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CELL THAWER AND OPERATING METHOD THEREFOR

Abstract

A cell thawer is provided. The cell thawer comprises: a thawing part comprising a heating block, which includes a first heating block and a second heating block that form a heating space for heating a container storing a predetermined amount of a biological material including cells, a heater, which is provided in the heating block so that the heating block can be provided with heat, an insulating block, which is coupled to the heating block so as to encompass the heater, and a support, which is for supporting the lower portion of the container in the heating space; a driving part for providing driving force that linearly moves each of the first heating block and the second heating block in the left and right directions; and a control part for controlling the operations of the thawing part and the driving part.

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Background/Summary

CROSS REFERENCE TO THE RELATED APPLICATIONS [0001] This application is the national phase entry of International Application No. PCT/KR2022/008715, filed on Jun. 20, 2022, which is based upon and claims priority to Korean Patent Application No. 10-2021-0082930 filed on Jun. 25, 2021, 10-2021-0098642 filed on Jul. 27, 2021 and 10-2021-0151330 filed on Nov. 5, 2021, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD
[0002] The present invention relates to a cell thawer and an operating method therefor.
BACKGROUND
[0003] In general, various biological materials are stored at low temperature after being stored in containers such as vials. For example, plasma and tissue cells are stored at a maximum of −100 degrees Celsius, and stem cells are stored at cryogenic temperatures of up to −165 degrees Celsius by using gaseous liquid nitrogen.
[0004] These biological materials are tested at a temperature higher than the storage temperature of the aforementioned low-temperature state. Accordingly, a thawing process is required to test the biological material.
[0005] To this end, a cell thawer has been proposed for thawing a biological material in a low-temperature state by heating a container such as a vial in which the biological material is stored.
[0006] However, conventional cell thawers adopt a method of transferring heat while a heating block and a container are in contact with each other. Accordingly, the conventional cell thawers have a problem in that it is difficult to uniformly heat the container as a whole, and since the high-temperature heating block directly contacts the container, there is a problem in that the container is cracked or deformed by the high temperature.
[0007] In addition, the conventional cell thawers have been operated in the manner of simply displaying whether the heating block is operating normally through an indicator such as an LED.
[0008] Accordingly, the conventional cell thawers have a problem in that the operating temperature of the heating block cannot be easily measured during qualification evaluation to determine whether the heating block operates correctly.
SUMMARY
[0009] The present invention has been devised in view of the above, and an object of the present invention is to provide a cell thawer which is capable of uniformly heating a container including a biological material in the heating process while ensuring stability against heat.
[0010] In addition, another object of the present invention is to provide a cell thawer which capable of increasing the efficiency of energy usage.
[0011] Moreover, still another object of the present invention is to provide a cell thawer which is

capable of conveniently measuring the operating temperature of a heating block during qualification evaluation.

[0012] In order to solve the above-described problems, the present invention provides a cell thawer, including a thawing part including a heating block which includes a first heating block and a second heating block that form a heating space for heating a container storing a predetermined amount of a biological material including cells, a heater which is installed in the heating block to provide heat to the heating block, a heat insulating block which is coupled to the heating block so as to encompass the heater, and a pedestal which is for supporting a lower portion of the container in the heating space; a driving part for providing a driving force that linearly moves each of the first heating block and the second heating block in the left and right directions; and a control part for controlling the operations of the thawing part and the driving part.

[0013] In addition, the present invention provides a method for operating a cell thawer including a first heating block and a second heating block that form a heating space for accommodating a container storing a predetermined amount of a biological material including cells through linear movement by a driving force of a motor, and heating the container accommodated in the heating space through heat provided from a heater, the method including a first step of preheating the first heating block and the second heating block to a predetermined temperature by driving the heater while one surface of the first heating block and one surface of the second heating block facing each other are in contact with each other; a second step of heating the container which is placed in the heating space so as to thaw the biological material while the first heating block and the second heating block are changed to a heating position forming the heating space; and a third step of changing the first heating block and the second heating block to a standby position by moving the same away from the heating position such that the container placed in the heating space can be removed, wherein in the second step, the container placed in the heating space is heated by heat transferred from the first heating block and the second heating block in a non-contact manner while not contacting the first heating block and the second heating block.

[0014] According to the present invention, the container can be uniformly heated by heating the container in a non-contact heating manner by using radiant heat, and it is possible to prevent cracks or thermal deformation of the container that may occur when the container is heated by conductive heat.

[0015] In addition, according to the present invention, since the temperature of the heating block can be maintained to be constant, a plurality of containers can be sequentially thawed. Through this, the present invention can improve energy consumption efficiency because it is possible to thaw a plurality of containers while reducing the reuse waiting time for thawing the containers.

[0016] Furthermore, according to the present invention, when the upper cover is separated, the sensor insertion hole for qualification evaluation is exposed to the outside such that qualification evaluation can be easily performed.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. **1** is a view showing a cell thawer according to one embodiment of the present invention;

[0018] FIG. **2** is a view of FIG. **1** viewed from another direction;

[0019] FIG. **3** is a view in which the housing is separated from FIG. **1**;

[0020] FIG. **4** is a view showing the cell thawer according to the first embodiment of the present invention, showing a state in which the housing and circuit board are removed from FIG. **3**;

[0021] FIG. **5** is a view of FIG. **4** viewed from another direction;

[0022] FIG. **6** is a view in which the thawing part is separated from FIG. **4**:

[0023] FIG. **7** is a view in which the thawing part is extracted and separated from FIG. **6**;
[0024] FIG. **8** is a view taken from the driving part in FIG. **6**;
[0025] FIG. **9** is an enlarged view of a part of FIG. **5**, in which portions of the first heating block and the second heating block are cut in a standby position;
[0026] FIG. **10** is a view showing a portion of the cell thawer according to the first embodiment of the present invention in a state where the heating block is disposed at a heating position;
[0027] FIG. **11** is a view showing the arrangement relationship of sensors and heating blocks corresponding to the state of FIG. **10**, showing a state in which the first heating block, the first heat insulating block and the first guide block are removed;
[0028] FIG. **12** is an operating state diagram of the cell thawer according to the first embodiment of the present invention, and is a partial cross-sectional view of the standby position when initially driven, viewed from the A-A direction in FIG. **10**;
[0029] FIG. **13** is an operating state diagram showing a state in which the heating block is preheated in the cell thawer according to the first embodiment of the present invention, and is a partial cross-sectional view as viewed from the A-A direction of FIG. **10**;
[0030] FIG. **14** is an operating state diagram showing the process of loading a container into the cell thawer according to the first embodiment of the present invention, and is a partial cross-sectional view viewed from the direction A-A of FIG. **10**;
[0031] FIG. **15** is an operating state diagram of the cell thawer according to the first embodiment of the present invention, and is a partial cross-sectional view of a state in which the container is heated in a heating position, as viewed from the A-A direction in FIG. **10**;
[0032] FIG. **16** is an operating state diagram of the cell thawer according to the first embodiment of the present invention, and is a partial cross-sectional view of the process of removing the container from the standby position, as viewed from the A-A direction of FIG. **10**;
[0033] FIG. **17** is a view showing a cell thawer according to the second embodiment of the present invention, showing a state in which the top cover is separated from the state in which the cover is removed in FIG. **1**;
[0034] FIG. **18** is a cross-sectional view taken in the B-B direction of FIG. **17**, extracting the thawing part;
[0035] FIG. **19** is a view showing the cell thawer according to the second embodiment of the present invention, showing a state in which the housing and circuit board are removed from FIG. **3**;
[0036] FIG. **20** is a view of FIG. **19** viewed from another direction;
[0037] FIG. **21** is a view in which the thawing part is separated from FIG. **19**;
[0038] FIG. **22** is a view in which the thawing part is extracted and separated in FIG. **21**;
[0039] FIG. **23** is a view in which the driving part is extracted in FIG. **21**;
[0040] FIG. **24** is an enlarged view of a portion of FIG. **20**, in which portions of the first heating block and the second heating block are cut in a standby position;
[0041] FIG. **25** is a view showing a portion of the cell thawer according to the second embodiment of the present invention in a state where the heating block is disposed at the heating position;
[0042] FIG. **26** is a view showing the arrangement relationship of sensors and heating blocks corresponding to the state of FIG. **25**, showing a state in which the first heating block, the first heat insulating block and the first guide block are removed;
[0043] FIG. **27** is an operating state diagram of the cell thawer according to the second embodiment of the present invention, and is a partial cross-sectional view of the standby position when initially driven, viewed from the C-C direction in FIG. **25**;
[0044] FIG. **28** is an operating state diagram showing a state in which the heating block is preheated in the cell thawer according to the second embodiment of the present invention, and is a partial cross-sectional view viewed from the C-C direction of FIG. **25**;
[0045] FIG. **29** is an operating state diagram showing the process of loading a container into the cell thawer according to the second embodiment of the present invention, and is a partial cross-

sectional view viewed from the C-C direction of FIG. **25**;

