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(71) Applicant (for all designated States except US): **LG**

ELECTRONICS INC. [KR/KR]; 20 Yeouido-
dong, Yeongdeungpo-gu, Seoul 150-721 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SON, Mina**

[KR/KR]; LG Electronics Inc. IP Group 391-2
Gaeumjeong-dong, Changwon-si, Gyeongnam 641-711

(KR). **KIM, Jeongyon** [KR/KR]; LG Electronics Inc. IP
Group 391-2 Gaeumjeong-dong, Changwon-si, Gyeong-
nam 641-711 (KR). **KIM, Hyeonjin** [KR/KR]; LG Elec-
tronics Inc. IP Group 391-2 Gaeumjeong-dong, Chang-
won-si, Gyeongnam 641-711 (KR). **KIM, Byunghyun**
[KR/KR]; LG Electronics Inc. IP Group 391-2
Gaeumjeong-dong, Changwon-si, Gyeongnam 641-711
(KR). **KIM, Eunjeong** [KR/KR]; LG Electronics Inc. IP
Group 391-2 Gaeumjeong-dong, Changwon-si, Gyeong-
nam 641-711 (KR).

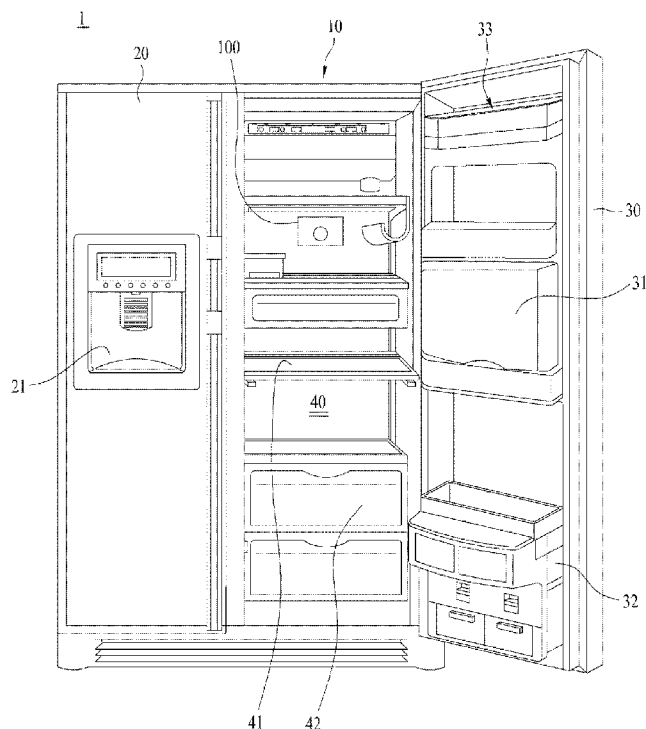
(74) Agents: **KIM, Yong In** et al.; KBK & Associates 7th
Floor, Hyundae Building, 175-9, Jamsil-dong, Songpa-ku,
Seoul 138-861 (KR).

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[Continued on next page]

(54) Title: REFRIGERATOR

[Fig. 1]



(57) Abstract: A refrigerator is disclosed. The refrigerator
stores foods at a low point of temperature and removes
bacteria of the foods stored in a storage room effectively,
to maintain the storage room clean.



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Description

Title of Invention: REFRIGERATOR

Technical Field

- [1] The present invention relates to a refrigerator which is able to store foods at a low point of temperature and to remove bacteria of the foods stored in a storage room effectively, to maintain the storage room clean.

Background Art

- [2] Generally, a refrigerator is an electric appliance that can store foods at a low point of a temperature to preserve foods fresh for a relatively long time. Based on statuses of stored items which are the foods, cold air is controlled to preserve them frozen or refrigerated.
- [3] The cold air supplied to the inside of the refrigerator is generated by heat exchange of refrigerant and it is constantly supplied to the inside of the refrigerator while a cycle configured of compression, condensation, expansion and evaporation is performed repeatedly. The supplied refrigerant is uniformly transported into the refrigerator by convection, such that the foods located in the refrigerator may be preserved at a desired point of a temperature.
- [4] Such the refrigerator may be categorized, based on a structure of freezer and refrigerator compartments provided therein, into a traditional top freezer type refrigerator, a side by side refrigerator and a bottom freezer type refrigerator.
- [5] The traditional top freezer type refrigerator includes a refrigerator compartment located on a top thereof and a refrigerator compartment located at a bottom thereof. The side by side type refrigerator includes freezer and refrigerator compartments located side by side.
- [6] The bottom freezer type refrigerators have been used a lot in the North America and the Europe. Such the bottom freezer type refrigerator includes a large-sized refrigerator compartment located on a top and a smaller freezer compartment than the refrigerator compartment located at a bottom.
- [7] In the meanwhile, the refrigerator includes a case having at least one storage room formed therein and a door rotatably coupled to the case to open and close the storage room selectively.
- [8] The storage room of the refrigerator is typically partitioned into freezer and refrigerator compartments. Behind the storage room may be arranged in an evaporator for generating cold air by heat-exchanging with air inside the storage room and a fan for blowing the air inside the storage room into the evaporator and for re-storing the heat-exchanged cold air into the storage room.

[9] Moreover, a variety of functions for user's convenience may be provided. To realize the functions, a home bar may be provided in the door or a plurality of baskets may be provided in a rear surface of the door, to store or keep a proper amount of foods or food containers in the door.

[10] In such the refrigerator may be stored vegetables and fruits, fish, various food materials and cooked-foods. Unless the storage room is cleaned periodically, the refrigerator might be full of unpleasant smell might generated from the variety of the foods stored in the storage room and bacteria and virus might reproduce. Because of that, sanitation could be poor and the user might have unpleasant feeling.

[11] Also, the bacteria and the like might be spreading into the other foods or moving inside the refrigerator along the cold air circulation. Because of that, sanitation inside the refrigerator might be poor disadvantageously.

Disclosure of Invention

Technical Problem

[12] To solve the problems, an object of the present invention is to provide a refrigerator that is able to remove bacteria from foods stored in a storage room and from air inside the storage room effectively and to maintain the storage room clean.

[13] Another object of the present invention is to provide a refrigerator that is able to maintain clean a plurality of storage rooms via an auxiliary sterilization passage independent from a cold air passage.

[14] A further object of the present invention is to provide a refrigerator that is able to sterilize/deodorize the storage room and to decompose remnants of dead bacteria automatically.

[15] A still further object of the present invention is to provide a refrigerator that is able to remove allergens located in the storage room to manage the storage room sanitarily and to keep freshness of the stored foods.

[16] A still further object of the present invention is to provide a refrigerator that is able to selectively perform sterilization based on introduction of foods, change of internal temperatures or usage of the foods to reduce power consumption.

[17] A still further object of the present invention is to provide a refrigerator that is able to detect the kind and amount of bacteria or odor factors located in the storage room to display the detected information to the user.

[18] A still further object of the present invention is to provide a refrigerator that is able to recognize image information relating to an appearance of a specific food or distribution of temperatures to acquire freshness of the food and to display the freshness to the user.

Solution to Problem

- [19] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a refrigerator includes a case comprising at least one storage room provided therein for low temperature storage; a compressor provided in the case, to compress refrigerant; at least one door to open and close the storage room selectively; a filter module comprising a housing arranged in the storage room, with an air inlet and an air outlet formed therein, a plurality of sterilization filters arranged in the housing and a fan; and a control unit to control the operation of the filter module.
- [20] The housing may include a front housing having the air inlet formed therein; a rear housing coupled to the front housing, having the air outlet formed therein to arrange the fan; and a front panel arranged in a front of the front housing.
- [21] The plurality of the sterilization filters may be configured of first to third sterilization filters arranged along the air outlet from the air inlet sequentially, and the size of mesh may be getting smaller from the first sterilization filter to the third sterilization filter.
- [22] The third sterilization filter may have a zebra pattern.
- [23] Leuconostoc enzyme may be coated on at least one of the sterilization filters.
- [24] A protein activity inhibitor may be further coated on the at least one sterilization filters.
- [25] The filter module may further include a deodorization filter to deodorize the air having passed the sterilization filters.
- [26] The filter module may further include an anti-allergen filter.
- [27] The anti-allergen filter may include at least one selected from a group composed of activated carbon (charcoal), silver (Au), allercatcher fiber, co-phthalocyanine and Fe-phthalocyanine.
- [28] The activated carbon may be T-SCOB, T-E or T-TS impregnated charcoal.
- [29] The case may include an inner case having the storage room provided therein and an outer case defining an exterior appearance of the refrigerator, and a cold air duct arranged in a space between the inner case and the outer case to supply cold air to the storage room and a multi duct comprising a plurality of outlets to draw the sterilized air exhausted from the filter module therein and to transport the drawn sterilized air to the storage room may be provided in the case.
- [30] A passing hole may be provided in the inner case, corresponding to the outlet of the multi duct, and the sterilized air may be drawn into the inner case via the passing hole.
- [31] The inner case may be partitioned into a plurality of storage sections, and at least one passing hole may be provided in each of the storage sections.
- [32] The cold duct and the multi duct may be connected with each other partially, and cold air and sterilized air may be supplied to the storage room together.
- [33] The control unit may drive the filter module for a preset time period, when a preset

integrated time of the compressor passes.

- [34] The control unit may drive the filter module for a first time period and stop the filter module for a second time period, and the control unit may repeat the driving and stopping of the filter module multiple times.
- [35] The integrated time of the compressor may be 5 hours and the first time period may be 10 minutes and the second time period may be 5 minutes.
- [36] The control unit may drive the filter module for a preset time period when the door is closed based on opening and closing of the door.
- [37] The control unit may drive the filter module for a preset time period when the door is closed based on at least one of a frequency of door opening/closing and a door opening time.
- [38] The control unit may stop the driving of the filter module when the door is opened during the driving of the filter module.
- [39] The control unit may stop the driving of the filter module when a defrost operation starts during the driving of the filter module.
- [40] In another aspect of the present invention, a refrigerator includes a case comprising at least one storage room provided therein for low temperature storage; a compressor provided in the case, to compress refrigerant; at least one door to open and close the storage room selectively; a filter module comprising at least one UV lighting source to irradiate an ultraviolet light toward air inside the storage room and a photocatalyst filter to filter the air having the UV light irradiated thereto; and a control unit to control the operation of the filter module.
- [41] Titanium may be coated on the photocatalyst filter.
- [42] The filter module may include a housing arranged in the storage room, with an air inlet and an air outlet formed therein, and a fan arranged adjacent to the air outlet of the housing, and the UV lighting source may be arranged adjacent to the air inlet within the housing and the photocatalyst filter may be arranged adjacent to the air outlet within the housing.
- [43] The case may include an inner case having the storage room provided therein and an outer case defining an exterior appearance of the refrigerator, and a cold air duct arranged in a space between the inner case and the outer case to supply cold air to the storage room and a multi duct comprising a plurality of outlets to draw the sterilized air exhausted from the filter module therein and to transport the drawn sterilized air to the storage room may be provided in the case.
- [44] A passing hole may be provided in the inner case, corresponding to the outlet of the multi duct, and the sterilized air may be drawn into the inner case via the passing hole.
- [45] The inner case may be partitioned into a plurality of storage sections, and at least one passing hole may be provided in each of the storage sections.

- [46] The UV lighting source may be operated based on at least one of a light emission duration time, a light emission intensity and a light emission period that are memorized in the control unit.
- [47] The UV lighting source may be operated based on at least one of a door opening status and temperature change of the storage room.
- [48] The filter module may further include an anti-allergen filter.
- [49] The anti-allergen filter may include at least one selected from a group composed of activated carbon (charcoal), silver (Au), allercatcher fiber, co-phthalocyanine and Fe-phthalocyanine.
- [50] In a further aspect of the present invention, a refrigerator includes a case comprising an inner case having the storage room provided therein and an outer case defining an exterior appearance thereof; a sensor unit to detect a contamination source inside the storage room; at least one door to open and close the storage room selectively; a multi duct arranged between the inner case and the outer case, to flow air inside the inner case therein; a filter module provided in the multi duct, the filter module comprising a steam generation unit to spray high-temperature steam toward the air drawn into the multi duct and a fan to adjust air flow inside the multi duct; and a control unit to control the operation of the filter module based on the result of the detection performed by the sensor unit.
- [51] The sensor unit may include at least one of a bio-sensor to detect a specific bacteria contaminant and a gas sensor to detect an offensive smell factor.
- [52] The sensor unit may include a camera unit arranged in the storage room, to detect and visualize an image of a stored food, and the control unit may determine spoiling of the stored food based on a difference between an image of the stored food pre-memorized therein and the image of the stored food detected by the camera unit.
- [53] The refrigerator may further include a display part provided in a door, to image surface temperature distribution of the stored food visualized by the camera unit and to display the imaged surface temperature distribution to the user.
- [54] The display part may display the spoiling of the stored food determined by the control unit to the user.
- [55] The camera unit may detect at least one of a temperature, a color and a shape of the stored food.
- [56] The control unit may increase cooling load of the storage room for a preset time period after steam spraying is complete.
- [57] The refrigerator may further include a display part to display a contamination status of the storage room detected by the sensor unit to the user.
- [58] The sensor unit may include a weight sensor to recognize weight change of the stored food.

Advantageous Effects of Invention

- [59] As mentioned above, according to the refrigerator relating to at least one embodiment, the foods stored in the storage room and air inside the storage room can be sterilized effectively. Also, the storage room can be maintained clean.
- [60] Furthermore, according to the refrigerator relating to at least one embodiment, the plurality of the storage rooms can be maintained clean by the sterilization passage independently separated from the cold air passage.
- [61] Still further, according to the refrigerator relating to at least one embodiment, the storage room can be sterilized and deodorized. In addition, remains of dead bacteria can be self-discomposed.
- [62] Still further according to the refrigerator relating to at least one embodiment, allergens that are allergy generation factors can be removed from the inside of the storage room. Because of that, the storage room can be managed more sanitarily and freshness of the stored foods can be kept.
- [63] Still further, according to the refrigerator relating to at least one embodiment, the sterilization can be selectively performed based on the food introduction, the internal temperature change or the usage. Because of that, power consumption may be reduced.
- [64] Still further, according to the refrigerator relating to at least one embodiment, the kinds and amount or the smell factor of bacteria located in the storage room can be detected and the detected information can be displayed to the user.
- [65] Still further, according to the refrigerator relating to at least one embodiment, image information relating to the shape or the temperature distribution of the specific food can be acquired and freshness of the food may be figured out, to display the freshness of the food to the user.

