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Description

Technical Field

[0001] The invention relates to a refrigerator, especially to a household or commercial refrigerator which is provided with a dispenser.

Background Art

[0002] The freezing compartment of a refrigerator can usually reach a temperature of lower than minus ten °C or more. The refrigerator body and the door of the refrigerator are provided with heat insulating layers to avoid losing of cold energy caused by heat exchange between the cold air within the refrigerator and the surrounding environment. However, as the increase in the refrigerator's volume and in the number of the components of the refrigerator door (for example, a dispenser for dispensing water or ice), some portions of the refrigerator door which are exposed to the atmosphere may have relatively low temperature under the influence of the storage compartment. When the difference between the temperature of the surface exposed to the atmosphere and the atmosphere temperature reaches dew point temperature, condensation will appear on the surface. The phenomenon of water condensation around the dispenser is extremely significant.

[0003] It is known in prior art that the particular surface temperature of the refrigerator can be increased by providing a heating element so at to prevent the generating of condensed water. For example, US patent No. 6,862,891 B1 discloses a refrigerator which has a heating element located near an ice dispensing means and a control unit connected with the heating element. The control unit is configured such that the voltage supplied to the heating element is variable, so that the heating element may operate at different non-zero voltages for reducing energy consumption.

[0004] For various reasons such as the door generally having an irregular shape at a location corresponding to a dispenser casing, various portions of the dispenser casing having different distances from an ice transfer passage which passes through the door, the heat insulating layer having different thicknesses at different portions of the dispenser casing, etc., different areas of the dispenser casing may have different dewing possibilities. Thus, in a dew prevention / dew removing process, some areas of the door may be overheated while other areas may be of a temperature that is too low to prevent dewing.

Summary of the Invention

[0005] In view of these factors, an object of the invention is to solve at least one of the technical problems found in the prior art so that the temperature of the dispenser casing may be evenly increased with a higher energy efficiency to prevent the dispenser casing from forming condensation and / or to remove any condensed water from the dispenser casing.

[0006] The invention in one aspect relates to a refrigerator according to claim 1.

[0007] In this way, the heat generated by the heater can be transmitted to the dispenser casing rapidly and evenly. On one hand, this configuration can prevent the portions of the dispenser casing which are adjacent to the heater from being overheated and the portions of the dispenser casing which are distant from the heater from being under heated and thus generating condensate, so that it is expected that condensation on the dispenser casing can be avoided with a reasonable energy consumption. On the other hand, by means of the heat transmitting function of the heat conducting element, the reaching area of the heat generated by the heater can be enlarged by the heat conducting element. That is to say, the heat generated by the heater may form a heat source for the heat conducting element and will be transmitted quickly by the heat conducting element, so that the deploying area of the heater can be advantageously reduced. For example, only the portions of the dispenser casing which are likely to occur condensation may be provided with a heater while other portions of the dispenser casing which are not likely to occur condensation may be only covered and supplied with heat by the heat conducting element.

[0008] Other features which are disclosed individually or in combination as features of the invention are defined in attached claims.

[0009] Although the heat conducting element may not directly contact with the heater, it is preferably that the heat conducting element contacts the heater according to a preferred embodiment of the invention, so that the heat generated by the heater may transmitted directly and quickly to the heat conducting element.

[0010] According to a preferred embodiment of the invention, the dispenser casing defines a dispensing cavity for receiving at least a part of an outside container, the dispensing cavity comprises a dispensing cavity wall extending in a longitudinal direction, and the heat conducting element covers at least a major portion of the dispensing cavity wall. Thus, the dispensing cavity wall may be evenly heated to reduce the possibility of occurring condensation. In addition, the dispensing cavity wall may be touched by a user. For this end, the heat conducting element is provided for preventing the dispensing cavity wall from being overheated, and thus any potential harm to the user by the overheated dispensing cavity wall can be avoided.

[0011] According to a preferred embodiment of the invention, only an edge area of the heat conducting element contacts the heater.

[0012] According to a preferred embodiment of the invention, the upper end of the heat conducting element contacts the heater.

[0013] According to a preferred embodiment of the invention, the heat conducting element comprises a metal

foil having a high heat conductivity, the metal foil establishes face-to-face contacting with the dispenser casing.

[0014] According to a preferred embodiment of the invention, the refrigerator comprises adhesive means for attaching the heat conducting element to the dispenser casing.

[0015] According to a preferred embodiment of the invention, the heater is arranged adjacent to the ice transfer passage. In this way, the portions of the dispenser casing which are located near the ice transfer passage will obtain more heat, so that the condensation possibility can be reduced. In addition, in the condition that the ice transfer passage is blocked by a closure element which closes a through hole, the condition that the closure element is frozen and thus cannot be opend can be advantageously avoided by means of the first heater provided adjacent to the ice transfer passage.

[0016] Although it is possible to arrange the heater adjacent to the dispenser casing but not directly contact with the dispenser casing, it is preferably that the heater is connected to the dispenser casing according to a preferred embodiment of the invention, so that the heat generated by the heater may be transmitted quickly to the dispenser casing, and thus the influence of the heat generated by the heater to the storage space is reduced.

[0017] According to a preferred embodiment of the invention, the heater comprises a first heater and a second heater which are controlled independently from each other. According to a preferred embodiment of the invention, the dispenser casing comprises a first area and a second area located near the first area, the first area and the second area are arranged adjacent to the heat insulating layer, and the first and second heater are disposed in the first area and the second area respectively. Thus, condensation can be prevented more effectively. For example, different heaters may be properly disposed according to the condensation characteristics of different areas of the dispenser casing, and it may prevent the occurring of condensation or removing the generated condensate more efficiently by individually control these heaters.

[0018] The structure and other objects and advantages of the invention will be apparent from the description to the preferred embodiments with reference to the drawings.

Brief Description of the Drawings

[0019] The invention will be further understood by reading the following detailed description with reference to the drawings which are incorporated herein as a part of the description and illustrate the invention and in which:

Figure 1 is a schematic perspective view of a refrigerator according to a preferred embodiment of the invention.

Figure 2 is a schematic partial sectional view taken along a direction indicated by line I-I of Figure 1.

Figure 3 is a schematic view of a partly assembled door of the according to the preferred embodiment of the invention.

Figure 4 is a schematic layout of a heating unit of a dispenser casing according to a preferred embodiment of the invention.

Figure 5 is a schematic block diagram of the refrigerator according to a preferred embodiment of the invention.