[0046] FIG. **30** is an operating state diagram of the cell thawer according to the second embodiment of the present invention, and is a partial cross-sectional view of the state in which the container is heated in the heating position, as viewed from the C-C direction in FIG. **25**;

[0047] FIG. **31** is an operating state diagram of the cell thawer according to the second embodiment of the present invention, and is a partial cross-sectional view of the process of taking out the container from a standby position, as viewed from the C-C direction in FIG. **25**; and

[0048] FIG. **32** is a block diagram showing the method for operating a cell thawer according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0049] Hereinafter, with reference to the accompanying drawings, the exemplary embodiments of the present invention will be described in detail so that those skilled in the art can easily practice the present invention. The present invention may be embodied in many different forms and is not limited to the exemplary embodiments set forth herein. In order to clearly describe the present invention in the drawings, parts that are irrelevant to the description are omitted, and the same reference numerals are assigned to the same or similar components throughout the specification.

[0050] The cell thawers **100**, **200** according to one embodiment of the present invention may heat and thaw a biological material in a low-temperature state (e.g., frozen state) contained in the container **10**.

[0051] Herein, the biological material may include cells, which are the structural basic unit of an organism, and the container **10** may be a known laboratory container or medical container such as a vial, a beaker or a test tube.

[0052] In addition, as illustrated in FIG. **1**, the container **10** may include a container body **12** in which the biological material is accommodated and a cap part **14** which covers an open top portion of the container body **12**, and approximately 6 mL or 10 mL of a biological material may be contained in the container body **12**. However, the shape of the container **10** and the capacity of the biological material contained in the container body **12** are not limited thereto. and may be changed into various shapes depending on design conditions.

[0053] In this case, the cell thawers **100**, **200** according to one embodiment of the present invention heats the container **10** uniformly as a whole by heating the container **10** in a non-contact heating manner through radiant heat and/or convection heat, and it is possible to prevent cracks or thermal deformation of the container **10** that may occur during contact heating by conductive heat in advance.

[0054] To this end, as illustrated in FIGS. **1** to **6** and **17** to **21**, the cell thawers **100**, **200** according to one embodiment of the present invention includes a housing **110**, a thawing part **120**, a driving part **130** and a control part **150**.

[0055] As illustrated in FIGS. **1** to **3**, the housing **110** may form an outer surface of the cell thawers **100**, **200**, and it may be formed in a box shape such that the thawing part **120**, the driving part **130** and the control part **150** may be placed therein.

[0056] The housing **110** may be composed of one member or may be composed of a plurality of members, and the plurality of members may be detachably coupled.

[0057] For example, as illustrated in FIG. **3**, the housing **110** may include a box-shaped main body **111**, a lower cover **112** for covering an open lower portion of the main body **111**, a rear cover **113** for covering an open rear surface of the main body **111**, and an upper cover **114** for covering the top of the main body **111**.

[0058] In this case, the thawing part **120**, the driving part **130** and the control part **150** may be disposed inside the main body **111**.

[0059] In this case, the housing **110** may include an inlet **115** which is formed to penetrate a predetermined area such that the container **10** can be inserted into the body **111**, and the inlet **115** may be covered through a cover **116**.

[0060] Herein, the inlet **115** may be formed to penetrate the housing **110** so as to be located at a position corresponding to a heating space **121** to be described below.
[0061] For example, the inlet **115** may be formed to penetrate the upper cover **114** so as to communicate with a heating space **121** formed in the thawing part **120** at a heating position to be described below. Through this, when the container **10** is inserted into the inlet **115**, the cap part **14** of the container **10** may be exposed to the outside through the inlet **115**, and the remaining part except for the cap part **14** may be inserted into the side of the heating space **121**.
[0062] In addition, as illustrated in FIG. **1**, a manipulation part **117** for manipulating the operation of the cell thawer **100**, **200** according to one embodiment of the present invention, and a display **118** for displaying the operating state of the cell thawers **100**, **200** may be provided on one side of the housing **110**.
[0063] Such a manipulation part **117** may be an interface for transmitting an input signal to the control part **150** through user manipulation.
[0064] Herein, the manipulation part **117** may be configured with a known press-type physical button or capacitive touch button.
[0065] In addition, the manipulation part **117** may be provided separately from the display **118**, or may be provided in an integrated form with the display **118**.
[0066] Moreover, the display **118** may output information on the overall operating state of the cell thawers **100**, **200** operated through the control part **150** (e.g., the temperature of the heating blocks **122***a*, **122***b*, and the surface temperature of the container **10**, the operation status such as thawing and completion of thawing, and thawing progress time), date and time at the time of thawing, an error message such as sensor or heater failure, which will be described below, and the like.
[0067] Through this, the user may transmit input signals, such as the operation and stop of the cell thawers **100**, **200**, thawing temperature adjustment, thawing time adjustment and the like, to the control part **150** through the manipulation of the manipulation part **117**, and the display **118** may output information on the overall state of the cell thawers **100**, **200** through the control part **150**.
[0068] Moreover, as illustrated in FIG. **2**, the cell thawers **100**, **200** may include at least one communication port **119** provided to be exposed to the outside from one side of the housing **110**, and the communication port **119** may be electrically connected to the control part **150**.
[0069] For example, the communication port **119** may include a LAN port **119***a* for communication with communication device such as an external network device or a PC, and a USB port **119***b* for inputting or outputting data, and the communication port **119** may be mounted on the rear cover **113** so as to be electrically connected to the control part **150**.
[0070] In this case, when the cell thawers **100**, **200** according to one embodiment of the present invention is connected to the external network device or communication device such as a PC through the communication port **119**, the control part **150** may be time-synchronized with communication device such as the external network device or PC.
[0071] For example, when the cell thawers **100**, **200** are connected to a PC such as a laptop computer, the cell thawers **100**, **200** may be synchronized with the date and time of the PC by using a synchronization program installed in the PC.
[0072] Through this, the cell thawers **100**, **200** according to one embodiment of the present invention may be synchronized with the local time of a region where thawing is performed when in use, and the local time of the region may be output through the display **118**.
[0073] As a result, the cell thawers **100**, **200** according to one embodiment of the present invention may store history information about the exact time of thawing of the biological material contained in the container **10**, and the user may confirm the exact thawing time of the biological material contained in the container **10** though the history information.
[0074] Moreover, information related to thawing may be stored in the cell thawer **100**, **200** itself or may be stored in a synchronization program of a communication device that is connected through the communication port **119**.

[0075] In this case, although the information related to thawing stored in the cell thawers **100**, **200** or the synchronization program may be stored by date, a thawing history may be stored for each thawing case, and the thawing history may include the local time of a region where the thawing is performed.

[0076] The thawing part **120** may heat the container **10** in a state where the container **10** introduced into the housing **110** through the inlet **115** is accommodated in the heating space **121**.

[0077] To this end, as illustrated in FIGS. **4** to **7** and **19** to **22**, the thawing part **120** may include heating blocks **122***a*, **122***b* for forming a heating space **121** for accommodating and heating the container **10**, heaters **123***a*, **123***b* which are installed in the heating blocks **122***a*, **122***b* to provide heat to the heating blocks **122***a*, **122***b*, heat insulating blocks **124***a*, **124***b* which are coupled to the heating blocks **122***a*, **122***b* so as to surround the heaters **123***a*, **123***b*, and a pedestal **125** for supporting a lower portion of the container **10** in the heating space **121**.

[0078] Accordingly, when the container **10** is introduced into the housing **110** through the inlet **115**, the lower portion of the container **10** may be supported through the pedestal **125**, and the container **10** may be surrounded by the heating blocks **122***a*, **122***b* while being accommodated in the heating space **121** (refer to FIGS. **15** and **30**).