Brief Description of Drawings

- [66] The accompanying drawings, which are included to provide further understanding of the disclosure and are incorporated in and constitute a part of this application, illustrate embodiments of the disclosure and together with the description serve to explain the principle of the disclosure and in the drawings:
- [67] FIG. 1 is a perspective view illustrating a door of a refrigerator according to an embodiment, which is open partially;
- [68] FIG. 2 is a perspective view illustrating key parts composing the refrigerator according to the embodiment;
- [69] FIG. 3 is a conceptual diagram illustrating an example of an operation status of a filter module composing a refrigerator according to the embodiment;
- [70] FIG. 4 is a conceptual diagram illustrating another example of the operation status of the filter module composing the refrigerator according to the embodiment;

- [71] FIG. 5 is a front view illustrating the key parts of the refrigerator according to the embodiment;
- [72] FIGS. 6 and 7 are conceptual diagrams illustrating a multi duct of the refrigerator according to the embodiment;
- [73] FIGS. 8 and 9 are conceptual diagrams illustrating an example of an operation status of a filter module and a multi duct;
- [74] FIG. 10 is a block view of the refrigerator according to the embodiment;
- [75] FIG. 11 is a diagram illustrating a control method of the refrigerator according to the embodiment;
- [76] FIGS. 12 and 13 are graphs illustrating an effect of the filter module composing the refrigerator according to the embodiment;
- [77] FIG. 14 is a photograph taken to illustrate the effect of the filter module composing the refrigerator according to the embodiment;
- [78] FIG. 15 is a graph illustrating the effect of the filter module composing the refrigerator according to the embodiment;
- [79] FIG. 16 is a conceptual diagram illustrating a filter module composing a refrigerator according to another embodiment;
- [80] FIG. 17 is a plane view illustrating the filter module and the multi duct shown in FIG. 16;
- [81] FIG. 18 is a perspective view illustrating a door of a refrigerator according to a further embodiment, which is open partially;
- [82] FIG. 19 is a block view illustrating the refrigerator according to the embodiment of FIG. 18;
- [83] FIG. 20 is a plane view illustrating a filter module and a multi duct which compose the refrigerator according to the embodiment of FIG. 18;
- [84] FIG 21 is a perspective view illustrating key parts of a camera unit composing the refrigerator according to the embodiment of FIG. 18; and
- [85] FIGS. 22 to 25 are photographs taken to illustrate an example of an operation status of the camera unit shown in FIG. 21.

Best Mode for Carrying out the Invention

- [86] As follows, a refrigerator according to an exemplary embodiment of the present invention will be described in detail in reference to the accompanying drawings. The accompanying drawings illustrate examples of the present invention and they are provided to explain the present invention in more detail. However, the scope of the present invention is not limited by the drawings.
- [87] Regardless of numeral references, the same reference numbers will be used throughout the drawings to refer to the same or like parts and repeated description will

be omitted. The size and appearance of each element shown in the drawings may be exaggerated or shrunk.

[88] In the meanwhile, the terms including ordinal numbers such as 'first' and 'second' used in the specification may be used to explain a variety of elements and the elements are not limited by the terms. The terms are used only for distinguishing one of the elements from the other.

[89] FIG. 1 is a perspective view illustrating a door of a refrigerator according to an embodiment of the present invention, which is open partially. FIG. 2 is a perspective view illustrating key parts composing the refrigerator according to the embodiment of the present invention.

[90] The refrigerator 1 according to the embodiment of the present invention may be applicable various types of refrigerators, for example, a traditional top freezer type refrigerator, a side by side type refrigerator or a bottom freezer type refrigerator. More specifically, the refrigerator may be a refrigerator including a case 10 having at least one storage room formed therein for low temperature storage and at least one door 20 and 30 rotatably coupled to the case 10 to open and close the storage room selectively.

[91] As follows, the side by side type refrigerator used broadly in recent will be embodied which includes freezer and refrigerator compartments located side by side, with being selectively closed by doors provided respectively, for explanation convenience.

[92] The refrigerator 1 may include a case 10 having at least one storage room for low temperature storage, a compressor (not shown) provided in the case 10 to compress refrigerant, at least one door 20 and 30 rotatably coupled to the case 10 to open and close the storage room, a filter module 100 mounted in the storage room of the case 10 and a control unit (not shown) configured to control the operation of the filter module 100.

[93] In reference to FIGS. 1 and 2, the refrigerator 1 according to the embodiment may include the case 10 capable of providing a room in which foods and food containers may be stored at a relatively low temperature and an exterior appearance of the refrigerator. The case 10 may have an approximately cube shape, with an open front to receive foods and food containers there through.

[94] The case 10 of the refrigerator 1 may include an outer case 12 and at least one inner case 11 capable of providing a storage room to freeze or refrigerate foods.

[95] In reference to FIG. 2, a cold air duct 60 may be arranged between the inner case 11 and the outer case 12 to supply cold air to the inside of the storage room 40.

[96] The at least one door 20 and 30 may be rotatably coupled to the open front of the case 10 to open and close the open front of the case 10 selectively. FIG. 1 illustrates the side by side type refrigerator which includes a first door 20 and a second door 30 coupled to the case 10 to open and close a left storage room (50, see FIG. 7) and a right storage room 40, respectively.

- [97] In recent, various functions may be added to the refrigerator 1 to make a user use the refrigerator 1 conveniently. To realize the functions, a dispenser 21 and a home bar 31 may be further provided in the doors 20 and 30. The user may keep and store a predetermined amount of food or food containers in the home bar 31 and he or she may get purified water or ice from the dispenser 21 outside.
- [98] At least one basket 33 may be arranged in a rear surface of the door 30.
- [99] Also, in case of the side by side type refrigerator 10, an internal space of the case 10 may be partitioned into a left room and a right room. Commonly, the left room is employed as a freezer compartment (50, see FIG. 7) storing foods and food containers below zero temperatures and the right room is employed as a refrigerator compartment 40 storing foods and food containers above zero temperatures.
- [100] The freezer compartment 50 may freeze the foods stored therein below the zero temperatures and it is used to store the foods for a relatively long time period. The refrigerator compartment 40 maintains the temperature lower than room temperature and it is used to store the foods fresh.
- [101] A plurality of shelves 51 and 41 may be provided in the freezer compartment (50, see FIG. 7) and the refrigerator compartment 40. The foods and the food containers may be placed on the plurality of the shelves 51 and 41. Because of the shelves 51 and 41, internal rooms of the freezer and refrigerator compartments may be partitioned into a plurality of layered spaces. Also, at least one drawer 52 and 42 may be further provided in the freezer compartment (50, see FIG. 7) and the refrigerator compartment 40 to receive foods such as fruit or vegetables.
- [102] In such the refrigerator 1 may be stored fruit and vegetables, meats, fish, a variety of food materials and related cooking. The plurality of the storage spaces may be formed in the case 10 by the shelves and drawers. Because of that, separate storage for each kind of the foods may be possible.
- [103] For example, a single drawer 42 that is one of the drawers provided in the refrigerator compartment 40 may be used as storage space for fruit and/or vegetables. Another drawer may be used as storage space for meats or fish. The other drawer 32 provided in the rear surface of the door 30 may be used as storage space for grains such as rice, beans or adzuki beans.
- [104] FIG. 3 is a conceptual diagram illustrating an example of an operation status of a filter module composing a refrigerator according to the embodiment. FIG. 4 is a conceptual diagram illustrating another example of the operation status of the filter module composing the refrigerator according to the embodiment. FIG. 5 is a front view illustrating the key parts of the refrigerator according to the embodiment.
- [105] Also, FIGS. 6 and 7 are conceptual diagrams illustrating a multi duct of the refrigerator according to the embodiment. FIGS. 8 and 9 are conceptual diagrams il-

lustrating an example of an operation status of a filter module and a multi duct.

- [106] The filter module 100 may include a housing 110 having an air inlet (not shown) and an air outlet (not shown), a plurality of sterilization filters 120 arranged in the housing 110 and a fan 130 for sucking air inside the storage space into the filter module 100 and for exhausting the sterilized air outside the housing 110.
- [107] The housing 110 may have various appearances and structures. According to an example in reference to FIG. 2, the housing 100 may include a front housing 111 having the air inlet formed therein, a rear housing 113 having the air outlet formed therein, with being coupled to a rear side of the front housing 111 to arrange the fan 130 therein, and a front panel 112 coupled to a front of the front housing 111.
- [108] Under such a structure, air inside the storage room 40 may be sucked via a gap formed between the front panel 112 and the front housing 111. The sucked air may reach the sterilization filter 120 via the air inlet formed in the front housing 111.
- [109] In addition, the sterilization filter 120 may be detachably arranged in the housing, with a replaceable structure.
- [110] Also, a slit plate 140 may be arranged in the filter module 110 to guide air flow between the sterilization filters 120 and the fan 130.
- [111] In reference to FIG. 3, the sterilization filters 120 may be composed of a first sterilization filter 121, a second sterilization filter 122 and a third sterilization filter 123 that are arranged from the air inlet toward the air outlet of the housing 110 sequentially. The first to third sterilization filters 121, 122 and 123 may perform three steps of sterilization.
- [112] Here, the size of mesh may be getting smaller from the first sterilization filter 121 toward the third sterilization filter 123. For example, the first sterilization filter 121 may have a mesh with a size of approximately $100\mu\text{m}$ or more. The second sterilization filter 122 may have a mesh with a size of approximately $5\mu\text{m}$ or more and the third sterilization filter 123 may have a mesh with a size of approximately $2.5\mu\text{m}$.
- [113] In addition, the filter module 100 may include a deodorization filter 124 used to deodorize the air having passed the sterilization filters 121 to 123.
- [114] The filter module 100 having the structure mentioned above may keep the air inside the storage room 40 clean by using the three steps of sterilization and the single step of deodorization.
- [115] Leuconostoc enzymes may be coated on at least one of the sterilization filters 121 to 124. The leuconostoc enzyme is a kind of Kimchi's lactic enzyme and it is highly effective in sterilization.
- [116] Also, protein activity inhibitor may be additionally coated on the sterilization filters 121 to 124 and the sterilization filters 121 to 124 may include an organic/inorganic binder and water. Preferably, a compound of Kimchi's lactic enzyme extract and

protein activity inhibitor may be coated on the sterilization filters 121 to 124.

[117] The third sterilization filter 123 may have a zebra pattern (not shown) to increase a coating area of the enzymes.

[118] In the meanwhile, the filter module 100 may further include an anti-allergen filter.

[119] In reference to FIG. 4, a filter module 150 shown in FIG. 4 may include a housing 151 having an air inlet and an air outlet formed therein, a filter box 160 detachably held in the 151 and a fan (not shown) arranged in the housing 151.

[120] The filter module 150 shown in FIG. 4 may be integrally formed with the housing, which is a different characteristic, in comparison with the filter module 100 mentioned above.

[121] Also, the filter box 160 may include a plurality of sterilization filters 161 and 162, an anti-allergen filter 163 and a deodorization filter 164 which are the same as mentioned above.

[122] The anti-allergen filter 163 may include at least one selected from a group composed of activated carbon (charcoal), silver (Au), allercatcher fiber, co-phthalocyanine and Fe- phthalocyanine. The activated carbon may be T-SCOB impregnated charcoal having encapsulated silver, T-E impregnated charcoal to selectively soak ethylene or T-TS impregnated charcoal to selectively soak aldehyde that is generated from Doenjang or fermented foods.

[123] Such the anti-allergen filter 163 may perform a function of removing allergens located in the storage room 40.

[124] An object of the embodiments may be to provide a refrigerator that is able to maintain the plurality of the storage rooms via the auxiliary sterilization passage independent from the cold air passage.

[125] In reference to FIGS. 2 and 5 to 7, in the case 10 may be arranged the cold air duct 60 configured to supply cold air to the storage room 40, located in a predetermined space formed between the inner case 11 and the outer case 12 and a multi-duct 70 that draws the sterilized air from the filter module 100 therein, with a plurality of outlets 71 to transport the drawn sterilized-air to the storage room 40.

[126] In reference to FIG. 5, an opening 11a may be formed in the inner 11 case to arrange the filter module 100 therein and a cold air supply hole 11b may be formed in the inner case 11 to supply cold air to the storage room. Also, a passing hole 11c may be provided in the inner case to supply the sterilized-air to the storage room via the multi duct 70.

[127] The passing hole 11c may be located at a position corresponding to the outlet 71 of the multi duct 70 and the sterilized air may be drawn into the inner case 11 via the passing hole 11c.

[128] Specifically, the air drawn into the filter module 100 from the storage room via the

air inlet of the housing may be sterilized and deodorized while passing the sterilization filters and the deodorization filter. The sterilized air may be drawn into the multi-duct 70 along the opening 11a of the inner case, after passing the air outlet of the housing 110.

[129] Hence, the sterilized air flowing inside the multi duct 70 passes the outlet 71 of the multi duct 70, the passing hole 11c of the inner case 11 sequentially, to be supplied to the storage room.

[130] In the meanwhile, the cold air duct 60 may be formed to surround the multi duct 70 to make better use of a space formed between the inner case and the outer case 12.

[131] Also, in reference to FIG. 6 (b), a longitudinal end (Z1) of the multi duct 70 may be connected with the cold air duct 60, to draw the sterilized air into the inner case 11 together with the cold air. In reference to FIG. 7, a longitudinal end (Z2) of the multi duct 70 may be separated from the cold air duct 60, to draw the sterilized air into the inner case separate from the cold air.

[132] In reference to FIG. 8, inner spaces 40 and 50 of the inner case may be partitioned into a plurality of storage sections 40-1 to 40-3 by the shelves 41 and 51. The filter module 100 may be arranged in a specific area (A to R) of each storage section.