Detailed Description of Preferred Embodiments

[0020] Please refer to the drawings, in particular Figures 1 and 2. A refrigerator 1 comprises a refrigerator body 2 and two doors 3 connected to the refrigerator body 2, as shown in Figures 1 and 2.

[0021] The refrigerator body 2 comprises an outer shell 11, an inner shell 12 and a heat insulating layer 6 disposed between the outer shell 11 and the inner shell 12. According to the invention, the heat insulating layer 6 is a foam-based insulating layer and is formed by foaming a heat insulating foam material.

[0022] The refrigerator body 2 defines at least one storage space for storing food. In this embodiment, the storage space comprises a freezing compartment 7 and a refrigerating compartment (not shown) which are juxtaposed with each other.

[0023] The doors 3 are pivotably connected to the refrigerator body 2 by hinges 4 respectively, and are rotatable about their corresponding rotation axes which are parallel to a vertical axis. As shown in Figure 2, it is also provided with a foam-based insulating layer 6 inside each of the doors 3. The doors 3 are usually closed to avoid escape of cold air from the freezing compartment 7 and the refrigerating compartment. When desired, the user may open the corresponding door 3 to perform an operation, such as taking out food from the freezing compartment or refrigerating compartment, or putting food into a corresponding storage compartment. The user can open or close the doors 3 by means of handles 5.

[0024] In this embodiment, each door 3 is configured to completely open or completely close a corresponding storage compartment. It can be understood that the invention is not limited thereto, and other embodiments are also possible. For example, in an alternative embodiment, one of the storage compartments may be opened or closed by two doors 3. That is to say, each door 3 may only open or close a part of such a storage compartment.

[0025] The door 3 which is corresponded to the freezing compartment 7 (hereinafter referred to as freezing compartment door) is equipped with a dispenser 8 to allow a user to take out ice and/or beverage (for example water), such as ice stored in the freezing compartment and water stored in a water tank arranged in the refrigerating compartment, without opening the door 3. Although in this embodiment the dispenser 8 is arranged

in the door 3 which is corresponded to the freezing compartment, it shall be appreciated that it is also possible to arrange the dispenser 8 in a suitable way in the door 3 which is corresponded to the refrigerating compartment.

[0026] As shown in Figures 2 and 3, the freezing compartment door 3 comprises a door panel 13 forming its front surface and an inner lining 23 facing towards the freezing compartment 7 when the freezing compartment door 3 is in its closed position. According to the invention the door panel 13 is made of a sheet metal material, and both sides of the door panel 13 are bent backwardly and extend to form into first and second longitudinal sidewalls 48 and 49 respectively. The heat insulating layer 6 is in tight contact with the door panel 13 and the first and second longitudinal sidewalls 48 and 49.

[0027] The door panel 13 has an opening 9 corresponding to the dispenser 8, which opening 9 having a substantially square or rectangular shape. The dispenser 8 comprises a dispenser casing 10 received between the door panel 13 and the inner lining 23. The dispenser casing 10 forms a cavity 14 which is inwardly recessed and has a front open end. The shape and dimension of the front open end of the inner cavity 14 correspond to that of the opening 9 substantially. The inner lining 23 protrudes toward the freezing compartment 7 at the location corresponded to the dispenser casing 10, with a predetermined distance between the protruding portion of the inner lining 23 and the dispenser casing 10 for disposing the heat insulating layer 6.

[0028] The dispenser 8 comprises a partition plate 15 within the inner cavity 14. The partition plate 15 is parallel to a horizontal plane and separates the inner cavity 14 into upper and lower portions. The portion of the inner cavity 14 located below the partition plate 15 forms into a dispensing cavity 16 whose front end is kept open. The dispensing cavity 16 is configured to accept at least a part of an external container such as a cup. In this embodiment, the dispensing cavity 16 is recessed backwardly from the front surface of the door 3 with a certain curvature to a predetermined depth.

[0029] The dispensing cavity 16 has a substantially flat support wall 17 for stably putting the external container thereon. The support wall 17 has a plurality of thin through holes (not shown), through which any liquid that is splashed out or overflows accidentally during an ice or water dispensing process flows into a water gathering slot 19 arranged below the support wall 17.

[0030] The refrigerator 1 comprises a control panel 20 arranged on the freezing compartment door 3, and the control panel 20 comprises a display screen 21 and a plurality of buttons or a touch area 22 for controlling the refrigerator 1. The display screen 21 can display the state of the refrigerator 1 and/or selectable parameters, etc.

[0031] In this embodiment, the control panel 20 is arranged along the upper end of the opening 9, closely adjacent to the dispensing cavity 16.

The portion of the opening 9 located above the partition plate 15 is adapted to be conformed to the out profile of the control panel 20, such that the control panel 20 can be engaged by the corresponding edge of the opening 9. The portion of the inner cavity 14 located above the partition plate 15 is shielded by the control panel 20.

[0032] The dispenser casing 10 comprises a cavity wall delimiting the inner cavity 14. The cavity wall comprises a first portion 24 located below the partition plate 15. The first portion 24 comprises a longitudinal wall 30 for forming a longitudinal boundary of the dispensing cavity 16. The longitudinal wall 30 is perpendicular to the horizontal plane and has a substantially arc-shaped cross-section. The longitudinal wall 30 has a rear surface which is closely adjacent to the heat insulating layer 6 and an outer surface which is exposed to the atmosphere.

[0033] The first portion 24 further comprises a bottom wall 31 which is connected to the lower end of the longitudinal wall 30 and extends forwardly. The bottom wall 31 is located below the support wall 17 and spaced from the support wall 17 by a certain distance so as to form the above-mentioned water gathering slot 19.

[0034] The cavity wall of the dispenser casing 10 further comprises a second portion 25 which is connected to the upper end of the first portion 24 and is located above the partition plate 15. The second portion 25 comprises an inclined wall 26 which extends from the longitudinal wall 30 and is inclined forwardly. The inclined wall 26 comprises a through hole 27 which allows ice to pass therethrough. The through hole 27 is configured as a part of an ice transfer passage 29. The ice transfer passage 29 is used for transferring ice from an ice storage unit 28 located within the freezing compartment 7 to the dispensing cavity 16. The second portion 25 further comprises a top wall 32 which forms the upper boundary of the inner cavity 14. The second portion 25 has a hole 33 through which a water supply pipe (not shown) passes, which water supply pipe transmitting drinkable water to the dispensing cavity 16.