[0079] In this case, as illustrated in FIGS. **7** and **22**, the heating blocks **122***a*, **122***b* may include arrangement grooves **126***a*, **126***b* that are formed to be drawn inwardly on one surface, and the heaters **123***a*, **123***b* may be inserted into the arrangement grooves **126***a*, **126***b*, and the heat insulating blocks **124***a*, **124***b* may be coupled to the heating blocks **122***a*, **122***b* so as to completely cover the arrangement grooves **126***a*, **126***b* while the heaters **123***a*, **123***b* are inserted into the placement groove **126***a*, **126***b*.

[0080] In addition, the cell thawers **100**, **200** according to one embodiment of the present invention may include auxiliary heat insulating blocks **124***c*, **124***d* to block heat transferred from the heaters **123***a*, **124***b* from being discharged to the outside, and the auxiliary heat insulating blocks **124***c*, **124***d* may be coupled to the heating blocks **122***a*, **122***b* to cover the upper surfaces of the heating blocks **122***a*, **122***b*.

[0081] Herein, the heating blocks **122***a*, **122***b* may be made of a material having thermal conductivity such as metal, and the heat insulating blocks **124***a*, **124***b* and the auxiliary heat insulating blocks **124***c*, **124***d* may be made of a material having heat insulating properties.

[0082] Accordingly, when the heaters **123***a*, **123***b* generate heat, the heating blocks **122***a*, **122***b* may be heated by the heat generated from the heaters **123***a*, **123***b*, and the heat generated from the heaters **123***a*, **123***b* may be concentrated toward the heating blocks **122***a*, **122***b* by limiting the direction of heat movement through the heat insulating blocks **124***a*, **124***b* and the auxiliary heat insulating blocks **124***c*, **124***d*, and the heat transferred from the heaters **123***a*, **123***b* to the heating blocks **122***a*, **122***b* may be transferred toward the heating space **121**.

[0083] As a result, the container **10** may be heated by the heat provided from the heating blocks **122***a*, **122***b*, and the biological material stored in the container **10** may be thawed by the heat.

[0084] Moreover, since the heat generated from the heaters **123***a*, **123***b* may be concentrated toward the heating blocks **122***a*, **122***b* by limiting the direction of heat movement through the heat insulating blocks **124***a*, **124***b* and the auxiliary heat insulating blocks **124***c*, **124***d*, the energy consumption efficiency of the cell thawers **100**, **200** according to one embodiment of the present invention may be improved.

[0085] In addition, since the container **10** accommodated in the heating space **121** may be heated by using the heat of the heating blocks **122***a*, **122***b* heated to a constant temperature by the heat transferred from the heaters **123***a*, **123***b*, the circumferential surface of the container **10** may be heated to a uniform temperature. Herein, the circumferential surface of the container **10** may be the circumferential surface of the container body **12** excluding the cap part **14** and the lower surface.

[0086] In this case, as illustrated in FIGS. **7** and **22**, the thawing part **120** may include temperature sensors **128***a*, **128***b* which are installed on the heating blocks **122***a*, **122***b* to measure the temperature of the heating blocks **122***a*, **122***b*. Herein, the temperature sensors **128***a*, **128***b* may be known contact temperature sensors such as thermocouples, resistance thermometers (RTDs) and thermistors, and the temperatures of the heating blocks **122***a*, **122***b* measured through the temperature sensors **128***a*, **128***b* may be transmitted to the control part **150**.

[0087] Accordingly, as the control part **150** controls the driving of the heaters **123***a*, **123***b* based on the temperature information measured by the temperature sensors **128***a*, **128***b*, it is possible to maintain the temperatures of the heating blocks **122***a*, **122***b* to constant temperatures. For example, the control part **150** may maintain the temperature of the heating blocks **122***a*, **122***b* to be constant by controlling the driving of the heaters **123***a*, **123***b* through PID control.

[0088] Moreover, the control part **150** may prevent overheating of the heating blocks **122***a*, **122***b* by controlling the driving of the heaters **123***a*, **123***b* based on the temperature information measured by the temperature sensors **128***a*, **128***b*.

[0089] In the present invention, the heaters **123***a*, **123***b* may be provided as ceramic heaters to secure reliability and improve the lifespan cycle of products even under operating conditions in which heating and cooling are repeatedly performed, but the present invention is not limited thereto, and a variety of heaters may all be applied.

[0090] Meanwhile, the heating space **121** may be provided in a shape corresponding to the shape of the container **10**, and the heating space **121** may be formed through at least two heating blocks **122***a*, **122***b*.

[0091] As a specific example, as illustrated in FIGS. **7** and **22**, the heating blocks **122***a*, **122***b* may include a first heating block **122***a* and a second heating block **122***b* that are disposed such that surfaces thereof face each other, and the heating space **121** may be formed through a pair of opposing surfaces **127***a*, **127***b* that are formed by being drawn in on surfaces thereof facing each other in the first heating block **122***a* and the second heating block **122***b*.

[0092] Herein, the pair of opposing surfaces **127***a*, **127***b* may be drawn inward to have a shape corresponding to the circumferential surface of the container **10**.

[0093] For example, when the container **10** is formed in the shape of a cylinder, the pair of opposing surfaces **127***a*, **127***b* may be arc-shaped curved surfaces, and when the container **10** is formed in the shape of a square column, the pair of opposing surfaces **127***a*, **127***b* may be formed as bent surfaces having a substantially ‘c’ cross-sectional shape.

[0094] Accordingly, when the container **10** is introduced into the heating space **121** through the inlet **115**, the container **10** may be completely surrounded by a pair of opposing surfaces **127***a*, **127***b* whose circumferential surface defines the heating space **121**.

[0095] As a result, the circumferential surface of the container **10** accommodated in the heating space **121** may be uniformly heated by the heat provided from the first heating block **122***a* and the second heating block **122***b*.

[0096] In this case, each of the first heating block **122***a* and the second heating block **122***b* may include arrangement grooves **126***a*, **126***b* that are formed to be drawn inward on one surface, and the heaters **123***a*, **123***b* may include a first heater **123***a* and a second heater **123***b* that are inserted into the arrangement groove **126***a* formed in the first heating block **122***a* and the arrangement groove **126***b* formed in the second heating block **122***b*, respectively.

[0097] In addition, the heat insulating blocks **124***a*, **124***b* may include a first heat insulating block **124***a* and a second heat insulating block **124***b*, and the first heat insulating block **124***a* may be coupled to the first heating block **122***a* so as to completely cover the arrangement groove **126***a* while the first heater **123***a* is inserted into the arrangement groove **126***a* of the first heating block **122***a*, and the second heat insulating block **125***a* may be coupled to the second heating block **122***b* so as to completely cover the arrangement groove **126***b* while the second heater **123***b* is inserted into the arrangement groove **126***b* of the second heating block **122***b*.

[0098] Moreover, the auxiliary heat insulating blocks **124***c*, **124***d* may include a first auxiliary heat insulating block **124***c* which is fastened to an upper surface of the first heating block **122***a* and a second auxiliary heat insulating block **124***d* which is fastened to an upper surface of the second heating block **122***b*.

[0099] In addition, the temperature sensors **128***a*, **128***b* may include a first temperature sensor **128***a* which is installed on the first heating block **122***a* to measure the temperature of the first heating block **122***a* and a second temperature sensor **128***b* which is installed on the second heating block **122***b* to measure the temperature of the second heating block **122***b*.

[0100] Accordingly, the heat generated from the first heater **123***a* may heat the first heating block **122***a*, and the heat generated from the second heater **123***b* may heat the second heating block **122***b*. In addition, the control part **150** may control the driving of the first heater **123***a* and the second heater **123***b* based on the temperature information measured by the first temperature sensor **128***a* and the second temperature sensor **128***b*.

[0101] Through this, the control part **150** may maintain the temperature of the first heating block **122***a* and the second heating block **122***b* to be constant.

[0102] In this case, the control part **150** may control the driving of the first heater **123***a* and the second heater **123***b* together based on the temperature information measured through the first temperature sensor **128***a* and the second temperature sensor **128***b*, or the control part **150** may individually control the driving of the first heater **123***a* and the second heater **123***b* based on temperature information measured through the first temperature sensor **128***a* and the second temperature sensor **128***b*.