[133] As mentioned above, when the filter module 100 is arranged in a specific area of one of the storage sections (for example, 40-2), the sterilized air may be supplied to storage sections 40-1 and 40-3 via the multi duct 70 mentioned above.

[134] Also, at least one outlet 71 of the multi duct 70 and at least one passing hole 11c of the inner case 11 may be provided in each of the storage sections 40-1 to 40-3.

[135] In reference to FIG. 6 (b), the cold air duct 60 and the multi duct 70 may be connected with each other at some area (Z1). Under this structure, the cold air and the sterilized air may be supplied to the storage room together.

[136] So far, it is described that the sterilized air exhausted from the filter module 100 may be supplied to the neighboring storage sections (40-1 to 40-3) via the multi duct 70. However, different from that, in reference to FIG. 9, an air path may be formed in a front surface or a side surface of the filter module and the sterilized air may be then circulated into the storage sections directly, not via the multi duct 70.

[137] It is shown in FIG. 9 that the sterilized air may be exhausted via a front surface of the filter unit 100, with air inside the storage sections being drawn into the filter unit 100 via at least one of side surfaces of the filter unit 100. Also, it is shown that the sterilized air is exhausted via at least one of the side surfaces of the filter unit 100, with the air inside the storage room being drawn via the front surface of the filter unit 100. However, the present invention is not limited thereby and the filter unit 100 may be arranged, spaced apart a proper distance from an inner circumferential surface of the inner case.

- [138] According to an example, the air inside the storage may be drawn via the front surface of the filter unit 100 under the structure and the sterilized air may be exhausted via the space between the filter unit 100 and the inner case 11.
- [139] FIG. 10 is a block view of the refrigerator according to the embodiment. FIG. 11 is a diagram illustrating a control method of the refrigerator according to the embodiment. FIGS. 12 and 13 are graphs illustrating an effect of the filter module composing the refrigerator according to the embodiment. FIG. 14 is a photograph taken to illustrate the effect of the filter module composing the refrigerator according to the embodiment. FIG. 15 is a graph illustrating the effect of the filter module composing the refrigerator according to the embodiment.
- [140] FIG. 11 is a block view illustrating key parts of a control unit composing the refrigerator relating to the embodiment.
- [141] The refrigerator 1 relating to the embodiment may include a control unit 80 configured to control the operation of the filter module 100. The control unit 80 may be a central control unit to control an overall operation of the refrigerator or a local control unit to control only the operation of the filter module 100.
- [142] The control unit 80 may include an input part 81 to input a control command such as on/off and an operational mode of the filter module 100 and a display part 82 to display to the user a status of the storage room, an operational status of the filter module 100 or a replacement cycle of the filter module 100.
- [143] In addition, the input part 81 may include a refrigerator compartment temperature adjusting part, a freezer compartment temperature adjusting part and a special storage room temperature adjusting part. Also, the input part 81 may include an operational mode selecting part and a lock setting/unlock inputting part for each storage room.
- [144] The refrigerator 1 may include various sensors to acquire information on a status of the storage room 40. For example, it may include a temperature sensor 83 to measure a temperature of either of the storage rooms 40 and 50 and a door sensor 84 to determine whether to open the doors 20 and 30.
- [145] The status information of the storage room 40 may include at least one of operation mode information, operation temperature information, door opening information, lock-setting information and abnormal status information.
- [146] Specifically, the display part 82 may display an operation temperature for a specific storage section requiring special treatment (for example, a drawer and a storage box), together with an operation temperature for each of the refrigerator and freezer compartments.
- [147] The operation mode of the filter module 100 may include a manual mode in which the user inputs on/off selectively if necessary and an auto-mode in which on/off is implemented based on a preset operation condition automatically.

- [148] Operation conditions of the auto-mode may be preset based on an integrated time of the compressor, a frequency and/or a time of door opening.
- [149] According to one of examples, the control unit 80 may operate the filter module 100 for a predetermined time period, once a preset integrated time of the compressor passes.
- [150] Here, the control unit 80 may control the filter module to be on for a first time period and to be off for a second time period. The control unit 80 may repeat the on and off of the filter module multiple times. For example, the integrated time of the compressor may be approximately 5 hours. The first time period may be approximately 10 minutes and the second time period may be approximately 5 minutes.
- [151] Alternatively, the control unit 80 may control the filter module 100 to be driven for a preset time period based on opening and closing of the door 20, in other words, when the door 20 is opened and closed. The control unit 80 may control the filter module 100 to be driven for the preset time period when the door is closed, based on at least one of the opening/closing frequency of the door and the opening time of the door.
- [152] In other words, when the door is closed after opened, it may be likely that food storage is performed and external air may be drawn into the storage room. Because of that, sterilization may be performed by using the filter module 100.
- [153] In reference to FIG. 11, an example will be described in detail that the filter module 100 is driven by the control unit 80 in an auto-mode according to an example.
- [154] First of all, considering the user's use status, the frequency and time of the door opening may increase in breakfast/lunch/dinner hours and the operation conditions of the filter module 100 may be determined based on such actual use cycle.
- [155] Also, an operation period of the compressor may be determined based on the actual use cycle mentioned above. The compressor may be driven for an approximately 8 hour period three times a day. The compressor may be stopped to operate for 3 hours after driven for integrated (accumulative) 5 hours.
- [156] Here, the filter module 100 may be driven three times at intervals of approximately 8 hours according to the operation period of the compressor. In other words, when the filter module 100 may be automatically driven for approximately 2 (integrated) hours by the control unit 80, when the integrated time of the compressor is 5 hours. At this time, the filter module 100 may be operated for approximately 2 hours (8 times), with repeating the driving for 10 minutes before stopping for 5 minutes.
- [157] Alternatively, the filter module 100 may be operated in a power mode when a much amount of foods are stored in the storage room or strong sterilization is required. According to an example, the filter module may be operated for about 4 hours (16 times), with repeating the driving for 10 minutes and stopping for 5 minutes (one time).

- [158] In the meanwhile, the control unit 80 may stop the driving of the filter module, when the door is opened during the driving of the filter module 100, and it may drive the filter module 100 for the remaining time with the remaining frequency after the door is closed.
- [159] When a defrost operation starts during the driving of the filter module 100, the control unit 80 may stop the driving of the filter module. The control unit 80 may drive the filter module 100 for the remaining time with the remaining frequency after the defrost operation finishes.
- [160] FIGS. 12 and 13 are graphs to describe a sterilization effect of the refrigerator 1 relating to the embodiment. (a) of FIGS. 12 and 13 illustrate experimental data, targeted at chicken and (b) of FIGS. 12 and 13 illustrate experimental data, targeted at beef.
- [161] In reference to FIG. 12, “R1” and “R2” refer to the viable microbe cell number according to passage of days when the filter module 200 is not applied. “L1” and “L2” refer to the viable microbe cell number according to passage of days when the filter module 100 is applied.
- [162] In reference to (a) of FIG. 12, approximately 32% of the viable microbe cell number may be decreased after 14 days when the filter module 100 is applied. In reference to (b) of FIG. 12, approximately 91% of the viable microbe cell number may be decreased after 14 days when the filter module 100 is applied.
- [163] In reference to FIG. 13, “R3” and “R4” refer to the viable microbe cell number according to passage of days when the compound of kimchi lactobacillus extract and protein activity inhibitor is not coated on the filter module 100. “L3” and “L4” refer to the viable microbe cell number according to passage of days when the compound of kimchi lactobacillus extract and protein activity inhibitor is coated on the filter module 100.
- [164] Also, in reference to (a) of FIG. 13, it is shown that approximately 49% of the viable microbe cell number is decreased after 2 days, when the compound of kimchi lactobacillus extract and protein activity inhibitor is coated on the filter module 100. In reference to (b) of FIG. 13, it is shown that approximately 23% of the viable microbe cell number is decreased after 3 days, when the compound of kimchi lactobacillus extract and protein activity inhibitor is coated on the filter module 100.
- [165] In reference to FIG. 14, (a) of FIG. 14 is a photograph of an air sample collected after being forcibly circulated by the fan, with spraying bacteria, when the filter module 100 is not applied to a preset experiment chamber, and (b) of FIG. 14 is a photograph of an air sample collected after forcibly circulated to pass the filter module 100 by the fan, with spraying bacteria, when the filter module 100 is applied to a preset experiment chamber.

- [166] According to the photographs, it is shown that approximately 99.8% of the bacteria are reduced when the filter module 100 is applied.
- [167] FIG. 15 is graphs illustrating decrease of contaminants when the filter module 100 is operated after arranged in a storage room of a refrigerator.
- [168] (a) Of FIG. 15 illustrates an effect in case of performing an experiment that uses microbial medium and it is shown that approximately 37% of microbes are decreased. (b) of FIG. 15 illustrates an effect in case of performing an experiment that uses chopped chicken and it is shown that approximately 25% of microbes are decreased.
- [169] Also, experimental data for a decreasing rate of various microbes in case of using the filter module 100 will as follows:
- [170] Table 1
- [Table 1]

Experiment Method	Protocol	Experiment Environment	Microbe	Decreasing Rate			
				0 min.	15 min.	30 min.	60 min.
Shaking flask	ASTME2 149-01	35%	E. coliATCC 11229	65.57%	99.98%	>99.98%	>99.99%
			S. aureusATCC 6538	25%	91.25%	99.42%	>99.99%
			S. enteriaATCC 13311	>99.95%	>99.99%	>99.99%	>99.99%
			L. monocytogenesATCC 19114	63.13%	60.71%	>99.99%	>99.99%
Shaking Flask	ASTME2 149-01	3%	E. coliATCC 11229	21.43%	7.41%	71.07%	92.86%
			S. aureusATCC 6538		>99.99%	37.04%	69.26%
			S. enteriaATCC 13311	99.79%	21.05%	>99.99%	>99.99%
			L. monocytogenesATCC 19114	10.53%	21.05%	26.32%	76.84%

[171]

[172] Table 2

[Table 2]

Experiment Method	Protocol	Experiment Environment	Microbe	Decreasing Rate(After 24 hours)
Shaking flask	FITIFC-TM-19	35%	E. coliATCC 11229	>99.99%
			S. aureusATCC 6538	>99.99%
			S. enteriaATCC 13311	>99.99%
			L. monocytogenesATCC 19114	>99.99%
			Feline caliciviruses	>99.99%

[173] Table 3

[Table 3]

Experiment Method	Protocol	Experiment Environment	Microbe	Decreasing Rate(After 24 hours)
Shaking flask	FITIFC-TM-19	4%	E. coliATCC 11229	>99.99%
			S. aureusATCC 6538	88.70%
			L. monocytogenesATCC 19114	94.20%

[174] As mentioned above, according to the refrigerator relating to at least one embodiment, the foods stored in the storage room and air inside the storage room may be sterilized effectively, only to keep the storage room clean.

[175] FIG. 16 is a conceptual diagram illustrating a filter module composing a refrigerator according to another embodiment. FIG. 17 is a plane view illustrating the filter module

and the multi duct shown in FIG. 16.

- [176] The refrigerator according to this embodiment may include a case having at least one storage room for low temperature storage, a compressor provided in the case to compress refrigerant, at least one door to open and close the storage room, a filter module 200 having at least one UV lighting source 21 to irradiate UV lights toward the storage room and a photocatalyst filter 220 to filter the air having the UV irradiated thereto, and a control unit to control the operation of the filter module 200.
- [177] The refrigerator according to this embodiment is the same as the refrigerator according to the embodiment mentioned above, except the filter module. As follows, the filter module that is the only difference will be described in detail and description of the other repeated components will be omitted accordingly.
- [178] Titanium may be coated on the photocatalyst filter 220.
- [179] In reference to FIG. 16, the UV lighting source 210 may irradiate UV lights toward the air inside the storage room. Once bacteria contained in the air is dead because of the UV, remnants of the dead bacteria may decompose because of the titanium-coated photocatalyst filter 220. As a result, the filter module 200 may have a remnants-removing effect as well as the sterilization effect.
- [180] Also, the filter module 200 may further include an anti-allergen filter and the anti-allergen filter is the same as described above.
- [181] In the meanwhile, the filter module 200 may have various structures. According to an example of the structures, the filter module 200 may include a housing (not shown) having an air inlet and an air outlet formed therein and a fan 230 arranged adjacent to the air outlet of the housing. The UV lighting source 210 may be arranged adjacent to the air inlet inside the housing and the photocatalyst filter 220 may be arranged adjacent to the air outlet inside the housing.
- [182] As it is the same as the refrigerator mentioned above in reference to FIGS. 2 to 6, the case of the refrigerator may include an inner case that defines the storage room and an outer case that defines an exterior appearance of the refrigerator. A cold air duct and a multi duct 70 may be provided in a predetermined space formed between the inner case and the outer case to provide cold air to the storage room and to provide a passage for sterilization, respectively.
- [183] In reference to FIG. 17, the filter module 200 may be arranged in the multi duct 70. In this case, an inlet 72 to draw air inside the storage room therein and an outlet 71 to exhaust the sterilized air to the storage room may be provided in the multi duct 70.
- [184] According to an example, the plurality of the UV lighting sources 210 may be arranged in an inner circumferential surface of the multi duct 70, spaced apart a proper distance from each other, to irradiate UV lights toward the air. A fan 230 may be arranged in the multi duct 70.

