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(54) Title: A FREEZER COMPRISING AN ICE MAKING UNIT AND THE CONTROL METHOD THEREOF

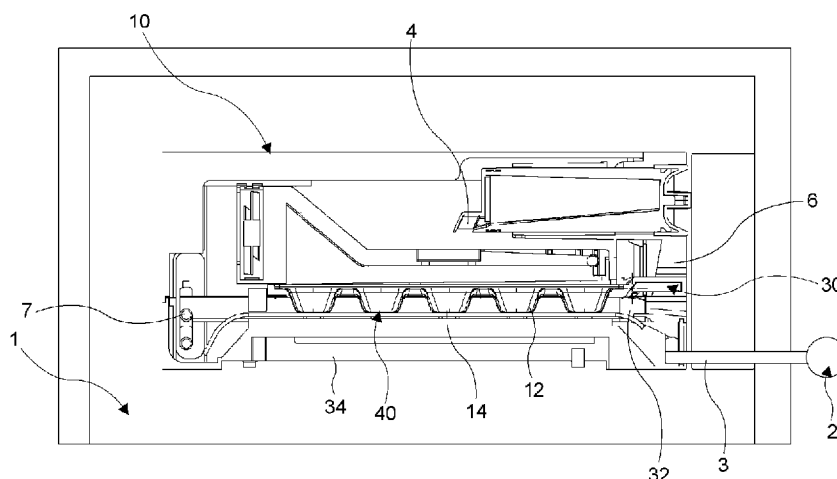


Figure 1

(57) Abstract: The present invention is a freezer comprising a thermally-insulated body (1) and an ice making unit (10) that is provided in the body (1) and that has an ice tray (12) that with a plurality of cavities (14), and a valve (6) that is selectively fluidly connected to the ice tray (12) so as to allow water to be delivered to the cavities (14) in a predetermined amount (ml) corresponding to a selected ice size (v1). The freezer comprises a control unit (20) that is configured to count a freezing time (t1) corresponding to the amount of water (ml) delivered to the ice tray (12) and a discharge means (30) that discharges the ice formed in the ice tray (12) into a storage container (34) after being activated with an end signal received from the control unit (20) at the end of the freezing time (t1).



Description**A FREEZER COMPRISING AN ICE MAKING UNIT AND THE CONTROL METHOD THEREOF**

- [0001] The present invention relates to a freezer comprising an ice making unit and to the control method of various parameters in the freezer for automatically perform the ice making process.
- [0002] Ice cubes are obtained by keeping for a certain time and freezing the water delivered by means of a water delivery system into the compartments arranged in an ice tray that is disposed into the freezers or the freezing compartments in the refrigerators. The ice cubes are emptied from the ice tray and transferred as a whole or in fragments into an ice container in the freezing compartment or taken out of the freezer through a water dispenser.
- [0003] The Patent No. US6637217 discloses an ice making unit of a refrigerator and the operational method thereof. The refrigerator comprises an ice making vessel having a plurality of cavities separated by partitions; an ejector rotatably mounted at an upper side of the ice making vessel and that separates ice formed from the ice making vessel; a heater for facilitating the separation of the ice, and a control unit for controlling the ice making process. When a valve is energized, water is supplied to each cavity through a water supply tube. When the valve is opened, the opening time and a preset value are compared to each other. If it is determined that the opening time has reached a pre-set value, the valve is turned off. The pre-set value signifies a value set according to the size of ice by the user. The amount of water supply filled in the cavity differs depending on time take to supply water, and accordingly, a corresponding size of ice differs. The control unit compares a temperature value received from a temperature sensor mounted on the ice making vessel and a pre-set value. If the signal is beyond the pre-set value, the control unit recognizes that ice making has been completed and operates the heater, and a driving gear rotates the motor, thus the vessel so that the ice is discharged.
- [0004] The aim of the present invention is to shorten the ice making time in

freezers with an automatic ice making unit wherein ice in different sizes can be made.