[0103] Through this, even if the heating blocks **122***a*, **122***b* include the first heating block **122***a* and the second heating block **122***b* in the cell thawers **100**, **200** according to one embodiment of the present invention, the temperatures of the first heating block **122***a* and the second heating block **122***b* may be preciously controlled through the control of the control part **150**.

[0104] Accordingly, since the first heating block **122***a* and the second heating block **122***b* may be maintained at the same temperature without temperature deviation through the control part **150**, the circumferential surface of the container **10** may be uniformly heated in the heating space **121**.

[0105] Moreover, when the control part **150** individually controls the driving of the first heater **123***a* and the second heater **123***b*, the user may immediately check an abnormality of the corresponding part based on the information output through the display **118**, and take appropriate action on the corresponding part in which the abnormality has occurred.

[0106] For example, if any one of the heaters **123***a*, **123***b* respectively installed in the first heating block **122***a* and the second heating block **122***b*, or any one of the temperature sensors **128***a*, **128***b* respectively installed in the first heating block **122***a* and the second heating block **122***b* does not operate normally, the user may immediately check an abnormality of the corresponding part based on the information output through the display **118**, and take appropriate action on the corresponding part in which the abnormality has occurred.

[0107] Meanwhile, in the cell thawers **100**, **200** according to one embodiment of the present invention, the container **10** accommodated in the heating space **121** may be heated by heat transferred in a non-contact manner from the heating blocks **122***a*, **122***b* while not in contact with the heating block **122***a*, **122***b*.

[0108] For example, while the container **10** is inserted into the heating space **121**, the circumferential surface of the container **10** may be spaced apart at a predetermined interval with the opposing surface **127***a* of the first heating block **122***a* and the opposing surface **127***b* of the second heating block **122***b* forming the heating space **121**.

[0109] In this case, the lower surface of the container **10** may be supported through a protruding member **125***a* which is formed to protrude from one surface of the pedestal **125** at a predetermined height.

[0110] That is, as illustrated in FIGS. **15** and **30**, while the container **10** is inserted into the heating space **121** and the lower portion of the container **10** is supported through the protruding member **125***a*, a gap (d) may be formed between the pair of opposing surfaces **127***a*, **127***b* and the outer surface of the container **10**.

[0111] Accordingly, the heat stored in the first heating block **122***a* and the second heating block **122***b* may be transferred to the relatively low-temperature container **10** through convection and/or radiation instead of conduction.

[0112] Therefore, since the cell thawers **100**, **200** according to one embodiment of the present invention may heat the circumferential surface of the container **10** through heat transfer using convection and/or radiation, the circumferential surface of the container **10** may be uniformly heated through convective heat and/or radiant heat transferred from the heating blocks **122***a*, **122***b*.

[0113] That is, compared to the case where the container **10** and the heating blocks **122***a*, **122***b* are in direct contact and the container **10** is heated through conduction heat, the cell thawers **100**, **200** according to one embodiment of the present invention may heat the circumferential surface of the container **10** through convective heat and or radiant heat, thereby preventing the concentration of heat in a local location of the container **10**.

[0114] Moreover, in the cell thawers **100**, **200** according to one embodiment of the present invention, even if the container **10** is made of a glass or plastic material that is vulnerable to high temperature heat, the first heating block **122***a* and the second heating block **122***b* are not in direct contact with the container **10**, and thus, it is possible to prevent cracks or thermal deformation of the container that may occur due to heat when in direct contact with a high-temperature object.

[0115] In the present invention, the gap (d) between the pair of opposing surfaces **127***a*, **127***b* forming the heating space **121** and the outer surface of the container **10** may be 0.2 mm to 0.3 mm, but the present invention is limited thereto, and the size of the gap (d) may be appropriately changed according to the overall size of the container **10**.

[0116] In this case, at least any one of the first heating block **122***a* and the second heating block **122***b* may be reciprocally moved in a straight line, and the heating space **121** may be formed when the first heating block **122***a* and the second heating block **122***b* are arranged to be located close to each other through a straight-line movement of at least any one of the first heating block **122***a* and the second heating block **122***b*. The detailed description thereof will be described below.

[0117] Meanwhile, as illustrated in FIGS. **7**, **9**, **22** and **24**, the pedestal **125** for supporting a lower portion of the container **10** may include a protruding members **125***a* which is formed to protrude at a predetermined height so that the lower portion of the container **10** is spaced apart from one surface of the pedestal **125** by a predetermined height.

[0118] When the container **10** is inserted into the inlet **115**, the protruding member **125***a* may support the lower surface of the container **10** such that the lower surface of the container **10** is spaced apart from one surface of the pedestal **125** by a predetermined height. Through this, the circumferential surface of the container **10** may be positioned in the heating space **121** at a position facing a pair of opposing surfaces **127***a*, **127***b* forming the heating space **121**.

[0119] Accordingly, the container **10** may be smoothly heated by the heat transferred through the pair of opposing surfaces **127***a*, **127***b* while being disposed in the heating space **121**, and the circumferential surface of the container **10** disposed in the heating space **121** may maintain a uniform gap with the pair of opposing surfaces **127***a*, **127***b*.

[0120] The driving part **130** may linearly move the heating blocks **122***a*, **122***b* in left and right directions. For example, as described above, when the heating blocks **122***a*, **122***b* include the first heating block **122***a* and the second heating block **122***b*, the driving part **130** may move at least any one of the first heating block **122***a* and the second heating block **122***b* in a straight line in the left and right directions.

[0121] As a non-limiting example, when the heating blocks **122***a*, **122***b* include the first heating block **122***a* and the second heating block **122***b*, the driving part **130** may move the first heating block **122***a* and the second heating block **122***b* in a straight line in the left and right directions, respectively.

[0122] Through this, in the cell thawers **100**, **200** according to one embodiment of the present invention, the first heating block **122**_a_ and the second heating block **122**_b_ may be changed to a heating position in which they are disposed to be close to each other through the driving of the driving part **130** (refer to FIGS. **15** and **30**), and a standby position in which they are disposed to be are spaced apart from each other at intervals (refer to FIGS. **12**, **14**, **16**, **27**, **29** and **31**).

[0123] Accordingly, as illustrated in FIGS. **15** and **30**, when the first heating block **122**_a_ and the second heating block **122**_b_ are located in the heating position, a heating space **121** for accommodating and heating the container **10** may be formed between the opposing surface **127**_a_ of the first heating block **122**_a_ and the opposing surface **127**_b_ of the second heating block **122**_b_.

[0124] In addition, as illustrated in FIGS. **12**, **14**, **16**, **27**, **29** and **31**, when the first heating block **122**_a_ and the second heating block **122**_b_ are located in the standby position, a gap between the opposing surface **127**_a_ of the first heating block **122**_a_ and the opposing surface **127**_b_ of the second heating block **122**_b_ may be widened. Through this, the user may insert the container **10** to be disposed between the first heating block **122**_a_ and the second heating block **122**_b_ or remove the container **10** that is disposed between the first heating block **122**_a_ and the second heating block **122**_b_.

[0125] To this end, as illustrated in FIGS. **6**, **8**, **21** and **23**, the driving part **130** may include a motor **131** for providing a driving force, a rotating member **132** which is axially coupled to a rotating shaft **131**_a_ of the motor **131**, a moving member **136** which moves up and down along the rotating member **132** when the rotating member **132** rotates, and a power transmission member which interconnects the rotating member **132** and the thawing part **120** such that the first heating block **122**_a_ and the second heating block **122**_b_ can be moved linearly in the left and right directions, respectively, through the driving force of the motor **131**.

[0126] In addition, the power transmission member may include guide blocks **134**_a_, **134**_b_ which are fixedly coupled to the heat insulating blocks **124**_a_, **124**_b_, a guide rail **135** for guiding linear movement of the guide blocks **134**_a_, **134**_b_, and link members **137**_a_, **137**_b_ for connecting the guide blocks **134**_a_, **134**_b_ and the moving member **136** to each other.

[0127] As a specific example, the guide blocks **134**_a_, **134**_b_ may include a first guide block **134**_a_ which is fixedly coupled to the first heat insulating block **124**_a_ and a second guide block **134**_b_ which is fixedly coupled to the second heat insulating block **124**_b_, and the first guide block **134**_a_ and the second guide block **134**_b_ may be slidably coupled to the guide rail **135**.