[0035] An ice discharge pipe 34 forming a major part of the ice transfer passage 29 is embedded in the freezing compartment door 3. One end of the ice discharge pipe 34 is connected to the second portion 25 and is in communication with the through hole 27. The other end of the ice discharge pipe is oriented towards a discharge outlet of the ice storage unit 28 within the freezing compartment 7 when the freezing compartment door 3 is closed. Thereby, the ice discharged from the ice storage unit 28 enters into the ice discharge pipe 34, and then is guided to the dispensing cavity 16 by means of an ice outlet 18 provided in the partition plate 15.

[0036] As shown in Figure 2, the portion of the inner cavity 14 which lies above the partition plate 15 is shielded by the control panel 20; however, the second portion 25 of the dispenser casing 10 still communicates with the atmosphere, that is, the second portion 25 is still exposed to the atmosphere, because the partition plate 15 is provided with the ice outlet 18 which is in communication with the portion of the inner cavity 14 which lies above

the partition plate 15.

[0037] To prevent air within the freezing compartment 7 from escaping from the freezing compartment 7 through the ice transfer passage 29 or prevent outside air from entering into the freezing compartment 7 through the ice transfer passage 29, the dispenser 8 is equipped with a closure element 36 for opening or closing the ice transfer passage 29. Usually, the ice transfer passage 29 is closed by the closure element 36. When there is a need for dispensing ice, the ice transfer passage 29 is opened by means of the closure element 36 to allow the transfer of ice. The shape and dimension of the closure element 36 are substantially corresponded to that of the through hole 27, such that in the closed position the closure element closes the through hole 27 and thus closes the ice transfer passage 29. In this embodiment, the closure element 36 is connected to the second portion 25 of the dispenser casing 10 and is received in the inner cavity 14.

[0038] Under the influence of the freezing compartment 7, the temperature of the dispenser casing 10 is usually lower than room temperature/ambient temperature. When the difference between ambient temperature and the temperature of the dispenser casing 10 reaches dew point temperature, condensate drops will be generated on the dispenser casing 10. The condensation possibility is relatively high due to the fact that the second portion 25 of the dispenser casing 10 is close to the ice discharge pipe 34 and forms a part of the ice transfer passage 29. For this end, the refrigerator 1 is provided with a heating unit 37 for increasing the surface temperature of the dispenser casing 10. As shown in Figure 2, the heating unit 37 is arranged between the dispenser casing 10 and the heat insulating layer 6.

[0039] Figure 4 is a schematic diagram of the heating unit 37 according to a preferred embodiment of the invention. As shown in Figure 4, the heating unit 37 comprises a first heater 38 and a second heater 39 adjacent to the first heater 38, for supplying heat to the dispenser casing 10. The first heater 38 and the second heater 39 are preferably resistance heaters, i.e. performing heating by resistors.

[0040] In order to evenly transmit the heat generated by the first heater 38 and the second heater 39 to the dispenser casing 10, the heating unit 37 further comprises a first heat conducting element 40 for transmitting the heat generated by the first heater 38 and the second heater 39 to the dispenser casing 10. In this embodiment, the first heat conducting element 40 is an aluminum foil having a high heat conductivity.

[0041] The first heat conducting element 40 has a hole (not shown) which is corresponded to the through hole 27. The first heater 38 and the second heater 39 can be arranged according to the distribution characteristics of condensate drops on the dispenser casing 10. In this embodiment, the first heater 38 comprises a plurality of arc-shaped heating segments 35 arranged around the hole. The second heater 39 is arranged close to the first heater 38 and preferably comprises a portion located between heating segments 35 of the first heater 38. Preferably, this portion has a shape that corresponds to the heating segment 35.

[0042] After the first heater 38 and the second heater 39 are arranged in a predetermined pattern on one side of the first heat conducting element 40, the other side of the first heat conducting element 40 is closely attached to the inner side of the dispenser casing 10.

[0043] The heating unit 37 is adhered to the inner side of the dispenser casing 10 by means of adhesive means (not shown), with the hole of the first heat conducting element 40 being aligned with the through hole 27. The first heat conducting element 40, the first heater 38 and the second heater 39 all are flexible and deformable, such that the portion of the heating unit 37 located between line A and line B is arranged on the inclined wall 26, the portion thereof located above line A is bent and then is adhered to the top wall 32 of the dispenser casing, and the portion thereof located below line B is bent and then is connected to the upper end of the longitudinal wall 30. Thereby, in this embodiment, the first heater 38 is mainly arranged on the inclined wall 26 and the top wall 32 of the dispenser casing 10. The lower end portion of the first heater 38 extends to the upper end of the longitudinal wall 30. The heating segment 35 most close to the through hole 27 is arranged around the through hole 27. The major portion of the second heater 39 is arranged on the inclined wall 26. The portion located below line B of the second heater extends to the upper end of the longitudinal wall 30 together with that of the first heater 38.

[0044] In this embodiment, the first heater 38 and the second heater 39 are disposed on a first region 51 and a second region 52 of the dispenser casing 10 respectively. The first region 51 is adjacent to the second region 52, but they do not overlap each other. The first region 51 comprises the majorities of the inclined wall 26 and the top wall 32 as well as the upper end portion of the longitudinal wall 30 which is close to the inclined wall 26. The second region 52 has an area smaller than the first region 51 and is surrounded by the first region 51.

[0045] Preferably, the power of the second heater 39 is lower than that of the first heater 38. Preferably, the power density of the second heater 39 is configured in such a way that the dispenser casing 10 is not subjected to overheating even if the second heater 39 is turned on for a long time or always turned on.

[0046] According to a preferred embodiment of the invention, the side of the longitudinal wall 30 which faces the heat insulating layer 6 is provided with a second heat conducting element 50, the upper end of which is connected to the first heater 38 and the second heater 39 or connected to the first heat conducting element40. Thereby, the first and second heaters 38 and 39 and/or the first heat conducting element 40 serve as a heat source for the second heat conducting element 50.

[0047] Since the second heat conducting element 50 is of a high heat conductivity, the heat generated by the

first and second heaters 38 and 39 is also transmitted to other portions of the longitudinal wall 30 that are not equipped with any heating element, such that the temperature of the whole longitudinal wall 30 can be increased so as to avoid the presence of condensate drops. Since the longitudinal wall 30 is located relatively distant from the ice transfer passage 29, such a configuration allows to avoid the presence of condensate drops on the longitudinal wall 30 without arranging any heater on the longitudinal wall 30 or merely by arranging a heater on the marginal region of the longitudinal wall 30 where is not easy to be touched by the user. Thus, energy consumption can be lowered. In addition, the situation that the user touches the high temperature region of the longitudinal wall 30 can be avoided.