- [185] Also, a passing hole may be provided in the inner case, corresponding to the outlet 71 of the multi duct 70. The sterilized air may be drawn into the inner case via the passing hole.
- [186] As mentioned above, the inner case may be partitioned into a plurality of storage sections. At least one passing hole of the inner case may be provided for each of the storage sections.
- [187] In other words, the sterilized air may be supplied to each of the storage sections via the multi duct 70 as mentioned above.
- [188] In the meanwhile, the UV lighting sources 210 may be operated based on at least one of a light emitting time, a light emission intensity and a light emission period that are stored in the control unit. The UV lighting sources 210 may be operated based on at least one of an opening status of the door and change of temperatures inside the storage room.
- [189] Also, the control unit may include an input part to input control commands such as On and Off of the UV lighting sources, the light emission duration time, the light emission intensity (for example, strong, middle and weak) and the light emission period and a display part to display a status of the storage room.
- [190] In addition, the input part may include a refrigerator compartment temperature adjusting part, a freezer compartment temperature adjusting part and a special storage room temperature adjusting part. Also, the input part may include an operational mode selecting part and a lock setting/unlock inputting part for each storage room.
- [191] The status information of the storage room may include at least one of operation mode information, operation temperature information, door opening information, lock-setting information and abnormal status information.
- [192] Specifically, the display part may display an operation temperature for a specific storage section requiring special treatment (for example, a drawer and a storage box), together with an operation temperature for each of the refrigerator and freezer compartments.
- [193] Also, the display part may be a liquid crystal display and it may be configured of a plurality of light emitting diodes (LED) capable of displaying numbers, characters and various symbols.
- [194] The UV lighting source 210 may be operated based on at least one of the light emission duration time, the light emission intensity (for example, strong, middle and weak) and the light emission period that are stored in the control unit.
- [195] The light emission duration time, the light emission intensity and the light emission period may be preset by the user, such that the UV lighting sources 210 may be controlled by the control unit constantly (auto-mode). Alternatively, they are input by the user at the time when he or she desires to drive the UV lighting sources 210, such

that the UV lighting source 210 may be controlled intermittently (manual-mode).

[196] Here, the control unit may control the operation of the UV lighting source 210 based on temperature change inside the storage room. According to an example, when the temperature of the storage room is a predetermined reference value or more, the control unit may operate the UV lighting source 210 for a preset time period.

[197] The reference value may be determined based on a result of experiments, for example, 2°C to 6°C and it may be approximately 3°C. When the temperature change inside the storage room is the reference value or more, the control unit may expect that the foods stored in the storage room could be contaminated and it may then operate the UV lighting sources 210.

[198] The control unit may control the operation of the UV lighting source based on an opening status of the door, an opening frequency of the door or an opening time of the door. For example, the control unit may operate the UV lighting source 210 for a preset time period after the door is opened and closed and it may not operate the UV lighting source 21 until the door is open and closed next time.

[199] In other words, there might be concern of contamination that can occur to the foods contained in the storage room when a new food is accommodated in the storage room. Because of that, the control unit may control the operation of the UV lighting source 210 based on the status of the door opening, the frequency of the door opening or the duration time of the door opening.

[200] In the meanwhile, so far, the embodiment that the operation of the UV lighting source 210 is controlled based on the status of the door opening or temperature change inside the storage room is described but the present invention is not limited thereby. The operation of the UV lighting source 210 may be controlled based on both of the door opening status and the storage room temperature change.

[201] For example, when the temperature inside the storage room is increased up to a reference value or more after the door is open and closed, the control unit may operate the UV lighting source 210 for a preset time period. Until the temperature inside the storage room is increased up to the reference value or more after the door is open and closed next time, the control unit may not operate the UV lighting source 210.

[202] In the meanwhile, when the UV lighting source 210 is operated in the refrigerator constantly, plastic material inside the refrigerator (an inner circumferential surface of the storage room and a food container) might be discolored even after the sterilization. Because of that, a replacing interval of the plastic material happens to be fast.

[203] As a result, according to the refrigerator 1 according to the first embodiment described above, the filter module 200 may be arranged in the multi duct 70. Because of that, the discoloration generated in the inner circumferential surface of the storage room and the food container may be prevented and usage of the UV lighting source

210 may be lengthened.

- [204] Also, in case concern over contamination of the foods is expected, the sterilization may be selectively performed based on the introduction of foods or internal temperature change. Because of that, power consumption may be reduced.
- [205] FIG. 18 is a perspective view illustrating a door of a refrigerator according to a further embodiment, which is open partially. FIG. 19 is a block view illustrating the refrigerator according to the embodiment of FIG. 18. FIG. 20 is a plane view illustrating a filter module and a multi duct which compose the refrigerator according to the embodiment of FIG. 18. FIG 21 is a perspective view illustrating key parts of a camera unit composing the refrigerator according to the embodiment of FIG. 18.
- [206] A refrigerator 1 according to a further embodiment may include a case 10 having an inner case defining at least one storage room formed therein for low temperature storage of foods and an outer case defining an exterior appearance thereof, a sensor unit 510 detecting a source of contamination inside the storage room, and at least one door 20 and 30 opening and closing the storage room selectively.
- [207] Also, the refrigerator may include a multi duct 70 arranged between the inner case and the outer case to flow air inside the inner case therein, a filter module 300 having a steam generation unit 310 provided in the multi duct 70 to spray high temperature gas toward the air drawn into the multi duct 70 and a fan 320 to adjust air flow inside the multi duct 70, and a control unit 500 to control the operation of the filter module 300 based on the result of the detection performed by the sensor unit 510.
- [208] The refrigerator 1 relating to this embodiment is the same and the refrigerator according to the embodiment described in reference to FIG. 1, except the sensor unit 510 and the filter module 300. As follows, the difference will be described in detail and the other repeated description of the same components will be omitted accordingly.
- [209] The sensor unit 510 may include at least one of a bio-sensor 511 to detect a specific bacteria contaminant and a gas sensor 512 to detect an offensive smell factor.
- [210] As mentioned above, the sensor unit 510 may include a weight sensor 513 to measure the weight of the stored goods (for example, foods) seated in the storage room and a temperature sensor 514 to identify information on a status inside the storage room 40.
- [211] In addition, the refrigerator 1 may further include a microbial response viewer (MRV) system 600 that is a simulation program configured to manage microbes for each kind of foods based on the temperature, pH, humidity, Aw and the surrounding environments.
- [212] The MRV system 600 may perform a function of analyzing the kinds and amount of the bacteria detected by the bio-sensor 511.

- [213] Also, the control unit 500 may include an input part 501 to input control commands relating to the operation of the filter module such as on and off of the steam generation unit and the fan, a steam spray time, a steam intensity (for example, strong, middle and weak) and a steam spray period, and a display part 502 to display a status of the storage room.
- [214] The input part 501 may include a refrigerator compartment temperature adjusting part, a freezer compartment temperature adjusting part and a special storage room temperature adjusting part. Also, the input part may include an operational mode selecting part and a lock setting/unlock inputting part for each storage room.
- [215] The display part 502 may display an operation temperature for a specific storage section requiring special treatment (for example, a drawer and a storage box), together with an operation temperature for each of the refrigerator and freezer compartments. One of the doors (for example, the door 20) may have the display part 502 arranged in an outer circumferential surface thereof.
- [216] The bio-sensor 511 may be an optical type bio-sensor and it may be able to detect food-poisoning bacteria located in the refrigerator.
- [217] The gas sensor 512 may detect an offensive smell factor generated in the storage room 40. When the detected smell factor is a preset concentration or more, the control unit 500 may drive the filter module 300.
- [218] Also, the control unit 500 may determine the spraying time and the steam temperature of the filter module based on the kind and amount of the bacteria detected by the bio-sensor 511 and the MRV system 600.
- [219] The control unit 500 may control the display part 502 to display a contamination status inside the storage room that is detected by the sensor unit 510 to the user.
- [220] In reference to FIG. 20, the filter module 300 may be arranged in the multi duct 70. In this case, an inlet 72 to draw air inside the storage room therein and an outlet 71 to exhaust the sterilized air to the storage room may be provided in the multi duct 70.
- [221] According to an example, the plurality of the steam generating units 310 may be arranged in an inner circumferential surface of the multi duct 70, spaced apart a proper distance from each other, to spray high- temperature steam toward the air. A fan 320 may be arranged in the multi duct 70.
- [222] Also, a passing hole may be provided in the inner case, corresponding to the outlet 71 of the multi duct 70. The sterilized air may be drawn into the inner case via the passing hole.
- [223] As mentioned above, the inner case may be partitioned into a plurality of storage sections. At least one passing hole of the inner case may be provided for each of the storage sections.
- [224] In other words, the sterilized air may be supplied to each of the storage sections via

the multi duct 70 as mentioned above.

- [225] Once the steam spraying is complete, the control unit 500 may increase cooling load of the storage room for a preset time period.
- [226] In other words, when the high-temperature steam is sprayed to the cold air inside the storage room to perform the sterilization, the temperature inside the storage room may be increased and there might be concern about food spoiling, which has to be prevented in advance.
- [227] In reference to FIG. 21, the sensor unit 510 may include a camera unit 400 arranged in a storage room 42 to detect an image of the stored food to visualize the stored food. The control unit 500 may determine spoiling of the stored food based on a difference between an image of the stored food memorized in advance and the image of the stored food detected by the camera unit 400.
- [228] The camera unit 400 may detect at least one of the temperature, color and shape of the stored food.
- [229] Also, the display part 502 may image surface temperature distribution of the visualized stored food to display the imaged surface temperature distribution to the user. Also, the display part 502 may display the result of determination on the spoiling of the stored food performed by the control unit 500 to the user.
- [230] In the meanwhile, the camera unit 400 may detect and visualize images of fruit or vegetables stored in the storage room (for example, the drawer 42).
- [231] In other words, the refrigerator 1 relating to this embodiment may analyze freshness and spoiling of the stored foods nondestructively by using image processing technology. The control unit 500 may process the acquired image information and display the processed information to the user via the display part 502.
- [232] In reference to FIG. 21, according to an example, the control unit 500 may determine whether a stored apple is spoiled based on a difference among distributed surface temperatures of the apple visualized by the camera unit 400.
- [233] In other words, a surface temperature of a plant may be determined by an environmental factor and transpiration (evaporative water via stomata of a plant emits extra heat). If a plant tissue damages because of various stresses, the plant closes the stomata and the closed stomata fails to perform the transpiration.
- [234] The damaged tissue that fails to generate the transpiration may fail to emit the heat. Because of that, a surface temperature of the plant may be increased.
- [235] FIGS. 22 to 25 are photographs taken to illustrate an example of an operation status of the camera unit shown in FIG. 21.
- [236] In reference to FIGS. 22 and 23, the control unit 500 may control the camera unit 400 to visualize surface temperature distribution of fruit and vegetables stored in the storage room 42 every preset time. The control unit 500 may compare the surface tem-

peratures of the fruit and vegetables with each other. When the difference among the surface temperatures out of a preset temperature range, the control unit 500 may determine that the fruit and vegetables are spoiled.

[237] The camera unit 400 may detect an infrared light radiated from the fruit and vegetable according to active thermography and passive thermography.

[238] That is, according to the active thermograph, a heat source is supplied to an object and an infrared light radiated from the object is detected after that. According to the passive thermograph, an infrared light self-radiated from the object is detected.

[239] As a result, when the surface temperature distribution of the fruit and vegetables is visualized according to the active thermograph, a heat source part (not shown) may be provided in the storage room 42 to supply heat to the, the fruit and vegetables stored in the storage room 42. The camera unit 400 may detect an infrared light radiated from the vegetables and the fruits supplied the heat by the heat source part, to visualize the surface temperature distribution.

[240] When the surface temperature distribution of the fruit and vegetables is visualized according to the passive thermograph, the camera unit 400 may detect an infrared light self-radiated from the fruit and vegetables supplied the heat by the heat source part, to visualize the surface temperature distribution.

[241] In the meanwhile, the display part 502 provided in an outer surface of the door 20 may image surface temperature distribution of the fruit and vegetables visualized by the camera unit 400 and it may display the imaged surface temperature distribution to the user at a predetermined interval.

[242] As a result, the user may recognize a quality status of the fruit and vegetables stored currently by looking at the surface temperature distribution of the fruit and vegetables stored in the storage room 42 via the display part 502.

[243] In the meanwhile, the surface temperature distribution of the fruit and vegetables that is visualized by the camera unit 400 may be memorized in a memory part (not shown). The control unit 500 may determine the spoiling of the fruit and vegetables stored in the storage room 42 based on the difference among the distributed surface temperatures stored in the memory part.

[244] That is, when the surface temperature distribution of the fruit and vegetables measured at preset intervals is out of a preset temperature range, the control unit 500 may determine that tissues of the fruit and vegetables are damaged.

[245] In reference to FIG. 22, the fruit such as an apple may acquire a yellow color generally, to have a relatively low surface temperature distribution

[246] However, as the times passes, the tissue of the apple may be damaged and the stomata is closed. Because of that, the transpiration fails to happen and the surface temperature of the apple is increased.

- [247] In reference to FIG. 23, when the tissue of the fruit such as an apple is damaged as the time passes, the fruit may acquire a red color around the damaged tissue to have a relatively high surface temperature distribution.
- [248] In this case, the control unit 500 may compare the imaged surface temperature distribution of the apple before a preset time passes with the imaged surface temperature distribution after the preset time passes. If the difference of the surface temperature distributions is out of a preset temperature range, the control unit may determine that the tissues of the fruit and vegetables are damaged.
- [249] When determining that the tissues of the fruit and vegetables are damaged, the control unit 500 may display the spoiling of the fruit and vegetables to the user via the display part 502 and it may also display a message of consuming or discarding the fruit and vegetables.
- [250] As a result, the user can discard or consume right away when the tissues of the fruit and vegetables stored in the storage room 42 are damaged. In case the fruit and vegetables are spoiled, the spoiled fruit and vegetables may be removed from the refrigerator and generation of offensive smell may be prevented.
- [251] Also, the possibility of the user's suffering from a disease caused by eating of the spoiled fruit and vegetables may be reduced.
- [252] FIG. 24 includes photographs showing change of the shape and color possessed by the foods stored in the storage room 42 provided in the refrigerator according to this embodiment, for example, spinach and pac-choi.
- [253] In reference to FIG. 24, vegetables such as spinach and pac-choi acquires a green color generally right after stored in the storage room 42, which means that a fresh status is maintained.
- [254] However, as it passes a preset time period, tissues of the spinach and the pac-choi are damaged and the color of spinach and the pac-choi is changed because of oxidation.
- [255] In other words, as shown in lower photographs of FIG. 24, a rate of yellow color may increase around the damaged tissues and an original color thereof may fade gradually, if the tissues of the spinach and the pac-choi are damaged.
- [256] In this case, the control unit 500 may compare an imaged surface color of the spinach and pac-choi before a preset time period passes and an imaged surface color thereof after the preset time period passes. When the difference between the surface colors is out of a preset color range, the control unit 500 may determine that the tissues of the fruit and vegetables are damaged.
- [257] In reference to FIG. 25, according to another example, when meat such as pork and beef is stored in the storage room 42, an overall shape of the meat right after stored in the storage room may be maintained almost the same as a shape of an outer surface possessed by the meat.