[0128] In addition, the link members **137**_a_, **137**_b_ may include a first link member **137**_a_ for linking the moving member **136** and the first guide block **134**_a_ to each other, and a second link member **137**_b_ for linking the moving member **136** and the second guide block **134**_b_ to each other.

[0129] In this case, the cell thawers **100**, **200** according to one embodiment of the present invention may further include a base **161**, a mounting table **162**, a support bar **163** and a support **164** that are disposed inside the housing **110**.

[0130] That is, as illustrated in FIGS. **6** and **21**, the mounting table **162** may be fixedly coupled to the upper surface of the base **161**, and the motor **131** may be fixedly coupled to one side of the mounting table **162** via a coupling base **165**, and the rotating member **132** which is axially coupled to a rotating shaft **131**_a_ of the motor **131** may be rotatably coupled to the mounting table **162**.

[0131] In addition, the plate-shaped support **164** having a predetermined area may be disposed in a state of being spaced apart from the base **161** by a predetermined interval upward through at least one support bar **163** having a predetermined length and having one end fixedly coupled to the base **161**, and the guide rail **135** may be fixedly coupled to one surface of the support **164**.

[0132] Moreover, the first guide block **134**_a_ and the second guide block **134**_b_ may be slidably coupled to the guide rail **135**, and the first heat insulating block **124**_a_ may be fixedly coupled to the first guide block **134**_a_, and the second heat insulating block **124**_b_ may be fixedly coupled to the second guide block **134**_b_.

[0133] Herein, the rotating member **132** may be a screw bar having a predetermined length and having one end axially coupled to a rotating shaft **131**_a_ of the motor **131**, and the moving member

136 may be movably screw-coupled to the rotating member **132**.

[0134] In addition, the support **164** may include a through-hole **164***a* having a long hole through which the first link member **137***a* and the second link member **137***b* may respectively pass.

[0135] In addition, both ends of the first link member **137***a* may be linked to the rotation member **132** and the first guide block **134***a*, respectively, and both ends of the second link member **137***b* may be linked to the rotation member **132** and the second guide block **134***b*, respectively.

[0136] Accordingly, when the rotating member **132** which is axially coupled to the rotating shaft **131***a* rotates when the motor **131** is driven, as illustrated in FIGS. **12** to **16** and **27** to **31**, the moving member **136** may be ascended and descended by screw movement along the rotating member **132**, and the first guide block **134***a* and the second guide block **134***b* which are each linked to the moving member **136** may be linearly moved in the left and right directions along the guide rail **136** through the ascending and descending of the moving member **136**.

[0137] As a result, the first heat insulating block **124***a* and the second heat insulating block **124***b* which are fixedly coupled to the first guide block **134***a* and the second guide block **134***b*, respectively, may be linearly moved in the left and right directions in the same manner as the first guide block **134***a* and the second guide block **134***b*, and the first heating block **122***a* and the second heating block **122***b* which are fixedly coupled to the first heat insulating block **124***a* and the second heat insulating block **124***b*, respectively, may also be linearly moved in the left and right directions.

[0138] Through this, in the cell thawers **100**, **200** according to one embodiment of the present invention, the first heating block **122***a* and the second heating block **122***b* may be changed to heating position in which the first heating block **122***a* and the second heating block **122***b* are disposed to be close to each other through the driving of the driving part **130**, and a standby position in which the first heating block **122***a* and the second heating block **122***b* are disposed to be spaced apart from each other.

[0139] Moreover, when the cell thawers **100**, **200** according to one embodiment of the present invention are changed from a standby position to a heating position through the control of the control part **140**, the lower portion of the container **10** which is accommodated in the heating space **121** may be located at a relatively higher position than the lower surfaces of the first heating block **122***a* and the second heating block **122***b* through the protruding member **125***a*.

[0140] Accordingly, the container **10** which is disposed in the heating space **121** may be disposed in a state where the circumferential surface thereof faces the opposing surfaces forming the heating space **121**.

[0141] The drawings and description illustrate and describe that the rotational movement of the motor **131** is changed into the linear movement of the first guide block **134***a* and the second guide block **134***b* through mutual coupling of the rotating member **132**, the moving member **136** and the link members **137***a*, **137***b*, but the present invention is not limited thereto, and various known structures such as a ball screw structure may all be applied as long as the rotational movement can be converted into linear movement.

[0142] In this case, the cell thawers **100**, **200** according to one embodiment of the present invention may further include a position detecting means for detecting the position of the heating blocks **122***a*, **122***b*.

[0143] For example, in the cell thawer **100** according to one embodiment of the present invention, the position detecting means may be a limit switch **170** for detecting the position of the heating blocks **122***a*, **122***b* through contact with the heat insulating blocks **124***a*, **124***b*.

[0144] As illustrated in FIG. **6**, such a limit switch **170** may be installed on one surface of the support **164**, and may detect the position of the second heating block **122***b* through contact with the second heat insulating block **124***b*, and the information detected through the limit switch **170** may be provided toward the control part **150**.

[0145] As a specific example, as illustrated in FIGS. **9** and **10**, the limit switch **170** may include a switch box **171** which is fixedly installed on one surface of the support **164**, an operating lever **172** which is operated by a hinge on one side of the switch box **171**, and a roller **173** which is rotatably coupled to one end of the operating lever **172**.

[0146] Accordingly, in the limit switch **170**, when the roller **173** contacts the second heat insulating block **124***b* and the operation lever **172** operates, the switch box **171** may be operated, and information on whether the switch box **171** is operated may be transmitted toward the control part **150**.

[0147] Specifically, as described above, when the first heating block **122***a* and the second heating block **122***b* are changed from the heating position to the standby position through the driving of the driving part **130**, the second heat insulating block **124***b* may move together with the second heating block **122***b*.

[0148] Through this, the second heat insulating block **124***b* may be in contact with the roller **173**, and as illustrated in FIG. **9**, when the second heating block **122***b* is completely moved to the standby position, the operating lever **172** is operated such that the switch box **171** can be operated.

[0149] In this case, the control part **150** determines that the second heating block **122***b* is positioned in the standby position and controls the driving of the motor **131** such that it is possible to prevent the second heating block **122***b* from moving excessively.

[0150] In addition, as illustrated in FIG. **10**, when the first heating block **122***a* and the second heating block **122***b* are changed from the standby position to the heating position through the driving of the driving part **130**, the second heat insulating block **124***b* is moved together with the second heating block **122***b* such that the contact state between the second heat insulating block **124***b* and the roller **173** can be released.

[0151] The drawings and description exemplify a hinge roller-type limit switch as a position detection means for detecting the position of the second heating block **122***b*, but the present invention is not limited thereto, and various known limit switches, such as a lever-type limit switch, a pin-type limit switch and the like, may all be employed.

[0152] As another example, in the cell thawer **200** according to one embodiment of the present invention, the position detecting means may be a position detection sensor **270** for detecting the position of the heating blocks **122***a*, **122***b* that linearly move in the left and right directions through the driving of the driving part **130**.

[0153] Such a position detection sensor **270** may be a non-contact position detection sensor.

[0154] As a specific example, the non-contact position detection sensor **270** may be a known photo-microsensor. As a non-limiting example, as illustrated in FIGS. **19** and **20**, the non-contact position detection sensor **270** may include a photosensor **272** which is installed on one surface of the support **164**, and a detection bar **274**, one end of which is fixedly installed in the second heat insulating block **124***b*.

[0155] Accordingly, when the detection bar **274** approaches the photosensor **272** through linear movement of the second heating block **122***b* and the second heat insulating block **124***b*, the photosensor **272** may detect the position of the second heating block **122***b* through the detection bar **274**, and the information detected through the position detection sensor **270** may be provided toward the control part **150**.

[0156] As a result, the control part **150** may accurately detect the position of the second heating block **122***b* through the non-contact position detection sensor **270**, and may accurately check the origin of the motor **131**.

[0157] Specifically, as described above, when the first heating block **122***a* and the second heating block **122***b* are changed from the heating position to the standby position through the driving of the driving part **130**, the second heat insulating block **124***b* may move together with the second heating block **122***b*.

