezer door **122**. However, this discussion is merely exemplary. The dispenser **900** may be formed in a depressed shape on the front surface of the refrigeration chamber door **112**.

[0049] Specifically, the dispenser **900** may include a nozzle **910** coupled to at least one of the cold water tank **300** and the hot water tank **400** and configured to selectively inject at least one of cold water stored in the cold water tank **300** and hot water stored in the hot water tank **400**. The nozzle **910** may be exposed to the outside.

[0050] Descriptions will not be made on the well known operations and processes of the refrigerator **10** according to one embodiment of the present disclosure configured as above.

[0051] If an electric current is supplied to the refrigerator **10**, cold air is continuously generated in the refrigerator **10** by circulating the refrigerant which repeatedly goes through a cooling cycle including compression, condensation, expansion and evaporation. Cold air thus generated is supplied into the refrigeration chamber **110** and the freezer **120** through the cold air injection ports **136** disposed in the rear walls of the refrigeration chamber **110** and the freezer **120**, thereby cooling the interior of the refrigeration chamber **110** and the freezer **120**.

[0052] The cold water tank **300** and the hot water tank **400** are disposed inside the refrigerator **10**. Specifically, the cold water tank **300** is disposed within the refrigeration chamber **110** which is maintained at a relatively low temperature (lower than room temperature). The hot water tank **400** is disposed within the machine room **200** which is maintained at a relatively high temperature (higher than room temperature).

[0053] As described above, cold air is continuously introduced into the refrigeration chamber **110**. Thus, the cold water tank **300** disposed within the refrigeration chamber **110** can be cooled by the cold air. In addition, if an electric current is supplied to the thermoelectric element **500**, a heat absorption reaction occurs in the heat absorption portion **510**. Water stored in the cold water tank **300** can be cooled by the heat absorption portion **510** of the thermoelectric element **500**. The heat of the cold water tank **300** absorbed by the heat absorption portion **510** can be transferred to the heat generation portion **520** and heat the hot water tank **400**.

[0054] The machine room **200**, in which the hot water tank **400** is disposed, is a closed space where the compressor, the condenser, the expander and the like are disposed.

[0055] The compressor can convert a gaseous refrigerant having a low temperature and a low pressure to a gaseous refrigerant having a high temperature and a high pressure. In this process, heat is generated. Furthermore, the gaseous refrigerant having a high temperature and a high pressure, which is generated in the compressor, is sent to the condenser. The gaseous refrigerant having a high temperature and a high pressure is liquefied by releasing heat as it passes through the condenser. For that reason, the machine room **200** is kept at a relatively high temperature.

[0056] The hot water tank 400 may be primarily heated by the heat in the machine room. Although water stored in the hot water tank 400 can be heated by the heat generated in the compressor, the heat is typically not enough to heat the water to a user desired temperature. According to embodiments of the present disclosure, the hot water tank 400 can be secondarily and additionally heated by the heat generated in the heat generation portion 520 of the thermoelectric element 500. As a result, the water stored in the hot water tank 400 may become hot water.

[0057] As described above, in the refrigerator 10, the cold water generated in the aforementioned process is stored in the cold water tank 300 and the hot water generated in the aforementioned process is stored in the hot water tank 400. Thus both cold water and hot water are readily available to a user.

[0058] If a user selects an option of cold water through an input part (not shown), a cold water supply signal is transmitted to the control unit. Then, the control unit generates a cold water injection signal so that cold water stored in the cold water tank 300 is injected through the nozzle 910 of the dispenser 900. Thus, a user may receive the cold water through the dispenser 900.

[0059] If a user selects an option of hot water through the input part, a hot water supply signal is transmitted to the control unit. Upon receiving the hot water supply signal, the control unit generates a hot water injection signal so that the hot water stored in the hot water tank 400 is injected through the nozzle 910 of the dispenser 900. Thus, a user may receive the hot water through the dispenser 900.

[0060] Although exemplary embodiments of the present disclosure are described above with reference to the accompanying drawings, those skilled in the art will understand that the present disclosure may be implemented in various ways without changing the necessary features or the spirit of the present disclosure.

[0061] Therefore, it should be understood that the exemplary embodiments described above are not limiting, but only an example in all respects. The scope of the present disclosure is expressed by Claims below, not the detailed description, and it should be construed that all changes and modifications achieved from the meanings and scope of Claims and equivalent concepts are included in the scope of the present disclosure.

