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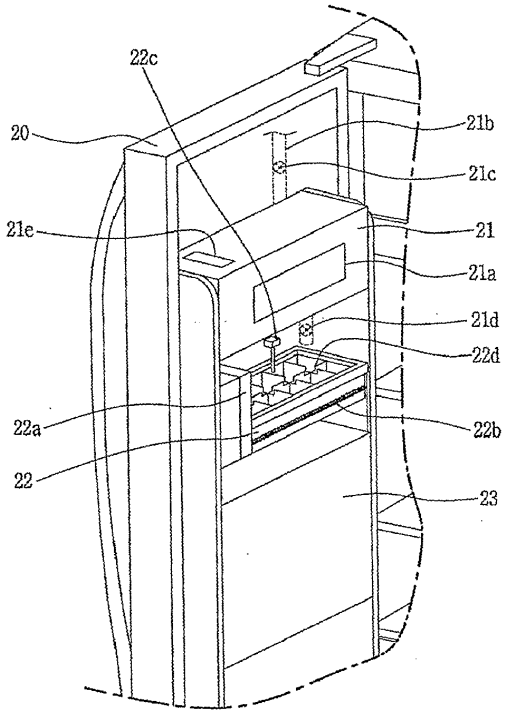
(54) ICE MAKER AND METHOD OF MAKING ICE

(57) The present invention discloses an ice maker including an ice tray (22) for containing water and making ice, and at least one energy generator (21a) disposed to supply energy to at least one of the water contained in the ice tray and the ice made in the ice tray, and a method of making ice.

[Fig. 4]



EP 3 029 398 A1

Description

Technical Field

[0001] The present invention relates to an ice maker and a method of making ice, and more particularly, to an ice maker and a method of making ice which can rapidly make slush or ice by using a supercooled liquid made by supplying energy such as an electric field, and easily separate the ice by converting the ice into a supercooled state by supplying energy.

Background Art

[0002] Supercooling means that a liquid such as water is not transited to a solid but maintained in a high temperature phase, namely, a liquid phase even below a phase transition temperature to the solid. Water drops can be supercooled in the natural state. In addition, water or beverages may be incidentally supercooled in a general refrigerator. A freezing method disclosed under Japan Laid-Open Patent Official Gazette S59-151834 and a freezing method and a refrigerator disclosed under Japan Laid-Open Patent Official Gazette 2001-086967 apply the supercooling principle to the refrigerator. An electric field or a magnetic field is applied to foods of the refrigerator, so that the foods can be maintained in a supercooled state below a phase transition temperature. An electrostatic field processing method disclosed under International Publication Official Gazette WO/98/41115 suggests various types of electrode structures that can be used to superoool and thaw foods.

[0003] Fig. 1 is a structure view illustrating a transparent ice maker disclosed under Korea Laid-Open Patent Official Gazette 2006-0013721. The transparent ice maker 100 includes a supercooling means 120 using blades 122. Thin plate ice is laminated by supplying supercooled water made by the supercooling means 120 to an ice making means 110 including an ice tray 111, an ice making chamber 112, a rotating shaft 114, ejectors 113 and a heater 117 at very small quantities, thereby making transparent ice. Here, heat is applied to the ice tray 111 by the heater 117 to separate the ice from the ice tray 111. The ice is slightly thawed to be easily separated from the ice tray 111. Thereafter, the ice is separated from the ice tray 111 by the ejectors 113 by rotating the rotating shaft 114.

[0004] The conventional ice maker supercools water by the mechanical method using the blades, and makes the thin plate ice by supplying the supercooled water at very small quantities. Therefore, the ice maker can not rapidly make the slush or ice.

[0005] In addition, the conventional ice maker uses only the heater to thaw the ice for easy ice separation. Accordingly, a temperature of the ice tray 111 must be increased to a phase transition temperature of water.

Disclosure of Invention

Technical Problem

[0006] An object of the present invention is to provide an ice maker and a method of making ice which use supercooling.

[0007] Another object of the present invention is to provide an ice maker and a method of making ice which can make slush or ice.

[0008] Yet another object of the present invention is to provide an ice maker and a method of making ice which can rapidly make slush or ice.

[0009] Yet another object of the present invention is to provide an ice maker and a method of making ice which can make slush or ice at need.