[0158] Through this, the detection bar **274** which is fixed to the second heat insulating block **124***b* may move toward the photosensor **272**, and as illustrated in FIG. **24**, when the second heating block **122***b* completely moves to the standby position, a partial length of the detection bar **274** may enter a groove part, which is formed in the photosensor **272**.

[0159] In this case, the control part **150** determines that the second heating block **122***b* is positioned in the standby position and controls the driving of the motor **131** such that it is possible to prevent the second heating block **122***b* from moving excessively.

[0160] In addition, as illustrated in FIG. **25**, when the first heating block **122***a* and the second heating block **122***b* are changed from the standby position to the heating position through the driving of the driving part **130**, the detection bar **274** which is fixed to the second heat insulating block **124***b* may move away from the photosensor **272**.

[0161] The drawings and description exemplify a non-contact sensor as a position detecting means for detecting the position of the second heating block **122***b*, but the present invention is not limited thereto, and various known position detection sensors may be employed as long as the position of the heating block **122** can be detected.

[0162] Meanwhile, the thawing part **120** may further include a sensor **141** for checking the state of the container **10** disposed in the heating space **121**. For example, the sensor **141** may detect the surface temperature of the container **10** disposed in the heating space **121** and provide the detected result toward the control part **150**.

[0163] Herein, the sensor **141** may be an infrared temperature sensor so as to measure the surface temperature of the container **10** in a non-contact manner, and the sensor **141** may measure the surface temperature of the container **10** which is disposed in the heating space while being fixed to a mounting member **142**.

[0164] Accordingly, the control part **150** may output information about the container **10** that is detected through the sensor **141** to the display **118**.

[0165] As a result, the user may check the thawing process of the biological material contained in the container **10** in real time through the information output from the display **118**, and may monitor whether the biological material is thawing within an appropriate temperature range.

[0166] To this end, as illustrated in FIGS. **9**, **11**, **24** and **26**, the sensor **141** may be coupled to the mounting member **142** to check the state of the container **10** disposed in the heating space **121**, and the mounting member **142** may be coupled to the pedestal **125** which is fixedly coupled to the support **164**.

[0167] In this case, the heating blocks **122***a*, **122***b* may include placement holes **129***a*, **129***b* which are formed in a shape corresponding to the sensor **141** such that the sensor **141** can enter the side of the heating space **121** side.

[0168] That is, the placement holes **129***a*, **129***b* may be formed to pass through the first heating block **122***a* and the second heating block **122***b*, respectively, as illustrated in FIGS. **13** and **28**, and the placement holes **129***a*, **129***b* may be formed by joining a portion **129***a* which is formed on the first heating block **122***a* and a portion **129***b* which is formed on the second heating block **122***b*.

[0169] Accordingly, when the thawing part **120** is located at the heating position, the sensor **141** may measure the surface temperature of the container **10** at a very nearby location while not coming into contact with the container **10** that is disposed in the heating space **121** through the placement holes **129***a*, **129***b*.

[0170] Moreover, the temperature information measured by the sensor **141** may be used as information for detecting whether the container **10** is disposed in the heating space **121**.

[0171] In the above description, an infrared temperature sensor is exemplified as the sensor **141**, but the present invention is not limited thereto, and various known sensors may all be employed, and depending on the type of employed sensors, the information of the container **10** measured may vary.

[0172] Moreover, the mounting member **142** to which the sensor **141** is fixed may be detachably coupled to the pedestal **125**. Accordingly, when the sensor **141** needs to be replaced, the sensor **141** may be easily replaced by separating the mounting member **142** from the pedestal **125**.

[0173] The control part **150** may control the overall driving of the cell thawers **100**, **200** according to one embodiment of the present invention.

[0174] As illustrated in FIG. **3**, the control part **150** may include a circuit board **151** and a chipset **152** such as an MCU that are mounted on the circuit board **151**, and the control part **150** may control all operations of the thawing part **120**, the driving part **130**, the sensor **141**, the display **118**, the operation part **117** and the position detection means described above.

[0175] In this case, when the container **10** accommodated in the heating space **121** is heated at the heating position, the control part **150** may control the driving of the driving part **130** so as to heat the container while the first heating block **122***a* and the second heating block **122***b* are in contact with each other, but it may also control the driving of the driving part **130** so as to heat the container while the first heating block **122***a* and the second heating block **122***b* are not in contact with each other.

[0176] That is, the control part **150** may set the heating position such that a predetermined gap is formed in the remaining portion except for portions where the opposing surfaces **127***a*, **127***b* for forming the heating space **121** are formed among surfaces on which the first heating block **122***a* and the second heating block **122***b* face each other.

[0177] Through this, the cell thawers **100**, **200** according to one embodiment of the present invention may prevent a load that may be generated on the motor **131** in order to maintain contact between the first heating block **122***a* and the second heating block **122***b* at the heating position.

[0178] Additionally, in the process of thawing the biological material contained in the container **10** at the heating position, the cell thawers **100**, **200** according to one embodiment of the present invention may discharge water vapor or moisture generated from the surface of the container **10** to the outside through the gap. Through this, the biological material may be thawed more smoothly.

[0179] Moreover, after the control part **150** preheats the heating blocks **122***a*, **122***b* to a predetermined temperature by driving the heaters **123***a*, **123***b*, it may start thawing the biological material contained in the container **10**.

[0180] As described above, the control part **150** may maintain the temperature of the heating blocks **122***a*, **122***b* to be constant through PID control, and when the heating blocks **122***a*, **122***b* are provided in plurality, the control part **150** may individually control each of the heating blocks **122***a*, **122***b*.

[0181] Herein, the preheating temperature of the heating blocks **122***a*, **122***b* may be the same as the thawing temperature for thawing the biological material contained in the container **10** or may be a relatively higher temperature than the thawing temperature.

[0182] In addition, while the thawing of the container **10** introduced into the heating space **121** is completed and the heating blocks **122***a*, **122***b* are changed to the standby position, the control part **150** may maintain the temperature of the heating blocks **122***a*, **122***b* to be constant.

[0183] Through this, the cell thawers **100**, **200** according to one embodiment of the present invention may be changed between a heating position and a standby position while the heating blocks **122***a*, **122***b* are continuously maintained at a constant temperature.

[0184] Accordingly, when the cell thawers **100**, **200** according to one embodiment of the present invention are used, the user may sequentially insert and remove a plurality of containers **10** into the heating space **121** to perform the thawing, thereby minimizing the waiting time to increase work productivity.

[0185] Meanwhile, the cell thawer **200** according to one embodiment of the present invention may conveniently perform qualification evaluation to verify the operating temperature of the heating block.

[0186] To this end, the cell thawer **200** according to one embodiment of the present invention may further include a sensor insertion hole **180**, and the sensor insertion hole **180** may be formed to be drawn inward from one surface of the heating blocks **122***a*, **122***b* at a certain depth.

[0187] The sensor insertion hole **180** may be a space into which a calibration sensor is inserted during calibration to check whether the heating blocks **122***a*, **122***b* are normally operating.

[0188] For example, the calibration sensor (not illustrated) may be a bar-shaped temperature sensor having a predetermined length, and a partial length of the calibration sensor may be inserted into the sensor insertion hole **180**.

[0189] Accordingly, the verifier may conveniently measure the temperature of the heating blocks **122***a*, **122***b* through the calibration sensor inserted into the sensor insertion hole **180**, and thus, it is possible to check whether the cell thawer **200** according to one embodiment of the present invention is operating normally.

[0190] Although the sensor insertion hole **180** may be provided as one, when the heating blocks **122***a*, **122***b* include the above-described first heating block **122***a* and second heating block **122***b*, it may be provided in plurality so as to be respectively formed in the first heating block **122***a* and the second heating block **122***b*.

[0191] In this case, the sensor insertion hole **180** may be formed on a side surface of the heating blocks **122***a*, **122***b*, but as illustrated in FIG. **17**, the sensor insertion hole **180** may be formed on the heating blocks **122***a*, **122***b* so as to be inserted from the upper surface to the lower portion of the heating block **122***a*, **122***b* at a certain depth.

[0192] In addition, when the cell thawer **200** according to one embodiment of the present invention includes auxiliary heat insulating blocks **124***c*, **124***d* for covering the upper surfaces of the heating blocks **122***a*, **122***b*, the sensor insertion hole **180** may be formed on the heating blocks **122***a*, **122***b* so as to be inserted from the upper surface to the lower portion of the heating blocks **122***a*, **122***b* to a certain depth while penetrating the auxiliary heat insulating blocks **124***c*, **124***d*.