[0048] Preferably, the second heat conducting element 50 comprises a metal foil of a high heat conductivity, such as aluminum foil. In a particularly preferable embodiment, the second heat conducting element 50 covers at least substantially most of the longitudinal wall 30. For example, the longitudinal wall 30 is entirely covered by the second heat conducting element 50. The second heat conduction element 50 is preferably adhered to the inner side of the longitudinal wall 30 by means of adhesive means, such as an adhesive tape.

[0049] In order to prevent the portions of the longitudinal wall 30 which are easy to be touched by the user from reaching a temperature which is greatly higher than ambient temperature, only an edge area of the second heat conducting element 50 contacts the first and second heater 38 and 39. Particularly preferably, the upper end of the second heat conducting element 50 contacts the first and second heater 38 and 39.

[0050] In the above embodiments, the first and second heater 38 and 39 extend to the upper end of longitudinal wall 30. However, the invention is not limited thereto. For example, in an alternative embodiment, the first and second heater 38 and 39 do not extend to the longitudinal wall 30; rather, the heat conducting element 50 may extend to a extend that is beyond the longitudinal wall 30 (such as extending to the inclined wall 26) so as to be contacted with the first and second heater 38 and 39 which lie outside the longitudinal wall 30.

[0051] The first longitudinal sidewall 48 of the freezing compartment door 3 is located adjacent to the rotation axis of the freezing compartment door 3, so that the second longitudinal sidewall 49 opposite to the first longitudinal sidewall 48 is located distant from the rotation axis of the freezing compartment door 3 and close to the door of the refrigerating compartment. According to a preferred embodiment of the invention, the freezing compartment door 3 is provided with a third heater 47 for supplying heat to the second longitudinal sidewall 49, so as to avoid the presence of condensate drops on the second longitudinal sidewall 49 due to the difference between surface temperature and the atmosphere temperature. In this embodiment, the third heater 47 is attached to the inner side of the second longitudinal sidewall 49.

[0052] The second longitudinal sidewall 49 is provided with a third heat conducting element 54 attached to the inner side thereof. The third heat conducting element 54 is located between the third heater 47 and the inner surface of the second longitudinal sidewall 49 to evenly transmit the heat generated by the third heater 47 to the second longitudinal sidewall 49. Preferably, the third heat conducting element 54 is attached to the inner surface of the second longitudinal sidewall 49 by adhesive means (for example, an adhesive tape).

[0053] It is most preferably to arrange the third heater 47 and/or the third heat conducting element 54 on a region of the second longitudinal sidewall 49 which is corresponded to the dispenser 8 in the longitudinal direction. Preferably, the third heater 47 at least partially overlaps the dispenser 8 in a transverse direction.

[0054] Figure 5 shows a structural schematic diagram of the refrigerator according to a preferred embodiment of the invention. Now a control method of the first heater 38 and the second heater 39 will be described with reference to Figure 5.

[0055] The refrigerator 1 comprises a control unit 41, and an input unit 43 and a display unit 44 coupled to the control unit 41 respectively, wherein the input unit 43 comprises the buttons or touch area 22 located on the control panel 20, and the display unit 44 comprises the display screen 21 located on the control panel 20. The control unit 41 comprises a microprocessor and a memory unit, such that some components of the refrigerator 1 such as the first heater 38 can be automatically controlled by means of a program stored in the memory unit.

[0056] The refrigerator 1 further comprises a sensing unit 42 for detecting at least one environmental parameter. The sensing unit 42 is coupled to the control unit 41 and feeds back the detected parameter to the control unit 41. In this embodiment, the sensing unit 42 comprises a temperature sensor for detecting ambient temperature. The sensing unit 42 controls the operation of the first heater 38, including turning on and turning off the first heater 38, based on the detected ambient temperature.

[0057] In a preferred embodiment, when the detected ambient temperature is lower than zero °C, the first heater 38 is turned off. When the detected ambient temperature is between 0 °C and 10 °C, the first heater 38 operates at a first output power and/or operates at a duty cycle of lower than 0.3. When the detected ambient temperature is between 10 °C and 15 °C, the first heater 38 is turned on at a second output power, or the first heater 38 is turned on and off in an alternative manner at a second duty cycle (for example, 0.4). When the detected ambient temperature is between 15 °C and 25 °C, the first heater 38 is turned on at a third output power and/or operates at a predetermined third duty cycle (for example, 0.5).

[0058] In an alternative embodiment, the sensing unit 42 further comprises a humidity sensor for detecting ambient relative humidity. The control unit 41 controls the operations of the first heater 38 based on the detected ambient temperature, ambient relative humidity and oth-

er factors.

[0059] The second heater 39 is controlled independently of the first heater 38. According to the invention, the second heater 39 is turned on only in an auxiliary heating mode, which is only manually initiated by the user. Thus, the user can, according to the dewing phenomenon on the refrigerator 1, make an active decision as to whether the second heater 39 should be actuated to increase heat for removing or preventing dewing.

[0060] In a preferred embodiment, the auxiliary heating mode is actuated by means of switching means 45 arranged on the freezing compartment door 3. The switching means 45 is preferably arranged on the dispenser 8 or near the dispenser 8. Particularly preferably, the switching means 45 is arranged on the partition plate 15.

[0061] In one embodiment, the switching means 45 is electrically connected to the second heater 39, and the turning on and off states of the second heater 39 is determined by the switching on and off states of the switching means 45. Preferably, when the switching means 45 is in the switching off state and the refrigerator 1 operates in a normal mode, the first heater 38 is turned on or off based on an instruction from the control unit 41, and the second heater 39 is turned off. When the user operates the switching means 45 to switch on it, the refrigerator 1 actuates the auxiliary heating mode, the second heater 39 is turned on to supply extra heat to the dispenser casing 10, and at the same time the first heater 38 is turned on or off based on an instruction from the control unit 41.

[0062] The switching means 45 can be provided independently of the control unit 41. For example, there is no coupling between the switching means 45 and the microprocessor of the control unit 41. In an alternative embodiment, the switching means 45 is connected to the control unit 41. For example, the display unit 44 can display whether the refrigerator 1 is under the normal heating mode or the auxiliary heating mode, or the user can select the parameters displayed on the display unit 44 by means of the switching means 45 in order to initiate the auxiliary heating mode.