[0010] Yet another object of the present invention is to provide an ice maker and a method of making ice which can make a supercooled liquid by using energy such as an electric field or a magnetic field, and make slush or ice by using the supercooled liquid.

[0011] Yet another object of the present invention is to provide an ice maker and a method of making ice which can convert a supercooled liquid into a solid phase by applying an external force, and make slush or ice by using the resulting object.

[0012] Yet another object of the present invention is to provide an ice maker and a method of making ice which can rapidly separate ice by lowering a phase transition temperature by using a supercooling principle.

[0013] Yet another object of the present invention is to provide an ice maker and a method of making ice which can rapidly separate ice by supplying electric field type energy by electrodes and heat type energy by a heater.

Technical Solution

[0014] In order to achieve the above-described objects of the invention, there is provided an ice maker, including: an ice tray for containing water and making ice; and at least one energy generator disposed to supply energy to at least one of the water contained in the ice tray and the ice made in the ice tray. This configuration serves to make the ice from the supercooled water or rapidly separate the ice from the ice tray.

[0015] In another aspect of the present invention, the at least one energy generator is an energy generator for supplying energy in the form of at least one of an electric field and a magnetic field.

[0016] In another aspect of the present invention, the at least one energy generator includes an electrode for supplying electric energy.

[0017] In another aspect of the present invention, the ice maker includes a storing tank for supplying water to be contained in the ice tray, and the at least one energy generator is disposed to supply energy to the water in the storing tank.

[0018] In another aspect of the present invention, the

at least one energy generator is disposed to supply energy to the ice made in the ice tray.

[0019] In another aspect of the present invention, the ice maker includes a heater for supplying heat to the ice tray.

[0020] According to another aspect of the present invention, there is provided an ice maker, including: a tray for containing a supercooled liquid; and a phase converter for applying an external force to convert the supercooled liquid contained in the tray into a solid phase.

[0021] According to yet another aspect of the present invention, there is provided an ice maker, including: a storing tank for storing a supercooled liquid; a tray disposed to be supplied with the supercooled liquid of the storing tank; and a phase converter for applying an external force to the supercooled liquid contained in the tray. As compared with the case in that slush or ice is made by using water having a temperature over the freezing point, the ice or slush can be rapidly made by this configuration. Generally, the ice is frozen from the outer surface in the tray. If an ice making time is short, the inner portion of the ice may be maintained in a liquid state. In accordance with the present invention, after the supercooled liquid is converted into the slush by the phase converter, the ice can be made to solve the above problem. Here, the supercooled liquid is not necessarily water, and the final product is not necessarily ice (can be slush).

[0022] In another aspect of the present invention, the ice maker includes an energy generator for supplying energy to the supercooled liquid to maintain the supercooled state.

[0023] In another aspect of the present invention, the phase converter is an electric igniter.

[0024] In another aspect of the present invention, at least a part of the tray is made of a conductive material. It serves to facilitate heat transmission and efficiently transmit an external force of the phase converter.

[0025] In another aspect of the present invention, the tray is formed for the contained supercooled liquid so as to communicate with one another. By this configuration, the external force of the phase converter applied to a specific point can be transmitted to the whole supercooled liquid (or the whole supercooled liquid can be converted into the solid phase by freezing cores generated by the external force of the phase converter applied to the specific point.).

[0026] In another aspect of the present invention, the ice maker includes a bank disposed to contain a solid phase supercooled liquid dropped from the tray. Especially, this configuration can be applied to a structure of a general refrigerator including an ice maker.

[0027] In another aspect of the present invention, the ice maker includes a heater attached to the tray.

[0028] According to yet another aspect of the present invention, there is provided an ice maker, including: a storing tank for storing a supercooled liquid, the storing tank including an energy generator for supplying energy by using at least one of an electric field and a magnetic field to maintain the supercooled state; a tray disposed to be supplied with the supercooled liquid of the storing tank; and a bank disposed to contain a solid phase supercooled liquid dropped from the tray. By this configuration, the supercooled liquid can be made in the ice maker by using the energy generator, and the slush or ice can be rapidly made by using the supercooled liquid.

[0029] In another aspect of the present invention, the tray is formed for the contained supercooled liquid to communicate with one another.