- [258] However, as time passes, tissues of the meat may be damaged and juice may come out of the meat. Because of that, the overall outer shape of the meat may change to a surface at which the juice comes.
- [259] In this case, the control unit 500 may compare imaged shapes of the meat before and after a preset time passes with each other. When a difference between the shapes is out of a preset shape range, the control unit 500 may determine that the tissues of the meat are damaged.
- [260] Here, the user may change the preset shape range into a desired range by using the button part 220.
- [261] When determining that the tissues of the meat and the tissues of the fruit and vegetables are damaged, the control unit 500 may display to the user that juice is coming out of the meat, that the color of the fruit and vegetables is changed via the display part 502. At the same time, the control unit 500 may display a message of consuming or discarding the meat and the fruit and vegetables.
- [262] As a result, when the tissues of the meat and the fruit and vegetables stored in the storage room 42 are damaged, the user can consume or discard them immediately. Because of that, the spoiled foods can be removed from the refrigerator quickly if the foods are spoiled and offensive smell may be prevented.
- [263] Also, the possibility of the user's suffering from a disease caused by eating of the spoiled meat, fruit and vegetables may be reduced.
- [264] As described above, according to the refrigerator relating to at least one embodiment, the foods stored in the storage room and air inside the storage room can be sterilized effectively. Also, the storage room can be maintained clean.
- [265] Furthermore, according to the refrigerator relating to at least one embodiment, the plurality of the storage rooms may be maintained clean by the sterilization passage independently separated from the cold air passage.
- [266] Still further, according to the refrigerator relating to at least one embodiment, the storage room may be sterilized and deodorized. In addition, remains of dead bacteria can be self-discomposed.
- [267] Still further according to the refrigerator relating to at least one embodiment, allergens that are allergy generation factors can be removed from the inside of the storage room. Because of that, the storage room can be managed more sanitarily and freshness of the stored foods can be kept.
- [268] Still further, according to the refrigerator relating to at least one embodiment, the sterilization can be selectively performed based on the food introduction, the internal temperature change or the usage. Because of that, power consumption can be reduced.
- [269] Still further, according to the refrigerator relating to at least one embodiment, the kinds and amount or the smell factor of bacteria located in the storage room can be

detected and the detected information can be displayed to the user.

[270] Still further, according to the refrigerator relating to at least one embodiment, image information relating to the shape or the temperature distribution of the specific food can be acquired and freshness of the food can be figured out, to display the freshness of the food to the user.

[271] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

- [Claim 1] A refrigerator comprising:
a case comprising at least one storage room provided therein;
a compressor provided in the case, to compress refrigerant;
at least one door to open and close the storage room selectively;
a filter module comprising a housing disposed in the storage room, with an air inlet and an air outlet formed therein, a plurality of sterilization filters disposed in the housing and a fan; and
a control unit to control the operation of the filter module.
- [Claim 2] The refrigerator as claimed in claim 1, wherein the housing comprises, a front housing having the air inlet formed therein;
a rear housing coupled to the front housing, having the air outlet formed therein to arrange the fan; and
a front panel arranged in a front of the front housing.
- [Claim 3] The refrigerator as claimed in claim 1, wherein the plurality of the sterilization filters are configured of first to third sterilization filters arranged along the air outlet from the air inlet sequentially, and the size of mesh is getting smaller from the first sterilization filter to the third sterilization filter.
- [Claim 4] The refrigerator as claimed in claim 3, wherein the third sterilization filter has a zebra pattern.
- [Claim 5] The refrigerator as claimed in claim 3, wherein Leuconostoc enzyme is coated on at least one of the sterilization filters.
- [Claim 6] The refrigerator as claimed in claim 5, wherein a protein activity inhibitor is further coated on the at least one sterilization filters.
- [Claim 7] The refrigerator as claimed in claim 1, wherein the filter module further comprises a deodorization filter to deodorize the air having passed the sterilization filters.
- [Claim 8] The refrigerator as claimed in claim 1, wherein the filter module further comprises an anti-allergen filter.
- [Claim 9] The refrigerator as claimed in claim 8, wherein the anti-allergen filter comprises at least one selected from a group composed of activated carbon (charcoal), silver (Au), allercatcher fiber, co-phthalocyanine and Fe-phthalocyanine.
- [Claim 10] The refrigerator as claimed in claim 9, wherein the activated carbon is T-SCOB, T-E or T-TS impregnated charcoal.
- [Claim 11] The refrigerator as claimed in claim 1, wherein the case comprises an

inner case having the storage room provided therein and an outer case defining an exterior appearance of the refrigerator, and
a cold air duct arranged in a space between the inner case and the outer case to supply cold air to the storage room and a multi duct comprising a plurality of outlets to draw the sterilized air exhausted from the filter module therein and to transport the drawn sterilized air to the storage room are provided in the case.

- [Claim 12] The refrigerator as claimed in claim 11, wherein a passing hole is provided in the inner case, corresponding to the outlet of the multi duct, and
the sterilized air is drawn into the inner case via the passing hole.
- [Claim 13] The refrigerator as claimed in claim 12, wherein the inner case is partitioned into a plurality of storage sections, and
at least one passing hole is provided in each of the storage sections.
- [Claim 14] The refrigerator as claimed in claim 11, wherein the cold duct and the multi duct are connected with each other partially, and
cold air and sterilized air are supplied to the storage room together.
- [Claim 15] The refrigerator as claimed in claim 1, wherein the control unit drives the filter module for a preset time period, when a preset integrated time of the compressor passes.
- [Claim 16] The refrigerator as claimed in claim 15, wherein the control unit drives the filter module for a first time period and stops the filter module for a second time period, and the control unit repeats the driving and stopping of the filter module multiple times.
- [Claim 17] The refrigerator as claimed in claim 16, wherein the integrated time of the compressor is 5 hours and the first time period is 10 minutes and the second time period is 5 minutes.
- [Claim 18] The refrigerator as claimed in claim 1, wherein the control unit drives the filter module for a preset time period when the door is closed based on opening and closing of the door.
- [Claim 19] The refrigerator as claimed in claim 1, wherein the control unit drives the filter module for a preset time period when the door is closed based on at least one of a frequency of door opening/closing and a door opening time.
- [Claim 20] The refrigerator as claimed in claim 1, wherein the control unit stops the driving of the filter module when the door is opened during the driving of the filter module.
- [Claim 21] The refrigerator as claimed in claim 1, wherein the control unit stops

the driving of the filter module when a defrost operation starts during the driving of the filter module.

[Claim 22]

A refrigerator comprising:

a case comprising at least one storage room provided therein;

a compressor provided in the case, to compress refrigerant;

at least one door to open and close the storage room selectively;

a filter module comprising at least one UV lighting source to irradiate an ultraviolet light toward air inside the storage room and a photo-

catalyst filter to filter the air having the UV light irradiated thereto; and

a control unit to control the operation of the filter module.

[Claim 23]

The refrigerator as claimed in claim 22, wherein titanium is coated on the photocatalyst filter.

[Claim 24]

The refrigerator as claimed in claim 22, wherein the filter module

comprises a housing arranged in the storage room, with an air inlet and an air outlet formed therein, and a fan arranged adjacent to the air outlet of the housing, and

the UV lighting source is arranged adjacent to the air inlet within the housing and the photocatalyst filter is arranged adjacent to the air outlet within the housing.

[Claim 25]

The refrigerator as claimed in claim 22, wherein the case comprises an inner case having the storage room provided therein and an outer case defining an exterior appearance of the refrigerator, and

a cold air duct arranged in a space between the inner case and the outer case to supply cold air to the storage room and a multi duct comprising a plurality of outlets to draw the sterilized air exhausted from the filter module therein and to transport the drawn sterilized air to the storage room are provided in the case.

[Claim 26]

The refrigerator as claimed in claim 25, wherein a passing hole is provided in the inner case, corresponding to the outlet of the multi duct, and

the sterilized air is drawn into the inner case via the passing hole.

[Claim 27]

The refrigerator as claimed in claim 26, wherein the inner case is partitioned into a plurality of storage sections, and

at least one passing hole is provided in each of the storage sections.

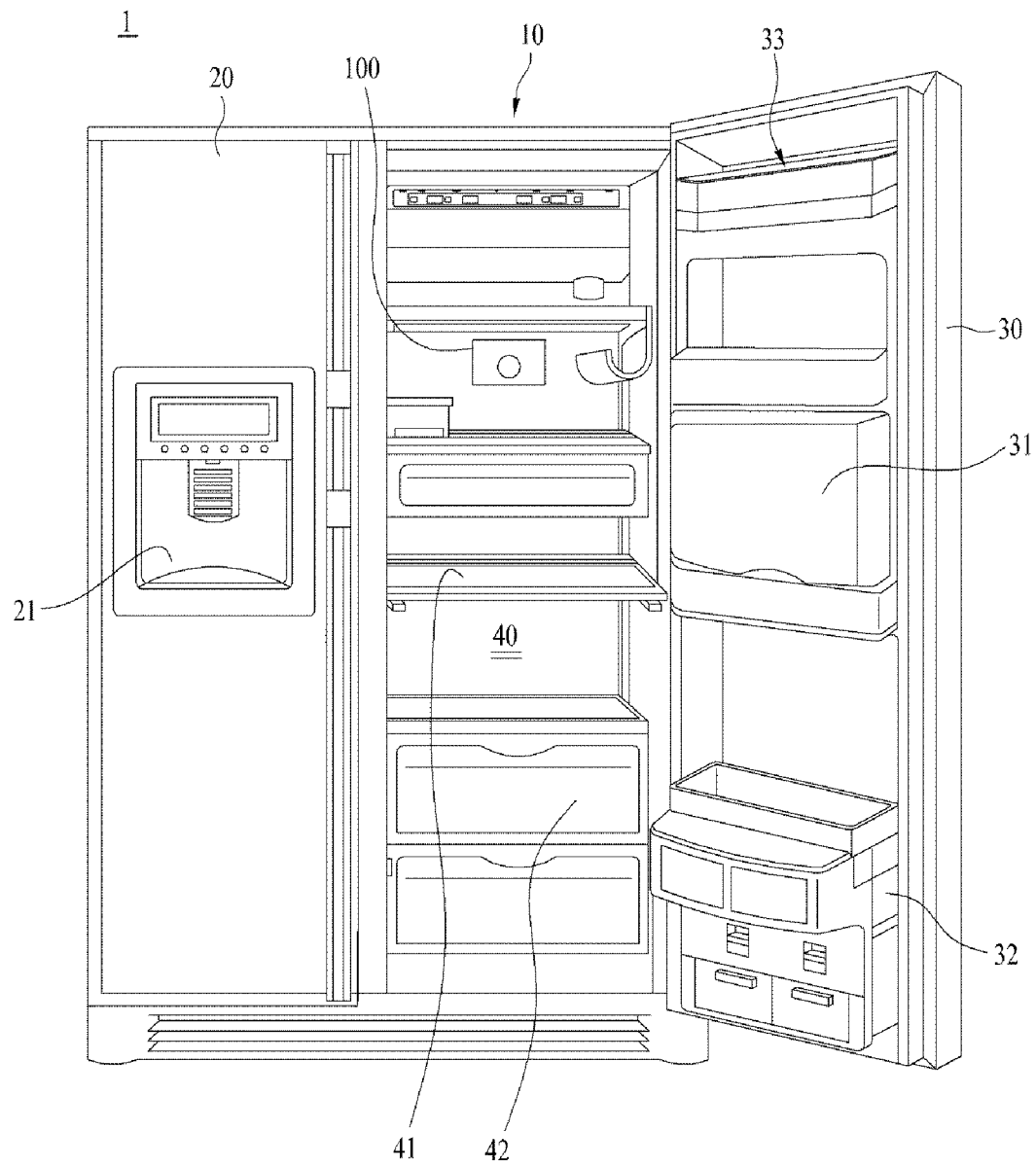
[Claim 28]

The refrigerator as claimed in claim 22, wherein the UV lighting source is operated based on at least one of a light emission duration time, a light emission intensity and a light emission period that are memorized in the control unit.