[0063] . The second heater 39 can be turned off by manually switching off the switching means 45, so that the auxiliary heating mode is ended. In an alternative embodiment, the second heater 39 can also be automatically turned off. For example, the control unit 41 is configured in such a manner of automatically turning off the second heater 39 after the second heater 39 has been turned on for a predetermined time, such as 15 minutes. This can be achieved by virtue of timing means connected to the control unit 41. The timing means is configured in such a way that it generates a signal when the second heater 39 has been turned on for a predetermined time, and then the second heater 39 is turned off based on this signal. Under the condition that the switching means 45 is not coupled with the microprocessor of the control unit 41, this can be achieved by timing means connected to the switching means 45 or timing means embedded the switching means 45.

[0064] In an alternative embodiment, the second heater 39 is also automatically controlled by the control unit 41. For example, the second heater 39 is turned on only when ambient temperature is higher than a predetermined value (for example, 30 °C) and/ or ambient relative humidity is higher than a predetermined value (for example, 80%).

[0065] In the embodiment shown in Figure 5, the control manner of the third heater 47 is the same as that of the first heater 38, that is, being automatically controlled by the control unit 41 based on detected parameters. In a preferred embodiment, the parameter comprises ambient temperature, ambient relative humidity and/or the temperature of the sidewall 49, such that the control unit 41 can control the third heater 47 based on the ambient temperature, the ambient relative humidity and/or the temperature of the sidewall 49, so as to for example determine whether or not the third heater 47 should be turned on, or determine the frequency of turning on and off or the duty cycle of the third heater 47.

Claims

1. A refrigerator (1) comprising:

a refrigerator body (2) defining at least one storage space, the storage space (7) comprising a freezing compartment and a refrigerating compartment which are juxtaposed with each other;
a freezing compartment door (3) connected to the refrigerator body (2) for closing at least a part of the storage space, the freezing compartment door (3) comprising a heat insulating layer (6);
a dispenser (8) provided in the freezing compartment door (3), the dispenser (8) comprising a dispenser casing (10) which is adjacent to the heat insulating layer (6); and
a heater (38, 39) arranged at least adjacent to the inner side of the dispenser casing (10),
wherein the freezing compartment door (3) comprises a door panel (13) forming its front surface and an inner lining (23) facing towards the freezing compartment (7) when the freezing compartment door (3) is in its closed position, the door panel (13) is made of a sheet metal material, and both sides of the door panel (13) are bent backwardly and extend to form into first and second longitudinal sidewalls (48) and (49) respectively, the heat insulating layer (6) is in tight contact with the door panel (13) and the first and second longitudinal sidewalls (48) and (49), the door panel (13) has an opening (9) corresponding to the dispenser (8), which opening (9) having a substantially square or rectangular shape, the dispenser casing (10) is received between the door panel (13) and the inner lining (23), the

dispenser casing (10) forms a cavity (14) which is inwardly recessed and has a front open end, the shape and dimension of the front open end of the inner cavity (14) correspond to that of the opening (9) substantially, the inner lining (23) protrudes toward the freezing compartment (7) at the location corresponded to the dispenser casing (10), with a predetermined distance between the protruding portion of the inner lining (23) and the dispenser casing (10) for disposing the heat insulating layer (6),
wherein the refrigerator further comprises a heat conducting element (40, 50) which covers at least a part of the inner surface of the dispenser casing (10) which faces toward the heat insulating layer (6), and the heat conducting element (40, 50) is arranged at least adjacent to the heater (38, 39) for transmitting the heat generated by the heater (38, 39) to the dispenser casing (10).

2. The refrigerator (1) of claim 1, **characterized in that** the heat conducting element (40, 50) contacts the heater (38, 39).

3. The refrigerator (1) of claim 1 or 2, **characterized in that** the dispenser casing (10) defines a dispensing cavity (16) for receiving at least a part of an outside container, the dispensing cavity (16) comprises a dispensing cavity wall (30) extending in a longitudinal direction, and the heat conducting element (50) covers at least a major portion of the dispensing cavity wall (30).

4. The refrigerator (1) of any one of preceding claims, **characterized in that** only an edge area of the heat conducting element (50) contacts the heater (38, 39).

5. The refrigerator (1) of any one of preceding claims, **characterized in that** the upper end of the heat conducting element (50) contacts the heater (38, 39).

6. The refrigerator (1) of any one of preceding claims, **characterized in that** the heat conducting element (40, 50) comprises a metal foil having a high heat conductivity, the metal foil establishes face-to-face contacting with the dispenser casing (10).

7. The refrigerator (1) of any one of preceding claims, **characterized in that** the refrigerator comprises adhesive means for attaching the heat conducting element (40, 50) to the dispenser casing (10).

8. The refrigerator (1) e of any one of preceding claims, **characterized in that** the refrigerator comprises an ice transfer passage (29) extending through the door (3), the heater (38, 39) being arranged near the ice transfer passage (29).

9. The refrigerator (1) of any one of preceding claims, **characterized in that** the heater (38, 39) is connected to the dispenser casing (10).

10. The refrigerator (1) of any one of preceding claims, **characterized in that** the heater (38, 39) comprises a first heater (38) and a second heater (39) which are controlled independently from each other.

11. The refrigerator (1) of claim 1, **characterized in that** the dispenser casing (10) comprises a first area (51) and a second area (52) located located near the first area (51), the first area (51) and the second area (52) are arranged adjacent to the heat insulating layer (6), and the first and second heater (38, 39) are disposed in the first area (51) and the second area (52) respectively.

Patentansprüche

1. Kühlschrank (1), welcher umfasst:

ein Kühlschrankgehäuse (2), welches mindestens einen Speicherraum definiert, wobei der Speicherraum ein Gefrierfach (7) und ein Kühlfach umfasst, welche nebeneinander angeordnet sind;
eine Gefrierfachtür (3), die mit dem Kühlschrankgehäuse (2) verbunden ist, zum Schließen wenigstens eines Teils des Speicherraums, wobei die Gefrierfachtür (3) eine wärmeisolierende Schicht (6) umfasst;
einen Spender (8), der in der Gefrierfachtür (3) vorgesehen ist, wobei der Spender (8) ein Spendergehäuse (10) umfasst, welches der wärmeisolierenden Schicht (6) benachbart ist; und
eine Heizeinrichtung (38, 39), die wenigstens der Innenseite des Spendergehäuses (10) benachbart angeordnet ist,
wobei die Gefrierfachtür (3) eine Türplatte (13), die ihre Vorderfläche bildet, und eine Innenverkleidung (23), die dem Gefrierfach (7) zugewandt ist, wenn sich die Gefrierfachtür (3) in ihrer geschlossenen Position befindet, umfasst, die Türplatte (13) aus einem Blechmaterial hergestellt ist und beide Seiten der Türplatte (13) zurückgebogen sind und sich so erstrecken, dass sie die Form einer ersten bzw. zweiten Längsseitenwand (48) und (49) annehmen, die wärmeisolierende Schicht (6) sich in engem Kontakt mit der Türplatte (13) und der ersten und der zweiten Längsseitenwand (48) und (49) befindet, die Türplatte (13) eine Öffnung (9) aufweist, die dem Spender (8) entspricht, wobei diese Öffnung (9) eine im Wesentlichen quadratische oder rechteckige Form hat, das Spendergehäuse (10) zwischen der Türplatte (13) und