- [0005] The present invention realized in order to attain the said aim is a freezer comprising a thermally-insulated body and an ice making unit that is provided in the body and that has an ice tray that with a plurality of cavities, and a valve that is selectively fluidly connected to the ice tray so as to allow water to be delivered to the cavities in a predetermined amount corresponding to a selected ice size. The preferred embodiment of the present invention comprises a control unit that is configured to count a freezing time corresponding to the amount of water delivered to the ice tray and a discharge means that discharges the ice formed in the ice tray into a storage container after being activated with an end signal received from the control unit at the end of the freezing time. By transferring the ice to the storage container after being kept by the control unit for the freezing time determined depending on the amount of the water, when less water is received to produce small ice cubes, the ice making process is completed without waiting for a standard freezing time required for full cavities. Thus, when the cavities is not full, the automatic ice making process time is shortened.
- [0006] The freezing time can be automatically selected from a memory module according to predetermined ice size values, for example, by means of a control panel or can be determined by the control unit depending on the supplied water data calculated based on the opening time of the valve or the like and the geometric shape of the cavities.
- [0007] A preferred embodiment comprises a display screen that is connected to the control unit in signal communication for selecting the ice size value and that has an ice size value input means providing that the control unit processes the selective connection of the valve depending on the selected ice size value. The display screen can be a LCD or similar display disposed on the body or can be a remote screen such as a smart phone screen or a connected TV screen in a network area. By inputting through the display screen, the user sends data to the control unit by selecting the ice size desired to be obtained with the ice making unit by making a

selection from the indicators such as small, medium, large, etc. or by manually inputting the ice volume value. The control unit calculates the amount of water to be taken according to the data received from the display screen and enables the determined amount of water to be delivered to the tray by opening/closing the valve for a long time or providing a steady flow.

- [0008] The display screen is provided with an alarm means that is activated with the end signal received from the control unit at the end of the freezing time. The alarm means can be a visual alert that is located on the display screen and that visually informs the user or a sound generator such as a speaker, etc. or a function element providing an audible alarm that is mounted to the display screen.
- [0009] The control unit comprises a memory module that is connected to the control unit in data communication, that stores the predetermined freezing time data for a predetermined ice size value and that provides the predetermined freezing time as the freezing time if the control unit matches the selected ice size value with the predetermined ice size value.
- [0010] The memory module can be in the form of an integrated circuit including a processor of the control unit or an additional hardware mounted to the circuit or can be the internal memory of a remote device such as a smart phone that is connected to the control unit in data communication. In this case, the user can install an appropriate control application on his/her smart phone and transmit to the control unit the predetermined freezing time corresponding to the ice size selected as a result of matching of a table determined according to the model of the freezer with the memory.
- [0011] A temperature sensor is provided on the ice tray so as to collect temperature data and transmits the collected temperature data to the control unit as electric signals. As an additional safety measure, if the temperature on the ice tray is above a safe value, for example -8 °C, after the time counted by the control unit has elapsed, the temperature sensor provides that the control unit counts a predetermined safety time and then generates the end signal upon deciding that the safe value has been reached after checking the temperature of the ice tray again.

- [0012] In a preferred embodiment, the body is connected to the water mains. This connection is realized by means of a water pipe that is delivered to the body so as to provide water connection to the valve and that is connected to the water mains from one end. The water pipe takes the drinking water received from the mains into the body and delivers the same to the ice tray through the valve.
- [0013] A preferred embodiment of the present invention is a control method for the above-mentioned appliance. The method comprises the operational steps of supplying the predetermined amount of water to the ice tray by opening/closing the valve; defining a freezing time according to the amount of water by the control unit; counting for the determined freezing time by the control unit and activating the discharge means to discharge the ice tray by generating an end signal. The freezing time defined according to the amount of water provides that the ice tray is discharged without waiting after the formation of ice.
- [0014] In a preferred embodiment of the present invention, the control unit determines the freezing time by calculating the freezing time of the water taken in the respective amount. The calculation is performed by taking into consideration parameters such as the flow rate of water, the opening time of the valve and the geometric shape of the tray.
- [0015] In a possible embodiment, the control unit selects a predetermined freezing time from the memory module according to a predetermined value of the amount of water. Thus, if one of the respective control buttons, where easily understandable sizes such small, medium, large or very large are shown by indicators in accordance with the calibration performed beforehand according to the sizes of the cavities of the ice tray, is pressed, the control unit performs the ice making process according to the amount of water received and freezing time values stored in the memory module according to the selected ice size.
- [0016] A freezer/cooling device realized in order to attain the aim of the present invention is illustrated in the attached figures, where:
- [0017] Figure 1 - is the sideways partial view of a domestic refrigerator comprising a representative embodiment of the ice making unit of the

present invention.