[0193] Accordingly, when the upper cover **114** on which the inlet **115** is formed is separated from the housing **110**, the sensor insertion holes **180** formed on the upper surfaces of the heating blocks **122***a*, **122***b* and the auxiliary heat insulating blocks **124***c*, **124***d* may be exposed to the outside.

[0194] As a result, even if only the upper cover **114** is separated from the housing **110** without the need to separate the entire housing in the cell thawer **200** according to one embodiment of the present invention, the sensor insertion hole **180** for calibration may be exposed to the outside.

[0195] Additionally, in the cell thawer **200** according to one embodiment of the present invention, since the sensor insertion hole **180** is formed to be inserted from the upper surface to the lower portion of the heating block **122***a*, **122***b* by a certain depth, the calibration sensor inserted into the sensor insertion hole **180** may maintain a state of being inserted upright into the sensor insertion hole **180** even without a separate fixing means.

[0196] Through this, after separating the upper cover **114**, when the verifier inserts a partial length of the calibration sensor into the sensor insertion hole **180** formed on the upper surface of the heating blocks **122***a*, **122***b*, the verifier may simply and accurately measure the operating temperature of the heating blocks **122***a*, **122***b*.

[0197] In this case, the sensor insertion hole **180** may be formed to be positioned directly above the temperature sensors **128***a*, **128***b* embedded in the heating blocks **122***a*, **122***b*.

[0198] For example, as illustrated in FIG. **18**, the sensor insertion hole **180** may be formed on the heating blocks **122***a*, **122***b* such that a lower end, which is a sealed end, is located directly above the temperature sensors **128***a*, **128***b*, and the lower end of the sensor insertion hole **180** may be formed on the heating block **122***a* or **122***b* to have a gap of 1 mm to 5 mm from the temperature sensor **128***a* or **128***b*.

[0199] Accordingly, during calibration, the temperatures of the heating blocks **122***a*, **122***b* measured by the calibration sensor inserted into the sensor insertion hole **180** may be similar to the temperatures of the heating blocks **122***a*, **122***b* measured by the temperature sensors **128***a*, **128***b*, when the cell thawer **200** according to one embodiment of the present invention operates.

[0200] As a result, when the calibration of the cell thawer **200** according to one embodiment of the present invention is performed by using the sensor insertion hole **180**, the temperatures of the heating blocks **122***a*, **122***b* measured through the calibration sensor and the temperatures of the heating blocks **122***a*, **122***b* measured through the temperature sensors **128***a*, **128***b* during normal

operation are similar, and thus, the calibration result may secure high reliability.
[0201] Hereinafter, the operation method of the above-described cell thawers **100**, **200** will be described with reference to FIGS. **12** to **16** and FIGS. **27** to **32**.
[0202] First of all, as a preparation step, the cover **116** for covering the inlet **115** is removed, and power is supplied to the cell thawers **100**, **200**.
[0203] When power is applied to the cell thawers **100**, **200**, the control part **150** may drive the driving part **130** to change the thawing part **120** to a standby position.
[0204] That is, as illustrated in FIGS. **12** and **27**, the control part **150** may drive the motor **131** to raise the moving member **136**. Accordingly, the first heating block **122***a* and the second heating block **122***b* may be slidably moved in a direction of moving away from each other, and may be changed to a standby position of being disposed to be spaced apart from each other at a certain interval.
[0205] If the first heating block **122***a* and the second heating block **122***b* are located in the standby position, the preparation step of changing the thawing part **120** to the standby position when power is applied may be omitted.
[0206] Next, as a first step (S1), the control part **150** operates the first heater **123***a* and the second heater **123***b* to preheat the first heating block **122***a* and the second heating block **122***b* to a predetermined temperature.
[0207] For example, the preheating temperature of the first heating block **122***a* and the second heating block **122***b* may be equal to or higher than the thawing temperature for thawing the biological material contained in the container **10**.
[0208] In this case, the preheating of the first heating block **122***a* and the second heating block **122***b* may be performed in a state where surfaces on which the first heating block **122***a* and the second heating block **122***b* face each other are in contact with each other.
[0209] That is, as illustrated in FIGS. **13** and **28**, the control part **150** may lower the moving member **136** by driving the motor **131**. Accordingly, the first heating block **122***a* and the second heating block **122***b* may be slidably moved in a direction of moving closer to each other in the standby position, respectively, and the first heating block **122***a* and the second heating block **122***b* may be changed to a state in which surfaces on which the first heating block **122***a* and the second heating block **122***b* face each other are in contact with each other.
[0210] In this state, the control part **150** may control the driving of the motor **131** such that the contact state of the first heating block **122***a* and the second heating block **122***b* can be maintained until the preheating of the first heating block **122***a* and the second heating block **122***b* is finished.
[0211] Accordingly, while the first heating block **122***a* and the second heating block **122***b* are in contact with each other, the first heating block **122***a* and the second heating block **122***b* may be heated simultaneously through the first heater **123***a* and the second heater **123***b* disposed on both sides, respectively, and thus, the first heating block **122***a* and the second heating block **122***b* may be quickly heated to a predetermined temperature through heat transferred from the first heater **123***a* and the second heater **123***b*.
[0212] Thereafter, when the preheating of the first heating block **122***a* and the second heating block **122***b* is completed, the control part **150** may output a message indicating that the preheating is completed to the display **118**, and the control part **150** may slide and move the first heating block **122***a* and the second heating block **122***b* by driving the motor **131**. Through this, as illustrated in FIG. **14**, the first heating block **122***a* and the second heating block **122***b* may be changed to a standby position of being disposed to be spaced apart from each other at a predetermined interval.
[0213] In this way, when the preheating of the first heating block **122***a* and the second heating block **122***b* is completed, the user checks the set thawing time through the display **118** and, if the set thawing time needs to be changed, the user may change the set thawing time to an appropriate time by manipulating the manipulation part **117**.
[0214] Next, as illustrated in FIGS. **14** and **29**, while the first heating block **122***a* and the second

heating block **122***b* are located in the standby position, the user may place the container **10** requiring thawing between the first heating block **122***a* and the second heating block **122** disposed in the standby position. In this case, the container **10** may be disposed such that the lower surface thereof is seated on one surface of the protruding member **125***a*.

[0215] Thereafter, the user may send a thawing start signal through the manipulation part **117** while the container **10** requiring thawing is placed between the first heating block **122***a* and the second heating block **122***b* that are disposed in the standby position.

[0216] Accordingly, the control part **150** may heat the container **10** to thaw the biological material contained in the container **10** as a second step (S2).

[0217] That is, the control part **150** may lower the moving member **136** by driving the motor **131** such that the first heating block **122***a* and the second heating block **122***b* can be moved in a direction of moving closer to each other.

[0218] Accordingly, as illustrated in FIGS. **15** and **30**, the first heating block **122***a* and the second heating block **122***b* may be changed to a heating position for forming a heating space **121** for accommodating and heating the container **10** in the standby position, and the circumferential surface of the container **10** may be surrounded by the first heating block **122***a* and the second heating block **122***b* while the container **10** is disposed in the heating space **121**.

[0219] In addition, the sensor **141** may measure the surface temperature of the container **10** at a very close position without contacting the container **10** that is disposed in the heating space **121** through the placement holes **129***a*, **129***b*.

[0220] Through this, the container **10** may be heated by the thawing time set by the user through the heat transferred from the first heating block **122***a* and the second heating block **122***b*, and through the sensor **141**, it is possible to measure the state of the container **10** in real time.

[0221] In this case, the control part **150** may output a message indicating that it is thawing to the display **118**, and based on the temperature information transmitted from the first temperature sensor **128***a* and the second temperature sensor **128***b*, the temperatures of the first heating block **122***a* and the second heating block **122***b* may be maintained to be constant by controlling the operation of the first heater **123***a* and the second heater **123***b*, and the state information about the container **10** detected through the sensor **141** may be output to the display **118** through the driving of the control part **150**.

[0222] In this case, as described above, while the container **10** disposed in the heating space **121** is not in contact with the first heating block **122***a* and the second heating block **122***b*, it may be heated by the heat transferred from the first heating block **122***a* and the second heating block **122***b* in a non-contact manner.