der Innenverkleidung (23) aufgenommen ist, das Spendergehäuse (10) einen Hohlraum (14) bildet, welcher nach innen vertieft ist und ein vorderes offenes Ende aufweist, die Form und die Abmessungen des vorderen offenen Endes des inneren Hohlraums (14) im Wesentlichen denjenigen der Öffnung (9) entsprechen, die Innenverkleidung (23) an der dem Spendergehäuse (10) entsprechenden Stelle zum Gefrierfach (7) hin vorsteht, mit einem vorbestimmten Abstand zwischen dem vorstehenden Abschnitt der Innenverkleidung (23) und dem Spendergehäuse (10) zum Anordnen der wärmeisolierenden Schicht (6),
wobei der Kühlschrank ferner ein wärmeleitendes Element (40, 50) umfasst, welches wenigstens einen Teil der Innenfläche des Spendergehäuses (10) bedeckt, welche der wärmeisolierenden Schicht (6) zugewandt ist, und das wärmeleitende Element (40, 50) wenigstens der Heizeinrichtung (38, 39) benachbart angeordnet ist, um die von der Heizeinrichtung (38, 39) erzeugte Wärme auf das Spendergehäuse (10) zu übertragen.

2. Kühlschrank (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** sich das wärmeleitende Element (40, 50) mit der Heizeinrichtung (38, 39) in Kontakt befindet.

3. Kühlschrank (1) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Spendergehäuse (10) einen Ausgabehohlraum (16) zur Aufnahme wenigstens eines Teils eines äußeren Behälters definiert, wobei der Ausgabehohlraum (16) eine Ausgabehohlraumwand (30) umfasst, die sich in einer Längsrichtung erstreckt, und das wärmeleitende Element (50) wenigstens den größten Teil der Ausgabehohlraumwand (30) bedeckt.

4. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich nur ein Randbereich des wärmeleitenden Elements (50) mit der Heizeinrichtung (38, 39) in Kontakt befindet.

5. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich das obere Ende des wärmeleitenden Elements (50) mit der Heizeinrichtung (38, 39) in Kontakt befindet.

6. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das wärmeleitende Element (40, 50) eine Metallfolie mit einer hohen Wärmeleitfähigkeit umfasst, wobei die Metallfolie einen Vorderseite-zu-Vorderseite-Kontakt mit dem Spendergehäuse (10) herstellt.

7. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Kühlschrank Klebemittel zum Befestigen des wärmeleitenden Elements (40, 50) an dem Spendergehäuse (10) umfasst.

8. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Kühlschrank einen Eisübergabekanal (29) umfasst, der sich durch die Tür (3) hindurch erstreckt, wobei die Heizeinrichtung (38, 39) in der Nähe des Eisübergabekanals (29) angeordnet ist.

9. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Heizeinrichtung (38, 39) mit dem Spendergehäuse (10) verbunden ist.

10. Kühlschrank (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Heizeinrichtung (38, 39) eine erste Heizeinrichtung (38) und eine zweite Heizeinrichtung (39) umfasst, welche unabhängig voneinander gesteuert werden.

11. Kühlschrank (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Spendergehäuse (10) einen ersten Bereich (51) und einen zweiten Bereich (52), der in der Nähe des ersten Bereiches (51) angeordnet ist, umfasst, wobei der erste Bereich (51) und der zweite Bereich (52) der wärmeisolierenden Schicht (6) benachbart angeordnet sind und die erste und die zweite Heizeinrichtung (38, 39) in dem ersten Bereich (51) bzw. dem zweiten Bereich (52) angeordnet sind.

Revendications

1. Réfrigérateur (1) comprenant :

un corps de réfrigérateur (2) définissant au moins un espace de stockage, l'espace de stockage comprenant un compartiment de congélation (7) et un compartiment de réfrigération juxtaposés ;
une porte de compartiment de congélation (3) reliée au corps de réfrigérateur (2) pour fermer au moins une partie de l'espace de stockage, la porte de compartiment de congélation (3) comprenant une couche d'isolation thermique (6) ;
un distributeur (8) prévu dans la porte de compartiment de congélation (3), le distributeur (8) comprenant un boitier de distributeur (10) adjacent à la couche d'isolation thermique (6) ; et
un corps de chauffe (38, 39) disposé au moins de manière adjacente au côté intérieur du boîtier de distributeur (10),
dans lequel la porte de compartiment de congé-

lation (3) comprend un panneau de porte (13) formant sa surface frontale et un revêtement intérieur (23) dirigé vers le compartiment de congélation (7) lorsque la porte de compartiment de congélation (3) se trouve en position fermée, le panneau de porte (13) est fait en un matériau tôlé et les deux côtés du panneau de porte (13) sont pliés vers l'arrière et s'étendent de sorte à former respectivement la première (48) et la deuxième (49) paroi latérale, la couche d'isolation thermique (6) est en contact étroit avec le panneau de porte (13) ainsi que la première (48) et la deuxième (49) paroi latérale, le panneau de porte (13) possède une ouverture (9) correspondant au distributeur (8), laquelle ouverture (9) présente une forme essentiellement carrée ou rectangulaire, le boîtier de distributeur (10) est logé entre le panneau de porte (13) et le revêtement intérieur (23), le boîtier de distributeur (10) forme une cavité (14) en renfoncement intérieur et possédant une extrémité frontale ouverte, la forme et la dimension de l'extrémité frontale ouverte de la cavité intérieure (14) correspond substantiellement à celle de l'ouverture (9), le revêtement interne (23) fait saillie vers le compartiment de congélation (7) à l'endroit correspondant au boîtier de distributeur (10), avec une distance prédéterminée entre la partie faisant saillie du revêtement intérieur (23) et le boîtier de distributeur (10) pour disposer la couche d'isolation thermique (6),
dans lequel le réfrigérateur comprend en outre un élément thermoconducteur (40, 50) qui couvre au moins une partie de la surface intérieure du boîtier de distributeur (10) dirigée vers la couche d'isolation thermique (6), et l'élément thermoconducteur (40, 50) est disposé au moins de manière adjacente au corps de chauffe (38, 39) pour transmettre la chaleur générée par le corps de chauffe (38, 39) au boîtier de distributeur (10).