[0030] According to yet another aspect of the present invention, there is provided a method of making ice, including: a first step for supplying a supercooled liquid to a tray; and a second step for applying an external force to the supercooled liquid supplied to the tray. The tray is not essentially divided into a plurality of sections. That is, the tray can be formed as one section. This configuration is preferable when slush is a final product of an ice maker.

[0031] In another aspect of the present invention, the method of making ice includes a third step for discharging a solid phase supercooled liquid to which the external force has been applied from the tray.

[0032] In another aspect of the present invention, the method of making ice includes a step for freezing the solid phase supercooled liquid to which the external force has been applied, prior to the third step.

[0033] In another aspect of the present invention, the method of making ice includes a step for applying heat to the tray prior to the third step.

[0034] In another aspect of the present invention, the method of making ice includes a step for supplying energy to the supercooled liquid to maintain the supercooled state, prior to the first step.

[0035] According to yet another aspect of the present invention, there is provided a method of making ice, including: a first step for supplying energy to a supercooled liquid to maintain a supercooled state; a second step for supplying the supercooled liquid to a tray; and a third step for freezing the supplied supercooled liquid.

[0036] In another aspect of the present invention, the method of making ice includes a fourth step for discharging the frozen supercooled liquid to a bank.

[0037] Here, slush means that the supercooled liquid has been converted into a solid phase by an external force. The liquid needs not to be water. Any kinds of liquids that can be supercooled or converted into the slush by external force can be used.

[0038] Energy can be supplied to the liquid or the supercooled liquid in the form of an electric field or a magnetic field. However, energy can be supplied in various types (for example, ultrasonic waves, magnetrons, etc.) so far as it maintains a liquid phase below a phase transition temperature of the liquid. It must be recognized that the present invention includes these types of energy.

[0039] According to yet another aspect of the present invention, there is provided an ice maker, including: a

tray having sections for containing ice; a heater for applying heat to the tray to easily separate the ice from the sections; and an energy generator for supplying energy to the ice side to lower the freezing point of the ice. Energy can be supplied to the tray or ice in the form of an electric field or a magnetic field. However, energy can be supplied in various types (for example, ultrasonic waves) so far as it lowers a phase transition temperature of an object. It must be recognized that the present invention includes these types of energy.

[0040] In another aspect of the present invention, the tray is made of a conductor.

[0041] In another aspect of the present invention, the ice maker includes an ice separator disposed at the sections side of the tray, for separating the ice from the sections.

[0042] In another aspect of the present invention, the energy generator is a unit for supplying energy by using an electric field.

[0043] According to yet another aspect of the present invention, there is provided a method of making ice, including: a first step for freezing ice in a tray; and a second step for applying energy to the ice side to lower the freezing point of the ice, and applying heat to the tray.

[0044] In another aspect of the present invention, the method of making ice includes a third step for separating the ice from the tray.

[0045] In another aspect of the present invention, in the second step, energy is generated by at least one of an electric field and a magnetic field.

Advantageous Effects

[0046] In accordance with the present invention, an ice maker and a method of making ice can make and separate the ice by using supercooling.

[0047] In accordance with the present invention, an ice maker and a method of making ice can make the slush or ice.

[0048] In accordance with the present invention, an ice maker and a method of making ice can rapidly make the slush or ice.

[0049] In accordance with the present invention, an ice maker and a method of making ice can make the slush or ice at need.

[0050] In accordance with the present invention, an ice maker and a method of making ice can make the supercooled liquid by using energy such as the electric field or the magnetic field, and make the slush or ice by using the supercooled liquid.

[0051] In accordance with the present invention, an ice maker and a method of making ice can convert the supercooled liquid into the solid phase by applying an external force, and make the slush or ice by using the resulting object.

[0052] In accordance with the present invention, an ice maker and a method of making ice can rapidly separate the ice by lowering the phase transition temperature by using the supercooling principle.

[0053] In accordance with the present invention, an ice maker and a method of making ice can rapidly separate the ice by supplying electric field type energy by the electrodes and heat type energy by the heater.