[0018] Figure 2 - is the front schematic view of the freezer comprising a display screen through which the ice making unit is controlled.

[0019] The elements illustrated in the figures are numbered as follows:

[0020] 1 Body

[0021] 2 Water source

[0022] 3 Water pipe

[0023] 4 Nozzle

[0024] 6 Valve

[0025] 7 Temperature sensor

[0026] 10 Ice making unit

[0027] 12 Ice tray

[0028] 14 Cavity

[0029] 20 Control unit

[0030] 22 Memory module

[0031] 24 Processor

[0032] 30 Discharge means

[0033] 32 Drive motor

[0034] 34 Storage container

[0035] 40 Display screen

[0036] 42 Alarm means

[0037] v1 Ice size value

[0038] m1 Water amount

[0039] t1 Freezing time

[0040] vset Predetermined ice size value

[0041] tset Predetermined freezing time

[0042] Figure 1 is the partial sideways view of a freezing compartment of a domestic refrigerator. A box-shaped ice making unit (10) is disposed into a thermally-insulated and cabinet-shaped body (1). The ice making unit (10) comprises a horizontal ice tray (12) wherein cavities (14), that form the cells shaping the ice cube, are arranged. The top of each cavity (14) is open and the cavity (14) has a form so as to allow the formation of a cube-shaped ice when filled. A storage container (34) in the form of a

open-top tray is horizontally disposed under the ice tray (12) in a slidably detachable manner.

- [0043] A water tube (3) that is connected to a water source (2) is passed along the rear side of the body (1) and coupled with a valve (6) from one end. The valve (6) can be opened/closed by solenoid control. When the valve (6) is opened, the water reaches a nozzle (4) under the pressure of the mains, and the water poured by means of a distributor therefrom is guided towards the upper side of the ice tray (12) and fills the cavities (14). The water freezing in the ice tray (12) in the freezing compartment forms ice cubes. The ice cubes are taken out of the ice tray (12) by means of a discharge means (30). The discharge means (30) comprises a drive motor that is mounted to the short edge of the ice tray (12) from one end. The drive motor (32) turns the ice tray (12) upside down around the transverse axis, thus enabling the ice cubes to be transferred into the storage container (34) through the open mouth surface of the cavities (14).
- [0044] Figure 2 is the front schematic view of the refrigerator comprising the ice making unit (10). The ice making unit (10) is electrically connected to a control unit (20). The control unit (20) comprises a processor (24) on a PCB and a memory module (22) that is connected to the processor (24) in signal communication. The control unit (20) is mounted to the upper part of the body (1). A display screen (40) is mounted to the front surface of the body (1). The display screen (40) is in the form of a touch-sensitive LCD panel by which the user can input data or adjust settings.
- [0045] In the memory module (22), a predetermined amount of water (m1) for three different ice size value (v1), that is small, normal and large, is calculated by multiplying the opening time of the valve (6) by the flow rate of the mains since the mains pressure is more or less known. This time is recorded in the memory module (22) as 3 seconds for the small ice, 4 seconds for the normal ice and 5 seconds for the large ice from the ice size values (v1). In an alternative embodiment, in case water is taken by using a water flow rate measurement means, the predetermined amount of water (m1) value can be recorded in the memory module (22) in grams instead of seconds.

- [0046] In the memory module (22), a freezing time (t1) is recorded corresponding to the ice size value (v1). The freezing time (t1) corresponding to the ice size values (v1) recorded in the memory module (22) is 60 minutes for the small ice, 80 minutes for the normal ice and 100 minutes for the large ice.
- [0047] When the user selects the ice size type desired to be obtained by using the display screen (40), the control unit (20) receives the selected ice size value (v1) as input. The processor (24) of the control unit (20) receives the opening time of the valve (6) for the predetermined amount of water (m1) corresponding to the ice size value (v1) in the memory module (22) and opens the valve (6) as much as this time and fills the ice tray (12) through the nozzle (4). Thus, since the water mains pressure is known, the water in the determined amount (m1) is stored in the cavities (14). The control unit (20) selects the freezing time (t1) corresponding to the selected ice size value (v1) from the memory module (22). For example, when the ice size value (v1) selected for obtaining small ice reaches the control unit (20), the valve (6) is kept open for 3 seconds and water is taken into the ice tray (12). Then, the control unit (20) reads the freezing time (t1) as 60 minutes from the memory module (22) and counts as much as this time. Afterwards, the control unit (20) generates an end signal and activates the alarm means (42) of the display screen (40). The alarm means (42) is an alarm area activated on the display screen (40).
- [0048] With the end signal, the control unit (20) triggers the discharge means (30). The control unit (20) triggers a switch (not shown in the figures) that activates the drive motor (32). Thus, the drive motor (32) rotates and turns the ice tray (12) upside down. The formed ice cubes are transferred from the cavities (14) into the storage container (34). After a certain time, the control unit (20) rotates the ice tray (12) in the opposite direction for an equal time, thus shifting the ice tray (12) to the initial position.