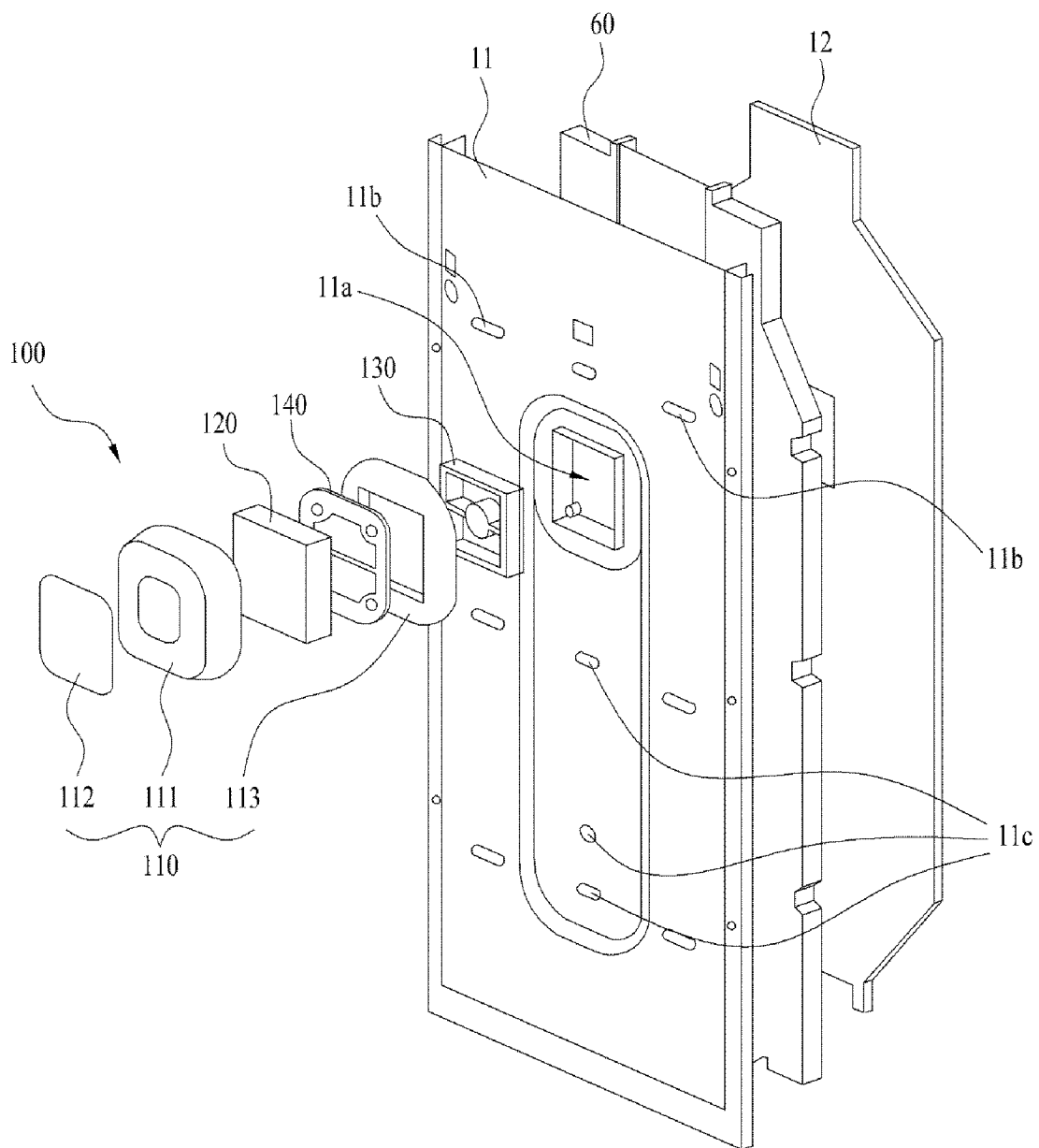
- [Claim 29] The refrigerator as claimed in claim 22, wherein the UV lighting source is operated based on at least one of a door opening status and temperature change of the storage room.
- [Claim 30] The refrigerator as claimed in claim 22, wherein the filter module further comprises an anti-allergen filter.
- [Claim 31] The refrigerator as claimed in claim 30, wherein the anti-allergen filter comprises at least one selected from a group composed of activated carbon (charcoal), silver (Au), allercatcher fiber, co-phthalocyanine and Fe-phthalocyanine.
- [Claim 32] A refrigerator comprising:
a case comprising an inner case having the storage room provided therein and an outer case defining an exterior appearance thereof;
a sensor unit to detect a contamination source inside the storage room;
at least one door to open and close the storage room selectively;
a multi duct arranged between the inner case and the outer case, to flow air inside the inner case therein;
a filter module provided in the multi duct, the filter module comprising a steam generation unit to spray high-temperature steam toward the air drawn into the multi duct and a fan to adjust air flow inside the multi duct; and
a control unit to control the operation of the filter module based on the result of the detection performed by the sensor unit.
- [Claim 33] The refrigerator as claimed in claim 32, wherein the sensor unit comprises at least one of a bio-sensor to detect a specific bacteria contaminant and a gas sensor to detect an offensive smell factor.
- [Claim 34] The refrigerator as claimed in claim 32, wherein the sensor unit comprises a camera unit arranged in the storage room, to detect and visualize an image of a stored food, and
the control unit determines spoiling of the stored food based on a difference between an image of the stored food pre-memorized therein and the image of the stored food detected by the camera unit.
- [Claim 35] The refrigerator as claimed in claim 34, further comprising:
a display part provided in a door, to image surface temperature distribution of the stored food visualized by the camera unit and to display the imaged surface temperature distribution to the user.
- [Claim 36] The refrigerator as claimed in claim 35, wherein the display part displays the spoiling of the stored food determined by the control unit to the user.

- [Claim 37] The refrigerator as claimed in claim 34, wherein the camera unit detects at least one of a temperature, a color and a shape of the stored food.
- [Claim 38] The refrigerator as claimed in claim 32, wherein the control unit increases cooling load of the storage room for a preset time period after steam spraying is complete.
- [Claim 39] The refrigerator as claimed in claim 32, further comprising:
a display part to display a contamination status of the storage room that is detected by the sensor unit to the user.
- [Claim 40] The refrigerator as claimed in claim 32, wherein the sensor unit comprises a weight sensor to recognize weight change of the stored food.

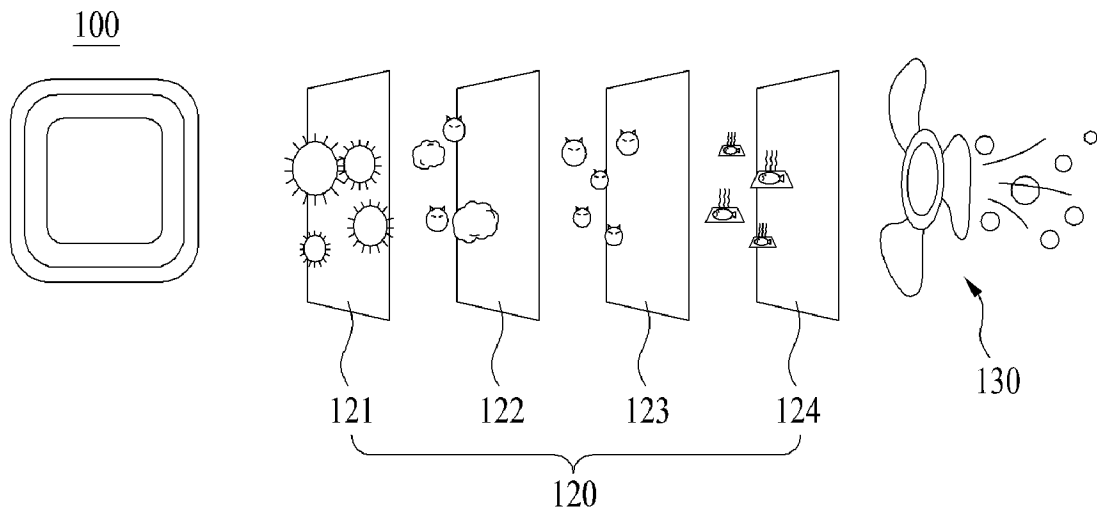
[Fig. 1]



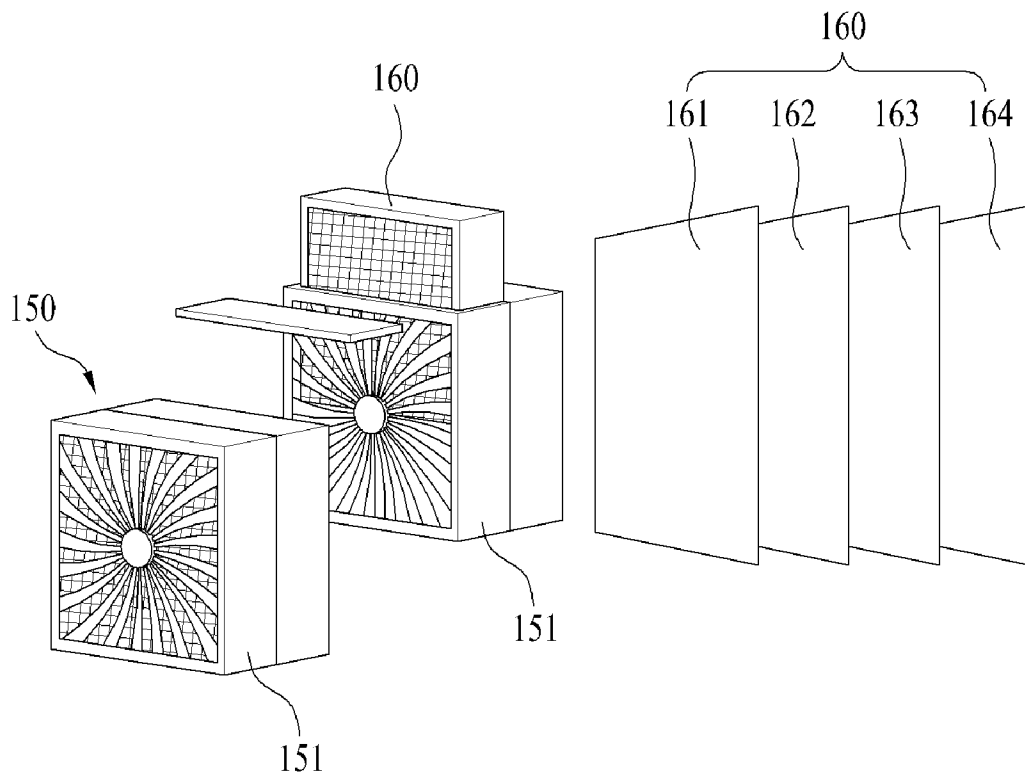
[Fig. 2]



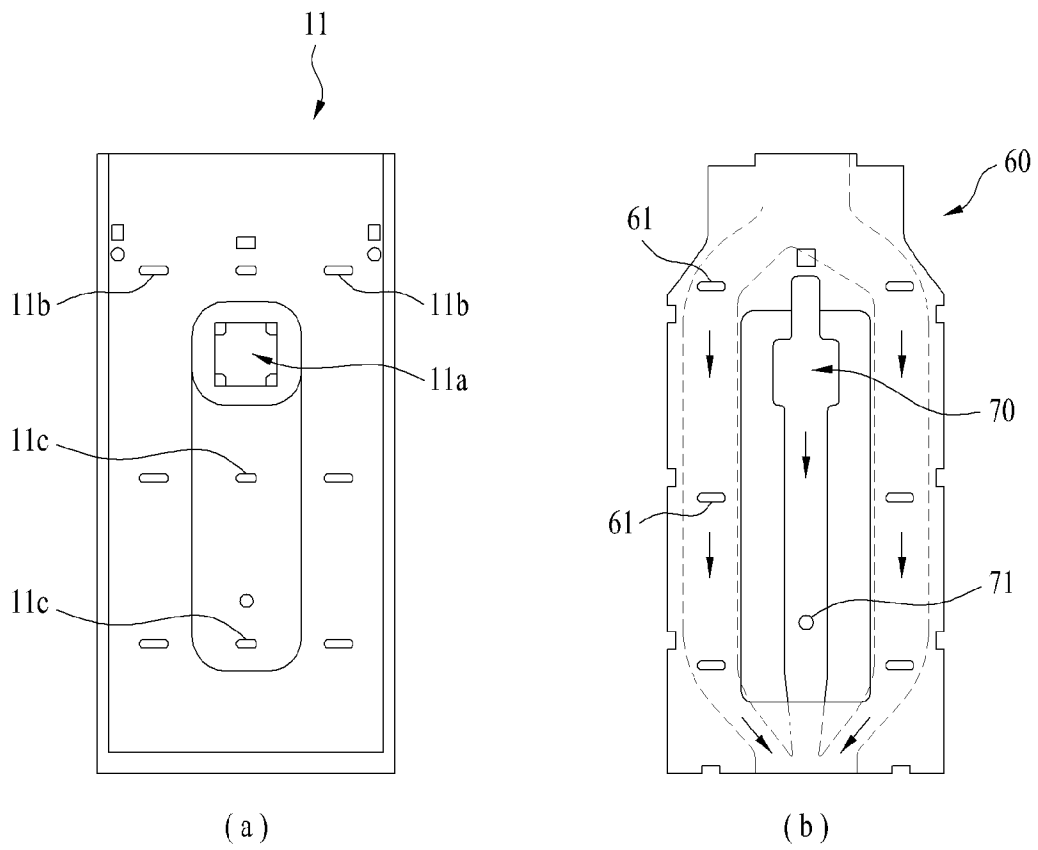
[Fig. 3]



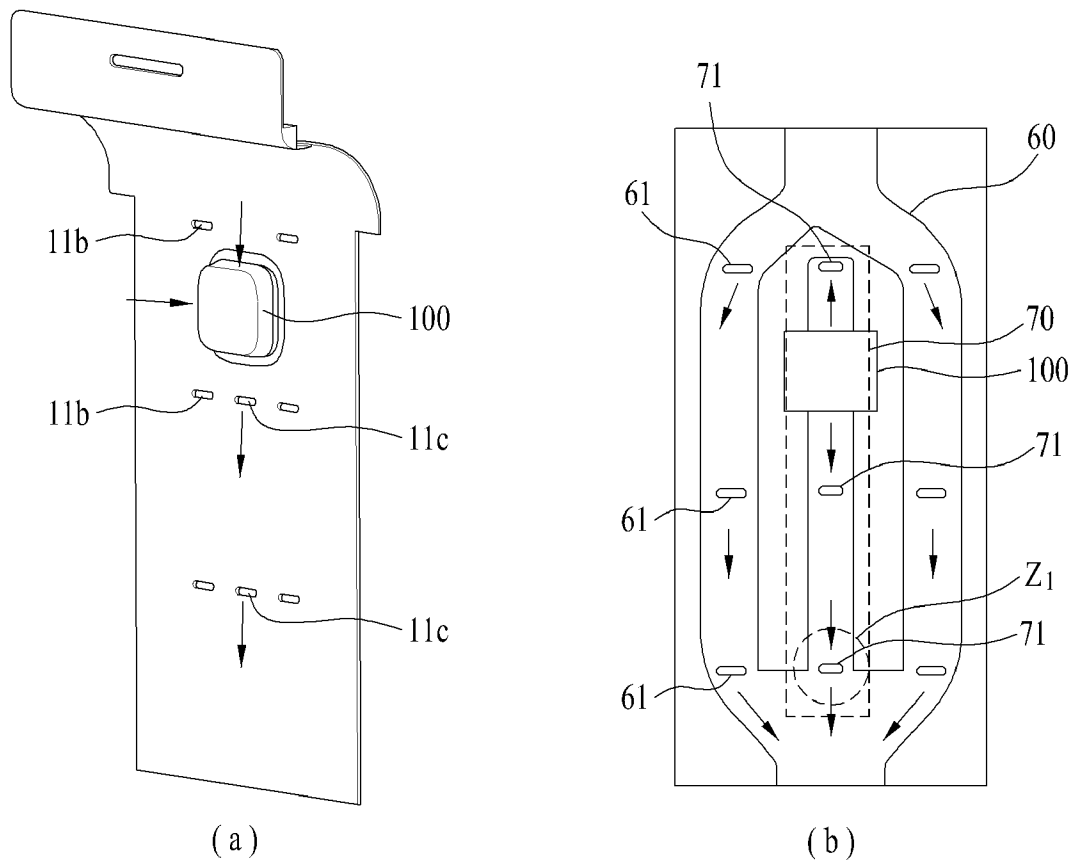
[Fig. 4]