Brief Description of the Drawings

[0054]

Fig. 1 is a structure view illustrating a transparent ice maker disclosed under Korea Laid-Open Patent Official Gazette 2006-0013721;

Fig. 2 is a concept view illustrating slush making or supercooling in accordance with the present invention;

Fig. 3 is a graph showing one example of an experiment result in accordance with the present invention;

Fig. 4 is a structure view illustrating an ice maker in accordance with one embodiment of the present invention;

Fig. 5 is a block diagram illustrating a method of operating an ice maker in accordance with the present invention;

Fig. 6 is a graph showing another example of the experiment result in accordance with the present invention; and

Fig. 7 is a structure view illustrating an ice maker in accordance with another embodiment of the present invention.

Mode for the Invention

[0055] An ice maker and a method of making ice in accordance with the present invention will now be described in detail with reference to the accompanying drawings.

[0056] Fig. 2 is a concept view illustrating slush making or supercooling in accordance with the present invention. Referring to Fig. 2, a liquid 41 which is a supercooling object is disposed between electrodes 40. In a state where cool air 42 is supplied, an electric field is applied to the liquid 41 by using an AC power source 43. Therefore, the liquid 41 is not frozen but supercooled below its phase transition temperature (for example, water in 0°C under 1 atm pressure). It is know that supply of energy such as an electric field interrupts hydrogen bonding of water consisting of oxygen and hydrogen, and thus water is not frozen. When an external force is applied to the supercooled liquid by a phase converter 44, for example, when electric force is applied to the supercooled liquid by an electric igniter, the supercooled state maintained by the energy which is being applied to the supercooled liquid or the energy which has been applied to the supercooled liquid (it means that the supercooled state can be maintained although energy supply is interrupted after a predetermined time) is disturbed by the force. Accord-

ingly, freezing cores are formed, and the supercooled liquid is rapidly converted into a solid phase, thereby generating slush. Here, a temperature of the supercooled liquid is changed from a supercooled state temperature to a phase transition temperature.

[0057] The experiment result of the present invention will now be explained.

1. Installation of Electrodes and Container

[0058] Two electrodes having width and length of 100mm were installed at an interval of 200mm. A container containing 1L of water was positioned between the two electrodes at a predetermined interval.

2. Supercooling

[0059] The above apparatus was put in a refrigerator having a temperature of -6.8°C and an electric field of 40kHz and 2kV was applied thereto. As soon as the apparatus was put into the refrigerator, the electric field was applied to the apparatus. After sufficient superoooling, the supercooled liquid was converted into a solid phase by using an electric igniter for 1500V electric lighter. The result was shown in Fig. 6.

[0060] Fig. 3 is a graph showing one example of the experiment result, especially, correlation between the applied power and the temperature of the supercooled liquid. As shown in Fig. 3, the applied power and the temperature of the supercooled liquid show almost linear proportion. It means that, in the given ambient temperature, the set temperature of the supercooled liquid can be controlled by adjusting power applied from an energy generator.

[0061] Fig. 4 is a structure view illustrating an ice maker in accordance with one embodiment of the present invention. A water tank 21, a tray 22 and a bank 23 are installed in order on a freezing chamber door 20. The water tank 21 is necessary to make a supercooled liquid. Electrodes 21a for applying electric field type energy are installed as an energy generator. A passage 21b is connected to the water tank 21, for supplying water. A valve 21c controls water supply to the water tank 21, and a valve 21d controls supercooled water supply to the tray 22. A temperature sensor 21e is formed at one side of the water tank 21, for measuring a temperature of the supercooled water. The tray 22 is rotatably installed, and rotation of the tray 22 is controlled by a motor 22a. Preferably, the tray 22 is made of a conductive material such as aluminum. A heater 22b is formed at the lower portion of the tray 22 for ice separation. On the other hand, an electric igniter 22c is installed at one side of the tray 22 as a phase converter. The electric igniter 22c is disposed to apply an electric shock to the tray 22 or the supercooled water contained in the tray 22, thereby converting the supercooled liquid into a solid phase, namely, slush. The tray 22 is divided into a plurality of sections by partitions 22d. Grooves are formed on connecting units 22e to link the supercooled liquid together, or for the supercooled liquid so as to communicate with one another, so that the electric shock applied to a specific point can be transmitted to the whole supercooled water. A bank 23 is formed at the lower portion of the tray 22, for containing slush or ice supplied from the rotated tray 22.