Claims

1. A freezer **comprising** a thermally-insulated body (1) and an ice making unit (10) that is provided in the body (12) and that has an ice tray (12) with a plurality of cavities (14), and a valve (6) that is selectively fluidly connected to the ice tray (12) so as to allow water to be delivered to the cavities (14) in a predetermined amount (m1) corresponding to a selected ice size (v1), **characterized by** comprising a control unit (20) that is configured to count a freezing time (t1) corresponding to the amount of water (m1) delivered to the ice tray (12) and a discharge means (30) that discharges the ice formed in the ice tray (12) into a storage container (34) after being activated with an end signal received from the control unit (20) at the end of the freezing time (t1).
2. A freezer as in Claim 1, **characterized by** comprising a display screen (40) that is connected to the control unit (20) in signal communication for selecting the ice size value (v1) and that has an ice size value (v1) input means providing that the control unit (20) processes the selective connection of the valve (6) depending on the selected ice size value (v1).
3. A freezer as in Claim 2, **characterized by** comprising an alarm means (42) that is provided on the display screen (40) and that is activated with the end signal received from the control unit (20) at the end of the freezing time (t1).
4. A freezer as in any one of the above claims, **characterized by** comprising a memory module (22) that is connected to the control unit (20) in data communication, that stores the predetermined freezing time (tset) data for a predetermined ice size value (vset) and that provides the predetermined freezing time (tset) as the freezing time (t1) if the control unit (20) matches the selected ice size value (v1) with the predetermined ice size value (vset).
5. A freezer as in any one of the above claims, **characterized by** comprising a temperature sensor (7) that is provided on the ice tray (12) so as to collect temperature data and transmits the collected temperature data to the control unit (20) as electric signals.
6. A freezer as in any one of the above claims, **characterized by** comprising a water pipe (3) that is delivered to the body (1) so as to provide water connection to the valve (6) and that is connected to the water mains from one end.

7. A control method for a freezer as in any one of the above claims, **characterized by** comprising the operational steps of supplying the predetermined amount of water (m_1) to the ice tray (12) by opening/closing the valve (6); defining a freezing time (t_1) according to the amount of water (m_1) by the control unit (20); counting for the determined freezing time (t_1) by the control unit (20) and activating the discharge means (30) to discharge the ice tray (12) by generating an end signal.
8. A control method as in Claim 7, **characterized by** comprising the step of determining the freezing time (t_1) by the control unit (20) by calculating the freezing time of the amount of water (m_1) taken.
9. 9 - A control method as in Claim 7, **characterized by** comprising the step of selecting a predetermined freezing time (t_{set}) as the freezing time (t_1) from the memory module (22) by the control unit (20) according to a predetermined amount of water (m_1) value.