[0062] From the foregoing, it will be appreciated that various embodiments of the present disclosure have been described herein for purposes of illustration, and that various modifications may be made without departing from the scope and spirit of the present disclosure. The exemplary embodiments disclosed in the specification of the present disclosure do not limit the present disclosure. The scope of the present disclosure will be interpreted by the Claims below, and it will be construed that all techniques within the scope equivalent thereto belong to the scope of the present disclosure.

What is claimed is :

1. A refrigerator comprising:

- a cold water tank configured to store water therein;
- a hot water tank configured to store water therein;
- a thermoelectric element disposed between the cold water tank and the hot water tank; and
- a control unit configured to control supply of a current to the thermoelectric element,

wherein the thermoelectric element comprises:

- a heat absorption portion operable to absorb heat and cool the cold water tank responsive to the current; and
- a heat generation portion operable to generate heat and provide heat to the hot water tank responsive to the current.

2. The refrigerator of claim 1 further comprising:

- a main body having the cold water tank therein; and
- a machine room disposed in a lower portion of the main body, wherein the hot water tank is disposed in the machine room.

3. The refrigerator of claim 2 further comprising a cooling member contacting the heat absorption portion of the thermoelectric element and operable to transfer heat between the heat absorption portion of the thermoelectric element and the cold water tank.

4. The refrigerator of claim 3 further comprising a heat radiation member contacting the heat generation portion of the thermoelectric element and operable to transfer heat between the heat generation portion of the thermoelectric element and the hot water tank.

5. The refrigerator of claim 2, wherein the main body comprises:

- a refrigeration chamber;
- a freezer; and
- a cold air generation room located at a rear side of the refrigeration chamber or a rear side of the freezer, wherein the cold air generation room is configured to accommodate an evaporator for evaporating a refrigerant to generate cold air.

6. The refrigerator of claim 5, wherein water stored in the cold water tank is cooled by one of cold air generated in the evaporator and the heat absorption portion of the thermoelectric element.

7. The refrigerator of claim 5, wherein the heat absorption portion of the thermoelectric element faces one of the refrigeration chamber and the freezer.

8. The refrigerator of claim 5, wherein the heat generation portion of the thermoelectric element faces the machine room.

9. The refrigerator of claim 4, wherein water stored in the hot water tank is primarily heated by heat generated in the machine room and is secondarily heated by heat generated by the heat generation portion of the thermoelectric element.

10. The refrigerator of claim 1 further comprising a dispenser comprising a nozzle configured to dispense water stored in the hot water tank and the cold water tank, wherein the nozzle opens outside of the refrigerator.

11. The refrigerator of claim 1, wherein the current is unidirectional.

12. A refrigerator comprising:

- a main body;
- a machine room in a lower portion of the main body;
- a cold water tank;
- a hot water tank;
- a dispenser comprising a nozzle coupled to at least one of the hot water tank and the cold water tank and configured to selectively dispense water stored in the hot water tank and the cold water tank to a user; and
- a thermoelectric element disposed between the cold water tank and the hot water tank and configured to absorb heat and release heat based on Peltier effect, and wherein the thermoelectric element is configured to cool the cold water tank and heat the hot water tank.

13. The refrigerator of claim **12** further comprising a control unit configured to control supply of current to the thermoelectric element, wherein the thermoelectric element is operable to both absorb heat from the cold water tank and release heat to the hot water tank responsive to the current.

14. The refrigerator of claim **13**, wherein the current is unidirectional.

15. The refrigerator of claim **12**, wherein the hot water tank is disposed in the machine room.

16. The refrigerator of claim **12**, wherein the cold water tank is disposed in the main body and outside of the machine room.

17. The refrigerator of claim **12**, wherein thermoelectric element comprises a heat absorption portion facing the cold water tank and a heat generation portion facing the hot water tank.

18. The refrigerator of claim **17** further comprising a cooling member contacting the heat absorption portion of the thermoelectric element and operable to transfer heat between the heat absorption portion of the thermoelectric element and the cold water tank.

19. The refrigerator of claim **17** further comprising a heat radiation member contacting the heat generation portion of the thermoelectric element and operable to transfer heat between the heat generation portion of the thermoelectric element and the hot water tank.

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