[0062] Fig. 5 is a block diagram illustrating a method of operating the ice maker in accordance with the present invention. When the valve 21c is opened, water is supplied to the water tank 21. The supplied water is supercooled by cool air of a freezing chamber and electric field type energy generated by the electrodes 21a, and maintained below a phase transition temperature without phase transition. According to a command of the user or temperature measurement of the temperature sensor 21e, the valve 21d is opened to supply the supercooled water to the tray 22. The supercooled water is frozen without the operation of the electric igniter 22c, converted into slush by the operation of the electric igniter 22c and then frozen, or converted into slush by the operation of the electric igniter 22c. The tray 22 is rotated by the operation of the motor 22a, so that the slush or ice can be contained in the bank 23. As shown in

[0063] Fig. 1, the motor 22a serves to rotate ejectors (not shown). It is also possible to supply the ice to the bank 23 by the operation of the ejectors without rotating the tray 22. When the ice is supplied to the bank 23, the heater 22d is operated to separate the ice from the tray 22.

[0064] Fig. 7 is a structure view illustrating an ice maker in accordance with another embodiment of the present invention. The ice maker 50 includes a tray 51 and an ice separator 52 disposed at the upper portion of the tray 51. The tray 51 includes a plurality of sections 51 a. Ice 51 b is contained in each section 51 a. A heater 53 is installed at the lower portions of the plurality of sections 51 a. Electrodes 54 for supplying electric field type energy are formed at both sides of the tray 51. The ice separator 52 includes a rotating shaft 52a, ejectors 52b connected to the rotating shaft 52a, and a motor 52c for rotating the rotating shaft 52a. Preferably, the tray 51 is made of a material having high electricity and heat conductivity for heat transmission and electric field type energy transmission.

[0065] A method of making and separating ice in accordance with the present invention will now be described. When the ice 51 b is made by freezing water contained in the tray 51 in the freezing chamber, energy is applied to the ice side by the electrodes 54 to lower the phase transition temperature of water, and heat is applied to the ice side by the heater 53. As a result, the ice maker 50 can more rapidly separate the ice 51 b than the general ice maker. Thereafter, the ice 51 b is separated from the tray 51 by the ejectors 52b by driving the motor 52c.

[0066] Embodiments of the invention are set out in the following clauses:

Clause A. An ice maker, comprising: an ice tray for containing water and making ice; and at least one energy generator disposed to supply energy to at least one of the water contained in the ice tray and the ice made in the ice tray.

Clause B. The ice maker of clause A, wherein the at least one energy generator is an energy generator for supplying energy in the form of at least one of an electric field and a magnetic field.

Clause C. The ice maker of clause A, wherein the at least one energy generator comprises an electrode for supplying electric energy.

Clause D. The ice maker of clause A, comprising a storing tank for supplying water to be contained in the ice tray, wherein the at least one energy generator is disposed to supply energy to the water in the storing tank.

Clause E. The ice maker of clause A, wherein the at least one energy generator is disposed to supply energy to the ice made in the ice tray.

Clause F. The ice maker of clause A, comprising a heater for supplying heat to the ice tray.

Clause G. An ice maker, comprising: a tray for containing a supercooled liquid; and a phase converter for applying an external force to convert the supercooled liquid contained in the tray into a solid phase.

Clause H. An ice maker, comprising: a storing tank for storing a supercooled liquid; a tray disposed to be supplied with the supercooled liquid of the storing tank; and a phase converter for applying an external force to the supercooled liquid contained in the tray.

Clause I. The ice maker of clause H, comprising an energy generator for supplying energy to the supercooled liquid to maintain the supercooled state.

Clause J. The ice maker of clause H, wherein the phase converter is an electric igniter.

Clause K. The ice maker of clause H, wherein at least a part of the tray is made of a conductive material.

Clause L. The ice maker of clause H, wherein the tray is formed for the contained supercooled liquid so as to communicate with one another.

Clause M. The ice maker of clause H, comprising a bank disposed to contain a solid phase supercooled liquid dropped from the tray.

Clause N. The ice maker of clause H, comprising a heater attached to the tray.