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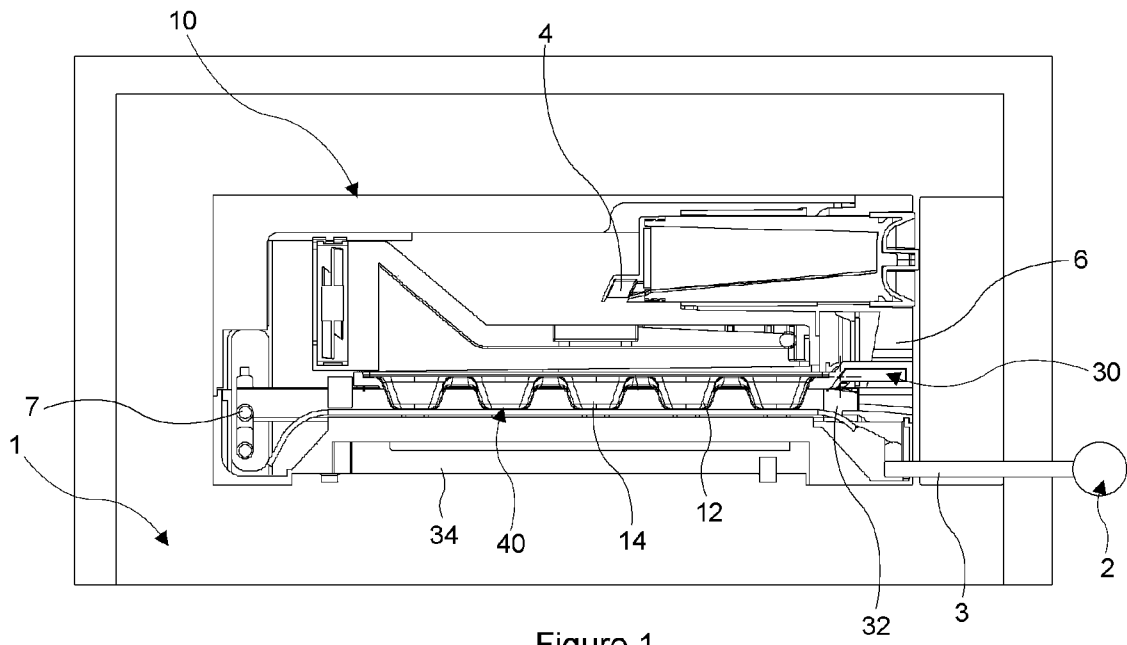


Figure 1

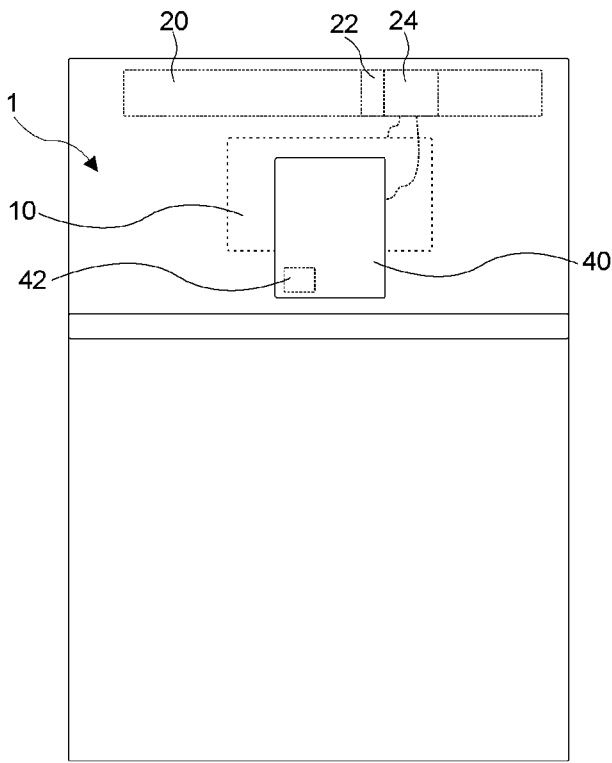


Figure 2

INTERNATIONAL SEARCH REPORT

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PCT/EP2017/061294

A. CLASSIFICATION OF SUBJECT MATTER
INV. F25C1/22 F25C1/04
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25C

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 653 171 A2 (WHIRLPOOL CO [US]) 3 May 2006 (2006-05-03)	1,4-9
Y	paragraph [0069] - paragraph [0074]; figures 1,2,8	2,3
Y	----- JP 2005 030759 A (SANYO ELECTRIC CO) 3 February 2005 (2005-02-03) abstract; figures 1,3,5	2,3
A	----- US 4 424 683 A (MANSON LARRY J [US]) 10 January 1984 (1984-01-10) the whole document	1
A	----- GB 2 383 119 A (LG ELECTRONICS INC [KR]) 18 June 2003 (2003-06-18) abstract; figure 3	2
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 787 216 A (CHESNUT PAUL B [US] ET AL) 29 November 1988 (1988-11-29) the whole document -----	2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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