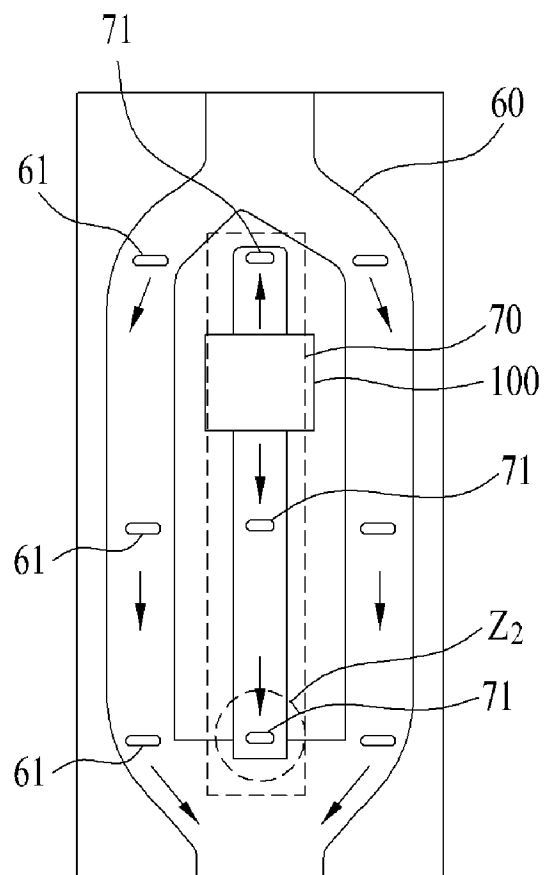
[Fig. 5]



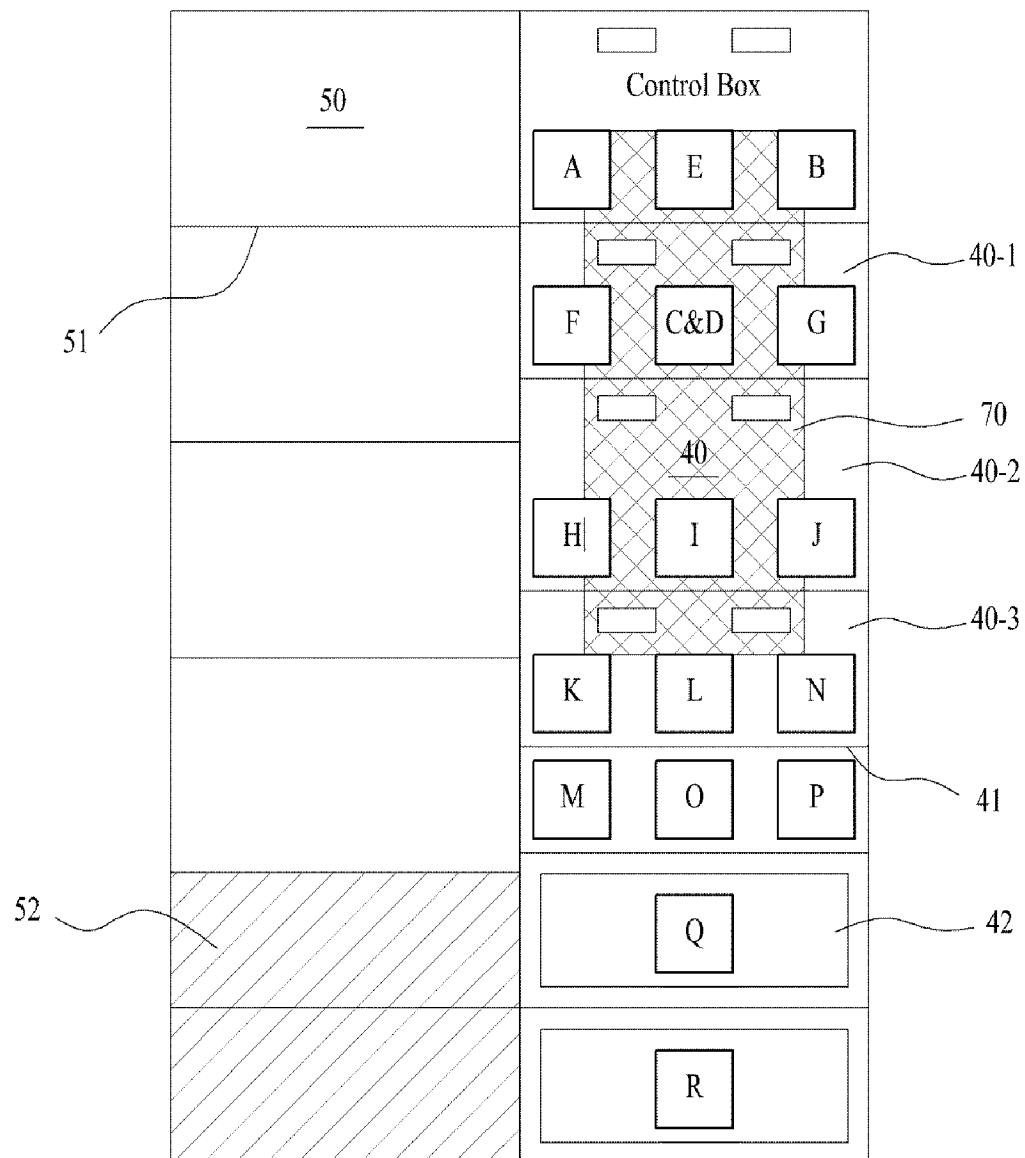
[Fig. 6]



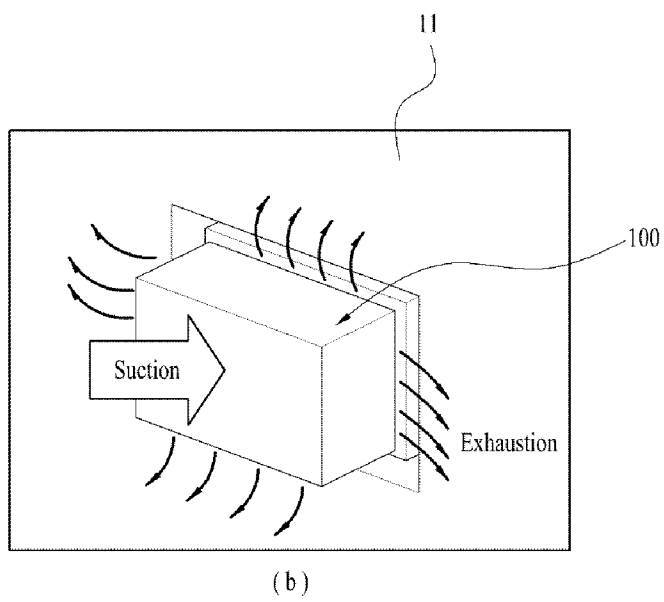
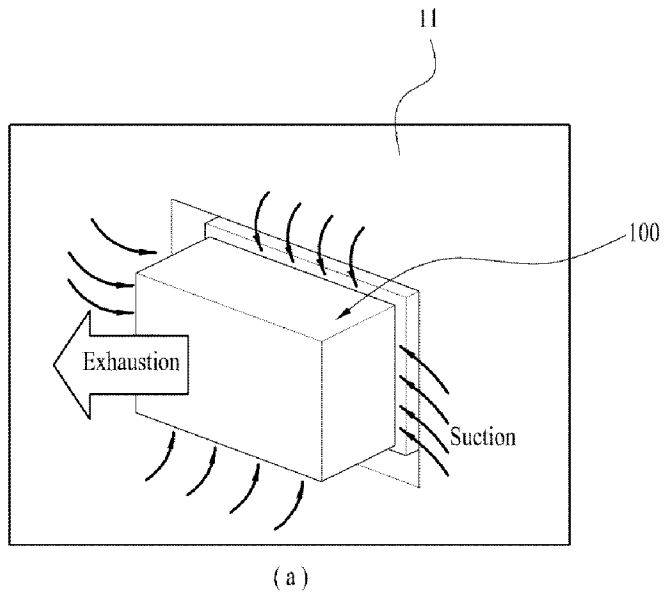
[Fig. 7]



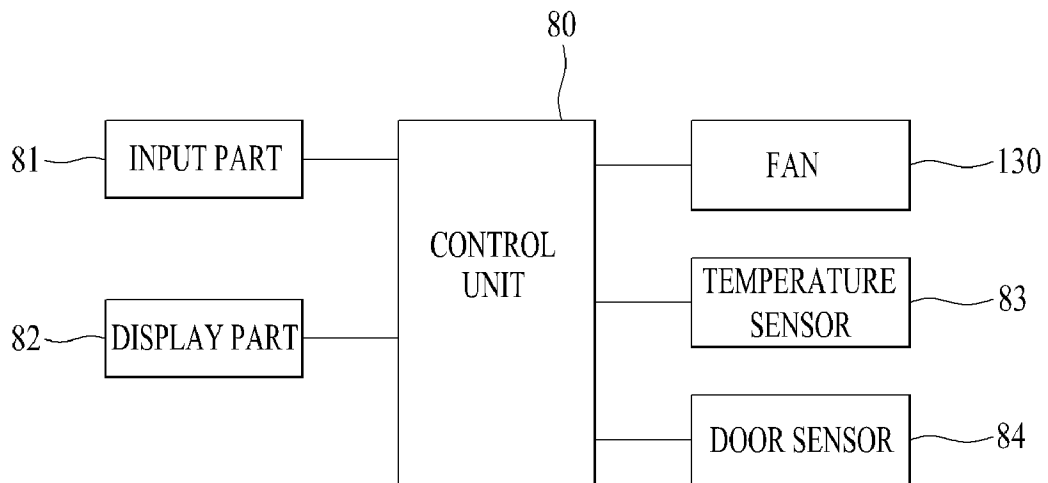
[Fig. 8]



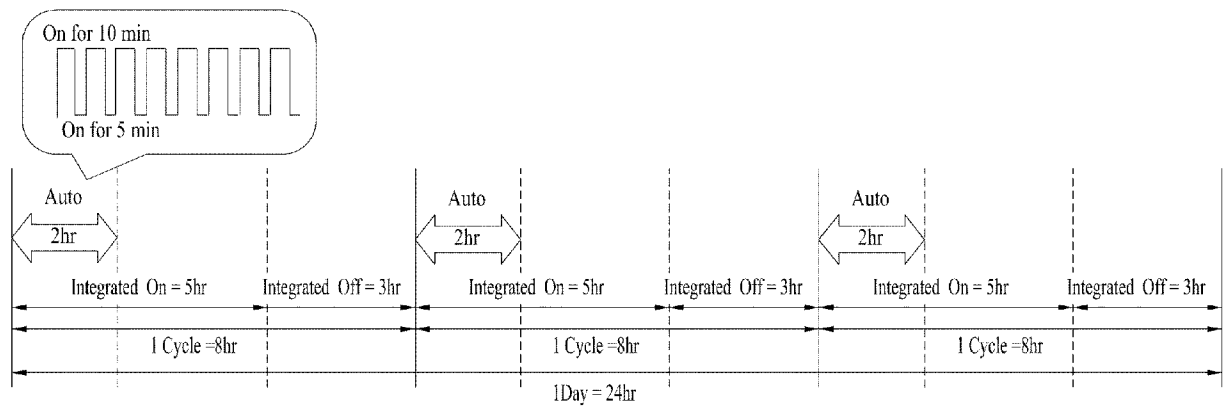
[Fig. 9]



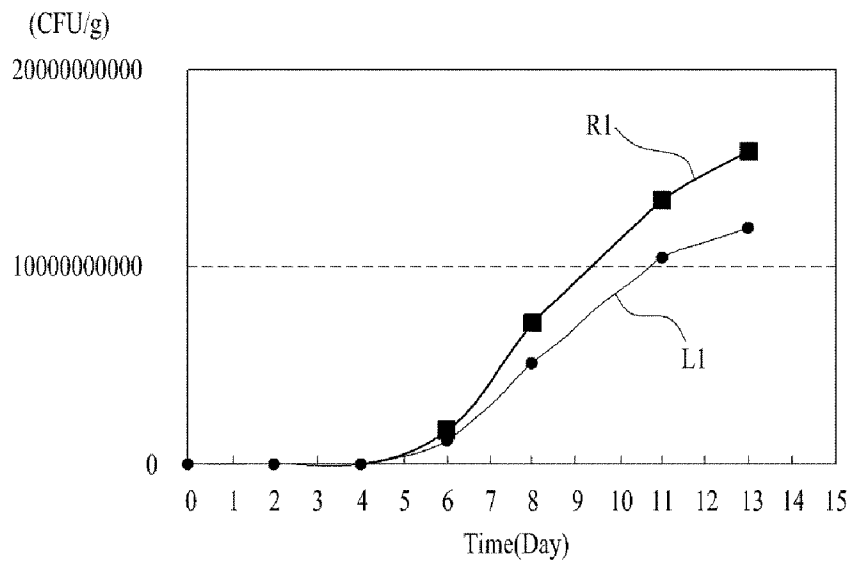
[Fig. 10]