Clause O. An ice maker, comprising: a storing tank for storing a supercooled liquid, the storing tank including an energy generator for supplying energy by using at least one of an electric field and a magnetic field to maintain the supercooled state; a tray disposed to be supplied with the supercooled liquid of the storing tank; and a bank disposed to contain a solid phase supercooled liquid dropped from the tray.

Clause P. The ice maker of clause O, wherein the tray is formed for the contained supercooled liquid so as to communicate with one another.

Clause Q. A method of making ice, comprising: a first step for supplying a supercooled liquid to a tray; and a second step for applying an external force to the supercooled liquid supplied to the tray.

Clause R. The method of clause Q, comprising a third step for discharging a solid phase supercooled liquid to which the external force has been applied from the tray.

Clause S. The method of clause R, comprising a step for freezing the solid phase supercooled liquid to which the external force has been applied, prior to the third step.

Clause T. The method of clause R, comprising a step for applying heat to the tray prior to the third step.

Clause U. The method of clause Q, comprising a step for supplying energy to the supercooled liquid to maintain the supercooled state, prior to the first step.

Clause V. A method of making ice, comprising: a first step for supplying energy to a supercooled liquid to maintain a supercooled state; a second step for supplying the supercooled liquid to a tray; and a third step for freezing the supplied supercooled liquid.

Clause W. The method of clause V, comprising a fourth step for discharging the frozen supercooled liquid to a bank.

Clause X. An ice maker, comprising: a tray having sections for containing ice; a heater for applying heat to the tray to easily separate the ice from the sections; and an energy generator for supplying energy to the ice side to lower the freezing point of the ice.

Clause Y. The ice maker of clause X, wherein the tray is made of a conductor.

Clause Z. The ice maker of clause X, comprising an ice separator disposed at the sections side of the tray, for separating the ice from the sections.

Clause AA. The ice maker of clause X, wherein the energy generator is a unit for supplying energy by using an electric field.

Clause AB. A method of making ice, comprising: a first step for freezing ice in a tray; and a second step for applying energy to the ice side to lower the freezing point of the ice, and applying heat to the tray.

Clause AC. The method of clause AB, comprising a third step for separating the ice from the tray.

Clause AD. The method of clause AB, wherein, in the second step, energy is generated by at least one of an electric field and a magnetic field.

Claims

1. An ice maker, comprising:

a storing tank (21) for storing a supercooled liquid;
a tray (22) disposed to be supplied with the supercooled liquid of the storing tank (21);
a phase converter (22c) for applying an external force to the supercooled liquid contained in the tray (22); and
an energy generator (21 a) for supplying energy to the supercooled liquid to maintain the supercooled state.

2. The ice maker of claim 1, wherein the phase converter (22c) is an electric igniter.

3. The ice maker of claim 1, wherein at least a part of the tray (22) is made of a conductive material.

4. The ice maker of claim 1, wherein the tray (22) is formed for the contained supercooled liquid so as to communicate with one another.

5. The ice maker of claim 1, comprising a bank (23) disposed to contain a solid phase supercooled liquid dropped from the tray (22).

6. The ice maker of claim 1, comprising a heater (22b) attached to the tray.

7. A method of making ice, comprising:

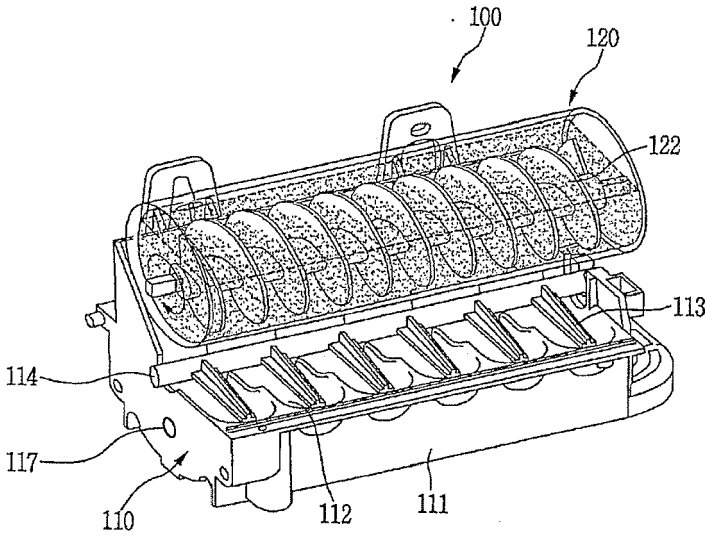
a step for supplying energy to the supercooled liquid to maintain the supercooled state;
a first step for supplying a supercooled liquid to a tray (22); and
a second step for applying an external force to the supercooled liquid supplied to the tray (22).