2. Réfrigérateur (1) selon la revendication 1, **caractérisé en ce que** l'élément thermoconducteur (40, 50) est en contact avec le corps de chauffe (38, 39).

3. Réfrigérateur (1) selon la revendication 1 ou 2, **caractérisé en ce que** le boîtier de distributeur (10) définit une cavité de distribution (16) pour recevoir au moins une partie d'un conteneur externe, la cavité de distribution (16) comprenant une paroi de cavité de distribution (30) s'étendant dans une direction longitudinale et l'élément thermoconducteur (50) couvrant au moins une majeure partie de la paroi de cavité de distribution (30).

4. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**uniquement un bord de l'élément thermoconducteur (50) est en contact avec le corps de chauffe (38, 39).

5. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'extrémité supérieure de l'élément thermoconducteur (50) est en contact avec le corps de chauffe (38, 39).

6. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément thermoconducteur (40, 50) comprend une feuille de métal possédant une conductivité thermique élevée, la feuille de métal établissant un contact face à face avec le boîtier de distributeur (10).

7. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le réfrigérateur comprend des moyens adhésifs pour fixer l'élément thermoconducteur (40, 50) au boîtier de distributeur (10).

8. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le réfrigérateur comprend un passage pour le transfert de glace (29) s'étendant à travers la porte (3), le corps de chauffe (38, 39) étant disposé à proximité du passage pour le transfert de glace (29).

9. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le corps de chauffe (40, 50) est relié au boîtier de distributeur (10).

10. Réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le corps de chauffe (38, 39) comprend un premier corps de chauffe (38) et un deuxième corps de chauffe (39) commandés de manière indépendante.

11. Réfrigérateur (1) selon la revendication 1, **caractérisé en ce que** le boîtier de distributeur (10) comprend une première zone (51) et une deuxième zone (52) située à proximité de la première zone (51), la première zone (51) et la deuxième zone (52) étant disposées de manière adjacente à la couche d'isolation thermique (6) et le premier ainsi que le deuxième corps de chauffe (38, 39) étant respectivement disposés dans la première zone (51) et dans la deuxième zone (52).