[0223] That is, while the container **10** is inserted into the heating space **121**, the circumferential surface of the container **10** may be spaced apart by a certain interval from the opposing surface **127***a* of the first heating block **122***a* and the opposing surface **127***b* of the second heating block **122***b* forming the heating space **121**.

[0224] Through this, a gap (d) may be formed between the pair of opposing surfaces **127***a*, **127***b* and the outer surface of the container **10** while the container **10** is disposed in the heating space **121**.

[0225] Accordingly, the heat stored in the first heating block **122***a* and the second heating block **122***b* may be transferred to the relatively low-temperature container **10** through convection and/or radiation instead of conduction.

[0226] As a result, since the circumferential surface of the container **10** may be heated through convective heat and/or radiant heat, the circumferential surface of the container **10** may be uniformly heated through convective heat and/or radiant heat transferred from the heating blocks **122***a*, **122***b*.

[0227] Additionally, in the second step (S2), the control part **150** may control the motor **131** to heat the container **10** in a state where the first heating block **122***a* and the second heating block **122***b* are

in contact with each other, but it is possible to control the driving of the motor **131** to heat the container **10** in a state where the first heating block **122***a* and the second heating block **122***b* do not contact each other.
[0228] That is, the control part **150** may set the heating position to form a predetermined gap in the remaining portion except for portions where the opposing surfaces **127***a*, **127***b* for forming the heating space **121** are formed among the surfaces on which the first heating block **122***a* and the second heating block **122***b* face each other.
[0229] Through this, the cell thawers **100**, **200** according to one embodiment of the present invention may prevent a load that may occur in the motor in order to maintain a state in which the first heating block **122***a* and the second heating block **122***b* are in contact with each other in the heating position, and in the process of thawing the biological material contained in the container **10** at the heating position, water vapor or moisture generated from the surface of the container **10** may be discharged to the outside through the gap such that it is possible to thaw the biological material more smoothly.
[0230] Next, when the thawing time set by the user elapses, the control part **150** may output a message indicating completion to the display **118**, and as a third step (S3), the control part **150** may drive the motor **131** to change the first heating block **122***a* and the second heating block **122***b* to a standby position.
[0231] Accordingly, as illustrated in FIGS. **16** and **31**, the user may remove the container **10** that is disposed on one surface of the protruding member **125***a* in a state where the first heating block **122***a* and the second heating block **122***b* are located in the standby position.
[0232] In this case, the control part **150** may control the operation of the first heater **123***a* and the second heater **123***b* such that the temperatures of the first heating block **122***a* and the second heating block **122***b* are continuously maintained to be constant.
[0233] Accordingly, the user may sequentially thaw a plurality of containers **10** by sequentially repeating the first step (S1) and the second step (S2).
[0234] Although one exemplary embodiment of the present invention has been described above, the spirit of the present invention is not limited to the exemplary embodiments presented herein, and those skilled in the art who understand the spirit of the present invention may easily suggest other exemplary embodiments by changing, modifying, deleting or adding components within the scope of the same spirit, but this will also fall within the scope of the present invention.

Claims

1. A cell thawer, comprising: a thawing part comprising a heating block, wherein the heating block comprises a first heating block and a second heating block that form a heating space for heating a container storing a predetermined amount of a biological material including cells, a heater, wherein the heater is installed in the heating block to provide heat to the heating block, a heat insulating block wherein the heat insulating block is coupled to the heating block so as to encompass the heater, and a pedestal, wherein the pedestal is for supporting a lower portion of the container in the heating space; a driving part for providing a driving force that linearly moves each of the first heating block and the second heating block in the left and right directions; and a control part for controlling the operations of the thawing part and the driving part.
2. The cell thawer according to claim 1, wherein the container accommodated in the heating space is heated by heat transferred from the heating block in a non-contact manner without contacting the heating block.
3. The cell thawer according to claim 1, wherein the heating block is made of a thermally conductive material.
4. The cell thawer according to claim 1, wherein the heating block comprises an arrangement groove, wherein the arrangement groove is formed on one surface to be drawn inward, the heater is

inserted into the arrangement groove, and the heat insulating block is coupled to the heating block to cover the arrangement groove.
5. The cell thawer according to claim 1, wherein the heating space is formed through opposing surfaces that are each formed to be drawn inward to have a shape corresponding to the circumferential surface of the container on surfaces on which the first heating block and the second heating block face each other.
6. The cell thawer according to claim 1, wherein the pedestal comprises a protruding member that is formed to protrude from one surface at a certain height, and the protruding member supports a lower surface of the container.
7. The cell thawer according to claim 1, wherein the thawing part further comprises an auxiliary heat insulating block for covering an upper surface of the heating block.
8. The cell thawer according to claim 1, wherein the thawing part comprises a temperature sensor, wherein the temperature sensor is installed on the heating block to measure the temperature of the heating block.
9. The cell thawer according to claim 8, wherein the cell thawer further comprises a sensor insertion hole, wherein the sensor insertion hole is formed to be drawn at a certain depth from an upper surface of the heating block to a lower portion such that a calibration sensor for measuring the temperature of the heating block can be inserted therein, and wherein the sensor insertion hole is formed to be located directly above the temperature sensor.
10. The cell thawer according to claim 1, wherein the driving part comprises a motor for providing a driving force, a rotating member, wherein the rotating member is axially coupled to a rotating shaft of the motor, a moving member, wherein the moving member moves up and down along the rotating member when the rotating member rotates, and a power transmission member for interconnecting the moving member and the thawing part such that the first heating block and the second heating block can be moved linearly in the left and right directions, respectively, through a driving force of the motor.
11. The cell thawer according to claim 10, wherein the power transmission member comprises a guide block, wherein the guide block is fixedly coupled to the heat insulating block, a guide rail, wherein the guide rail guides the linear movement of the guide block, and a link member, wherein the link member links the guide block and the moving member to each other.
12. The cell thawer according to claim 1, wherein the cell thawer further comprises a sensor for detecting the state of the container placed in the heating space.
13. The cell thawer according to claim 1, wherein the cell thawer further comprises a limit switch for detecting the position of the heating block through contact with the heat insulating block.
14. The cell thawer according to claim 1, wherein the cell thawer further comprises a non-contact position detection sensor for detecting the position of the heating block.
15. The cell thawer according to claim 1, wherein the cell thawer comprises a housing having an inlet, wherein the inlet is formed through a position corresponding to the heating space.
16. The cell thawer according to claim 15, wherein the cell thawer further comprises a sensor insertion hole, wherein the sensor insertion hole is formed to be drawn at a certain depth from an upper surface of the heating block to a lower portion such that a calibration sensor for measuring the temperature of the heating block can be inserted therein, wherein the housing comprises a box-shaped main body and an upper cover that is detachably coupled to the main body so as to cover an upper portion of the main body, wherein the inlet is formed on the upper cover so as to be located in a position corresponding to the heating space, and wherein the sensor insertion hole is exposed to the outside when the upper cover and the main body are separated.
17. The cell thawer according to claim 15, wherein the cell thawer comprises a communication port, wherein the communication port is provided on one side of the housing.
18. The cell thawer of claim 1, wherein when heating a container accommodated in the heating space, the control part controls the driving of the driving part to heat the container in a state where

the first heating block and the second heating block are not in contact with each other.

19. The cell thawer according to claim 1, wherein the control part individually controls the temperatures of the first heating block and the second heating block.

20. A method for operating a cell thawer comprising a first heating block and a second heating block that form a heating space for accommodating a container storing a predetermined amount of a biological material including cells through linear movement by a driving force of a motor, and heating the container accommodated in the heating space through heat provided from a heater, the method comprising: a first step of preheating the first heating block and the second heating block to a predetermined temperature by driving the heater while one surface of the first heating block and one surface of the second heating block facing each other are in contact with each other; a second step of heating the container which is placed in the heating space so as to thaw the biological material while the first heating block and the second heating block are changed to a heating position forming the heating space; and a third step of changing the first heating block and the second heating block in a direction of moving away from each other from the heating position to a standby position such that the container placed in the heating space can be removed, wherein in the second step, the container placed in the heating space is heated by heat transferred from the first heating block and the second heating block in a non-contact manner while not contacting the first heating block and the second heating block.