8. The method of claim 7, comprising a third step for discharging a solid phase supercooled liquid to which the external force has been applied from the tray (22).

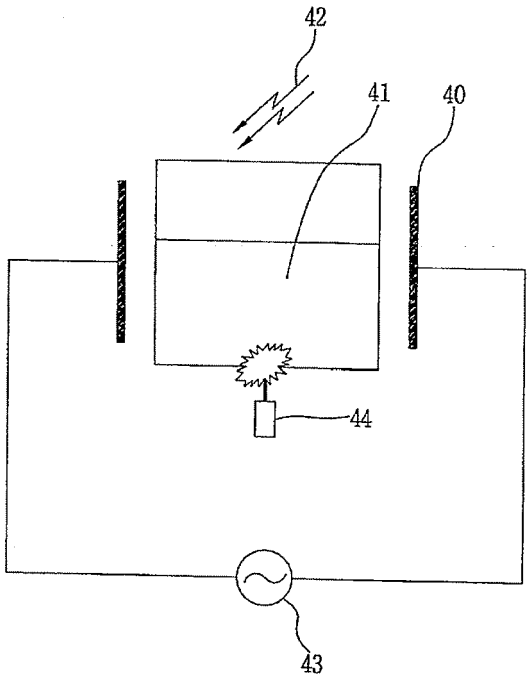
9. The method of claim 8, comprising a step for freezing the solid phase supercooled liquid to which the external force has been applied, prior to the third step.

10. The method of claim 8, comprising a step for applying heat to the tray (22) prior to the third step.

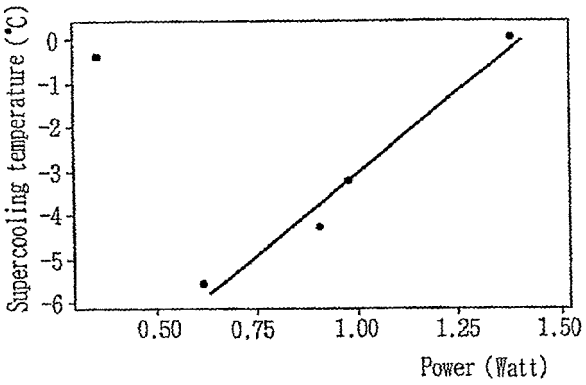
[Fig. 1]



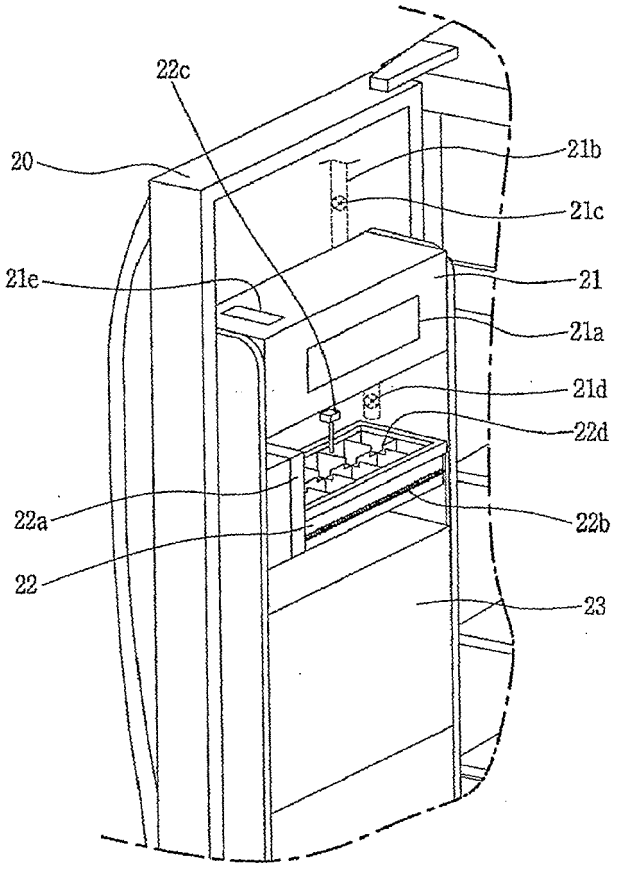
[Fig. 2]