Fig. 1

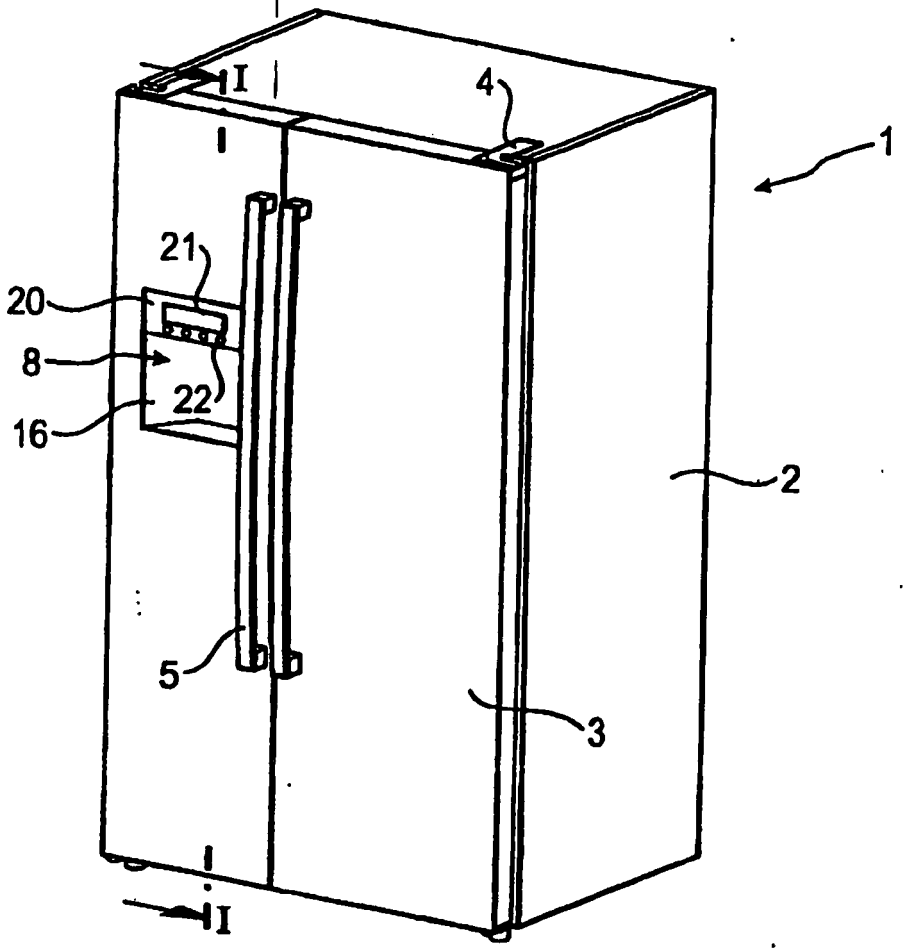


Fig. 2

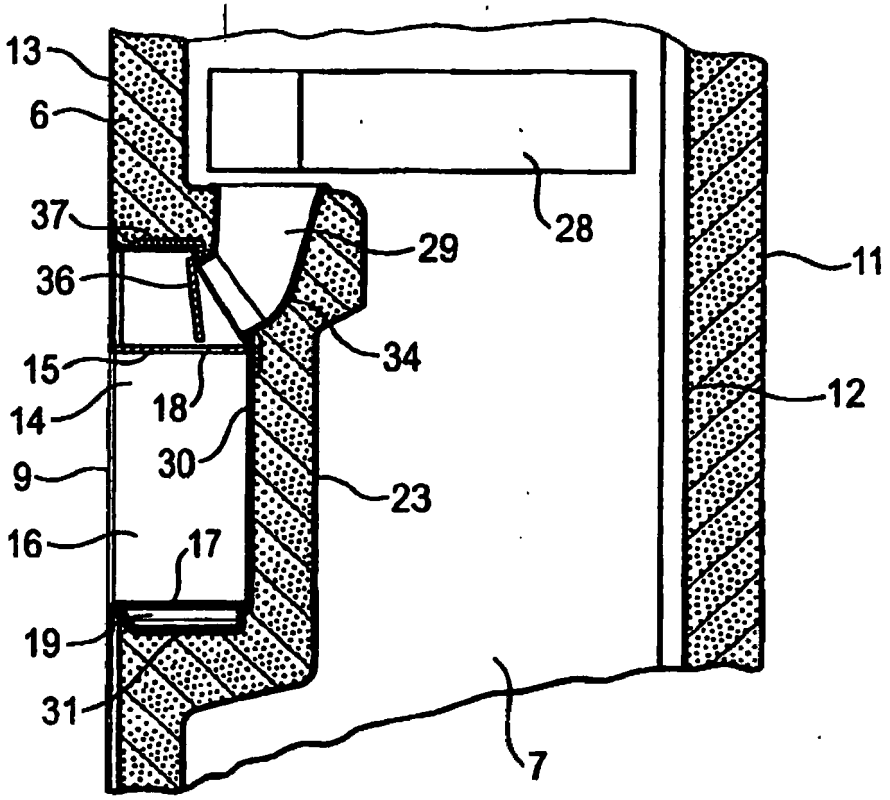


Fig. 3

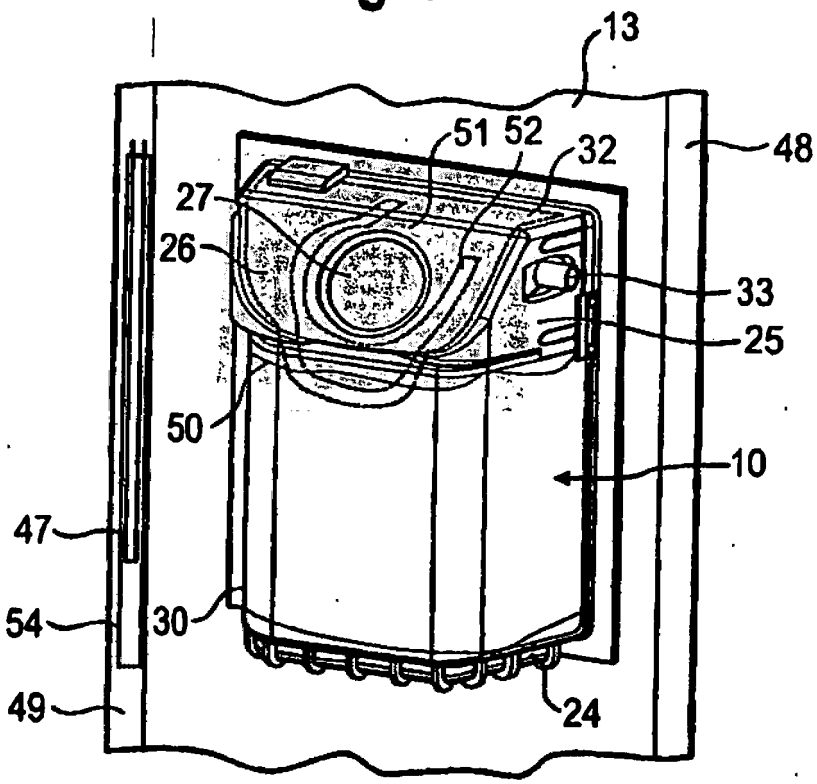


Fig. 4

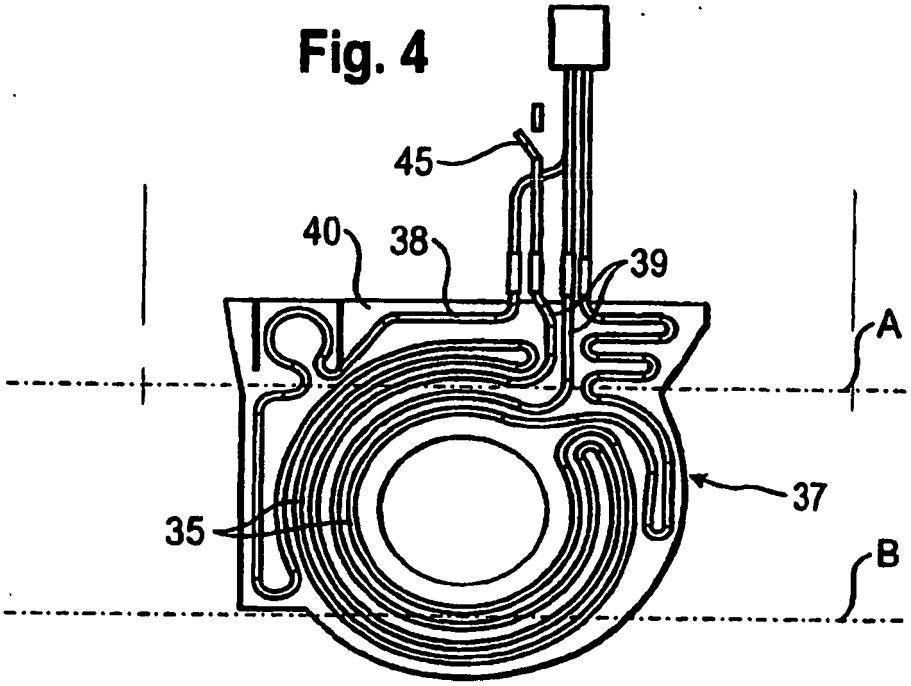
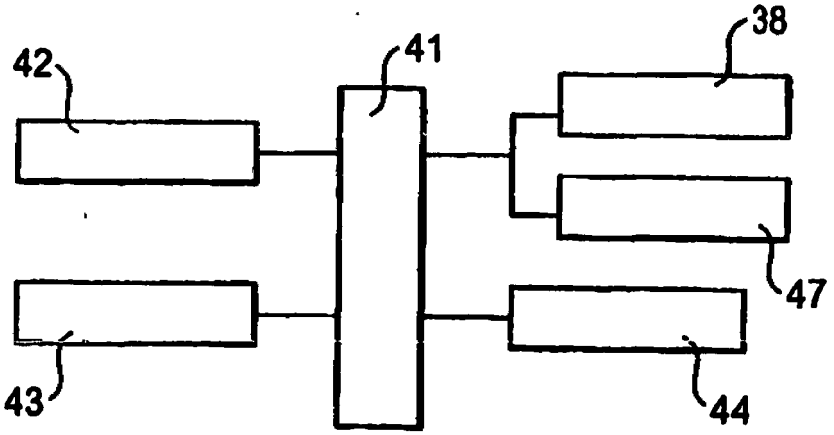


Fig. 5



REFERENCES CITED IN THE DESCRIPTION

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