[Fig. 3]


Supercooling temperature (℃)
0
-1
-2
-3
-4
-5
-6
0.50
0.75
1.00
1.25
1.50
Power (Watt)

[Fig. 4]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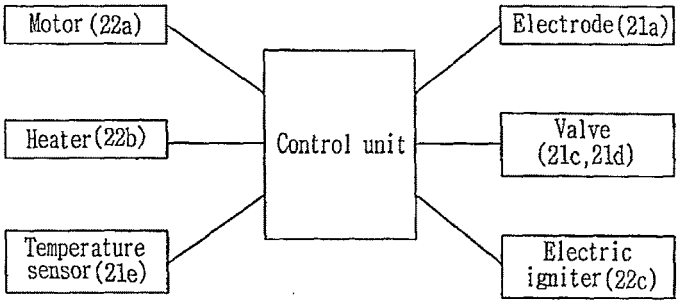
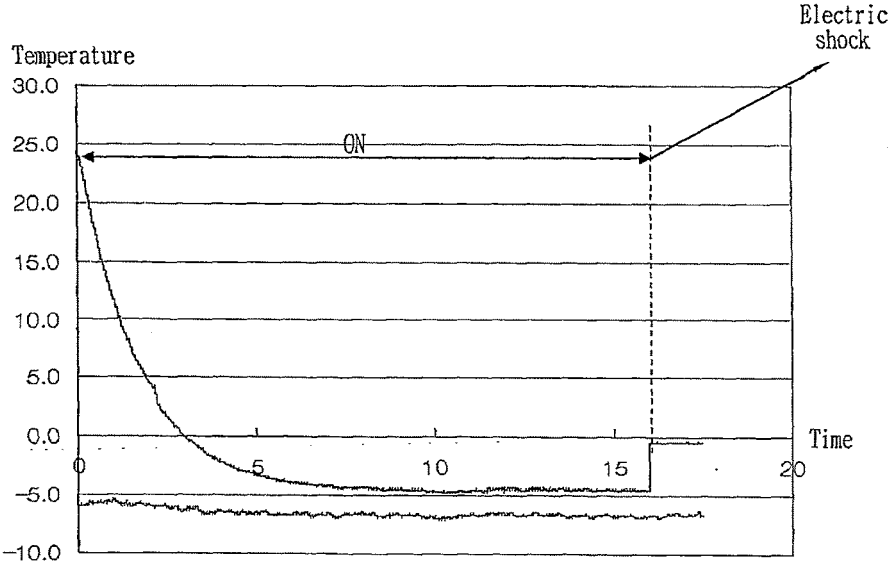
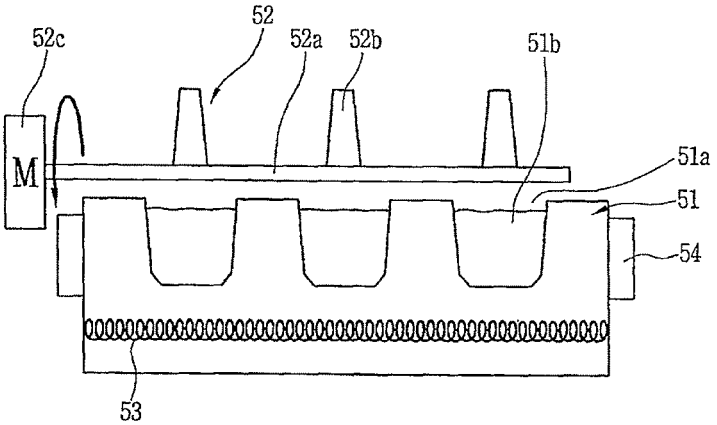
[Fig. 5]



[Fig. 6]



[Fig. 7]



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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 0838

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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F25D
F25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 April 2016	Dezso, Gabor

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