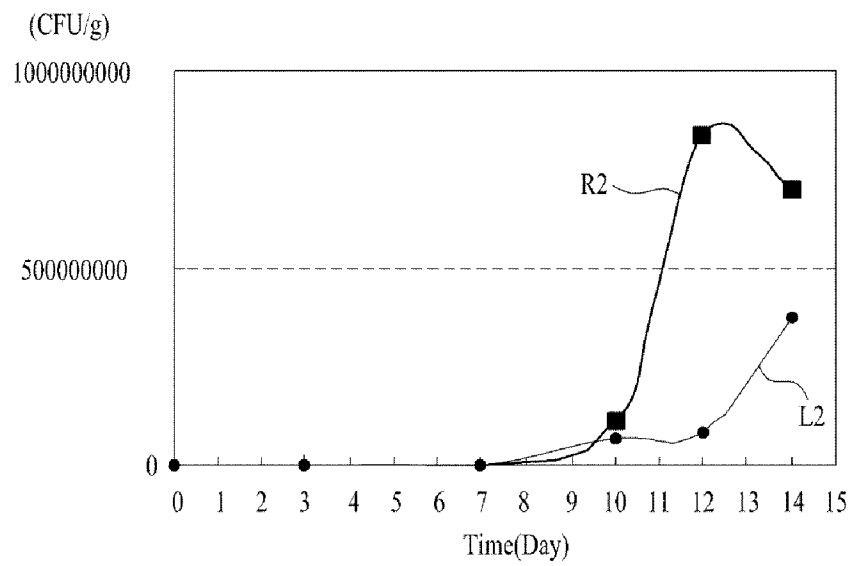
[Fig. 11]



[Fig. 12]

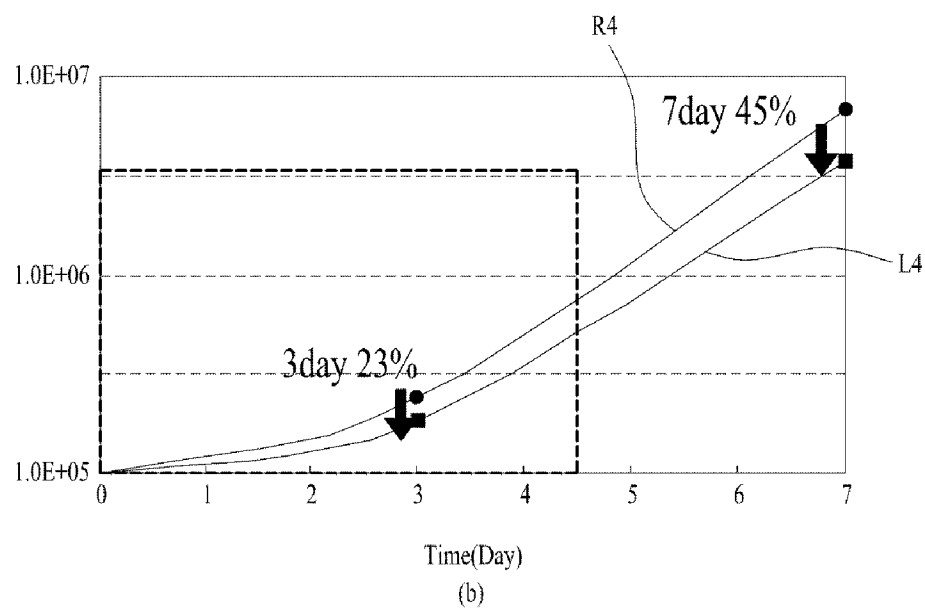
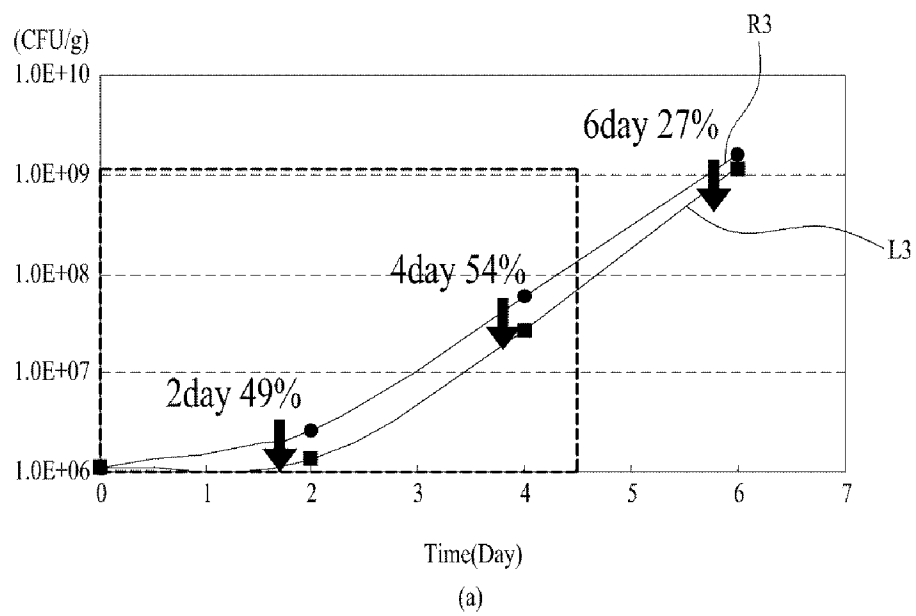


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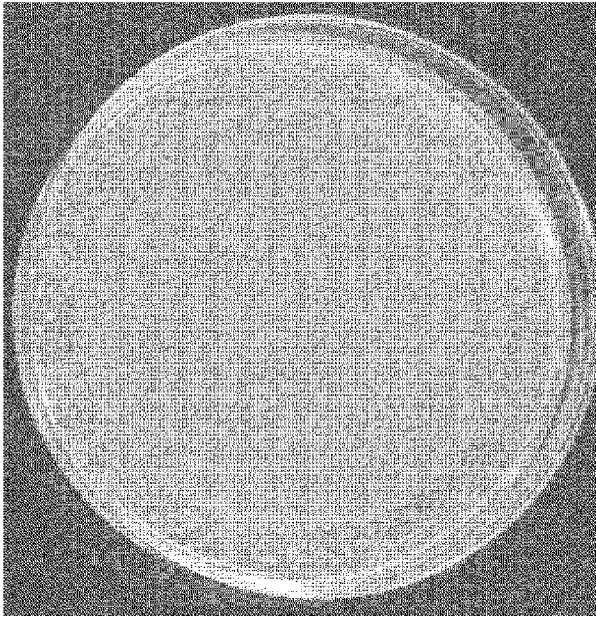


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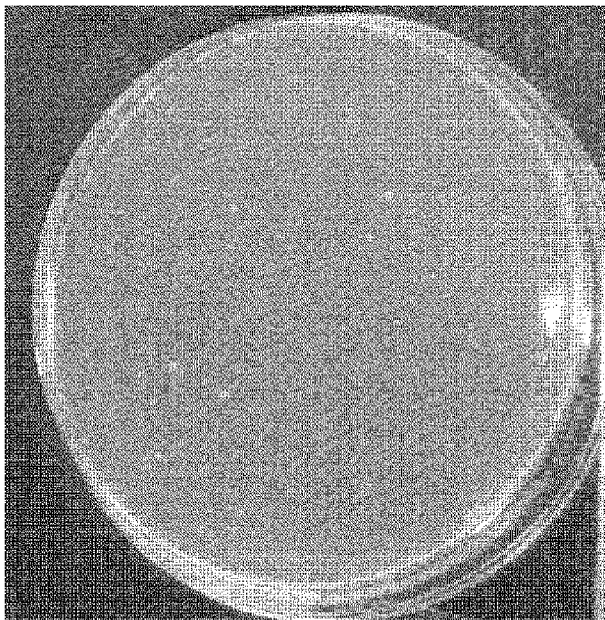
[Fig. 13]



[Fig. 14]

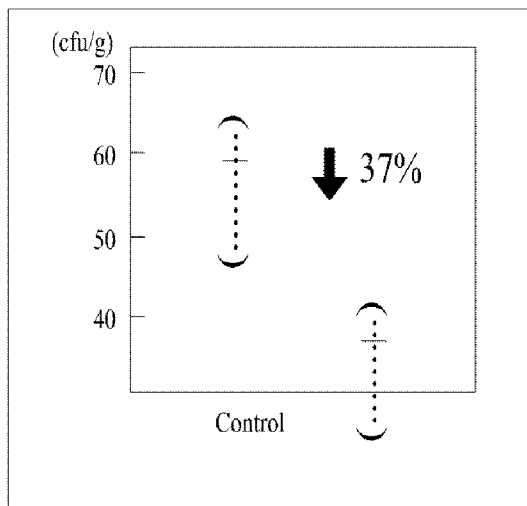


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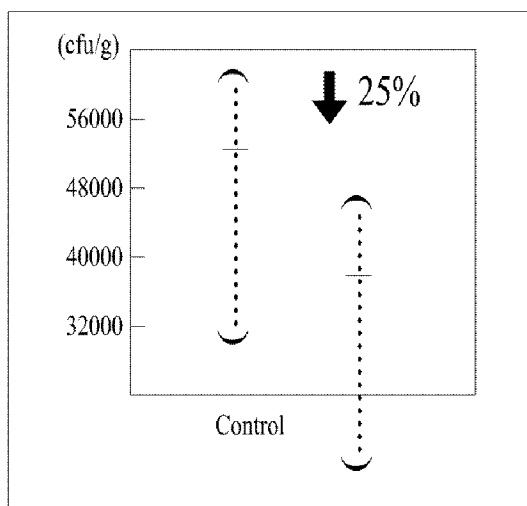


(b)

[Fig. 15]

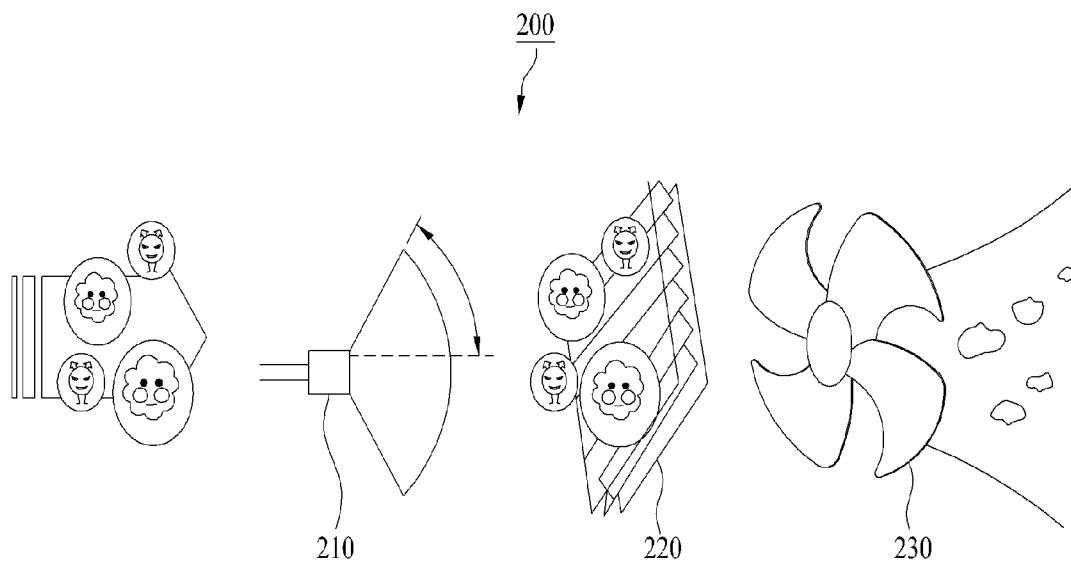


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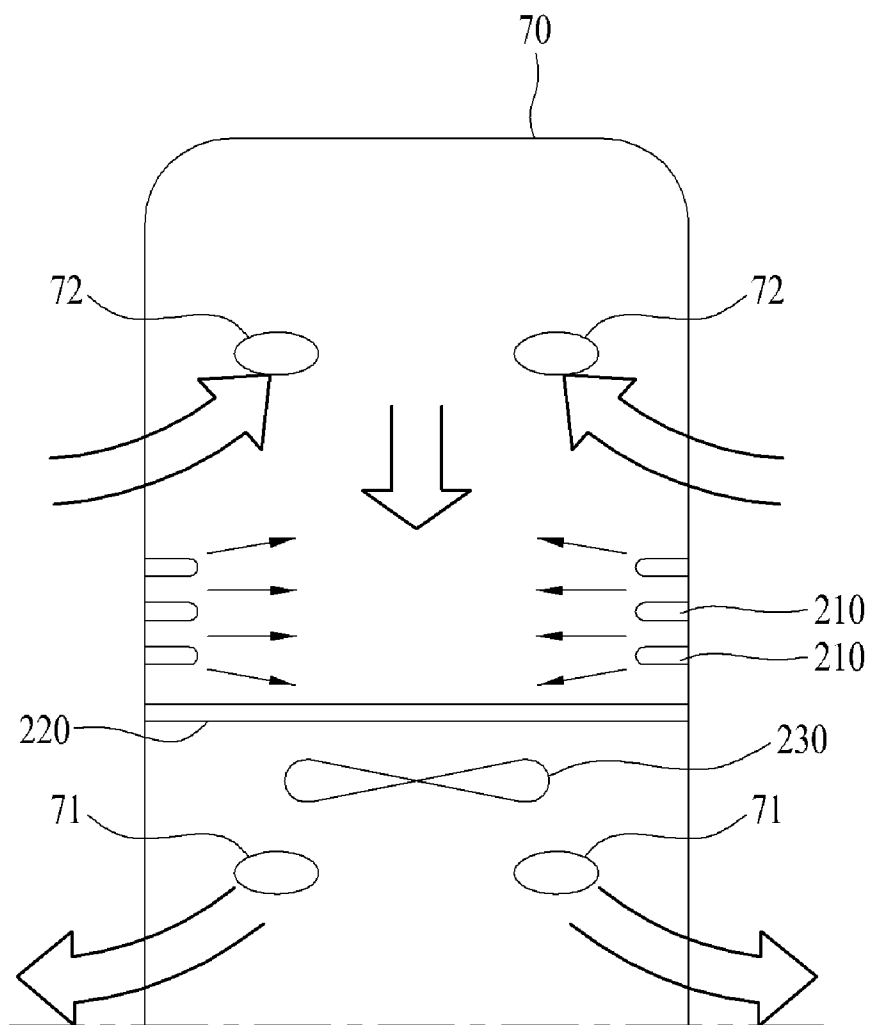


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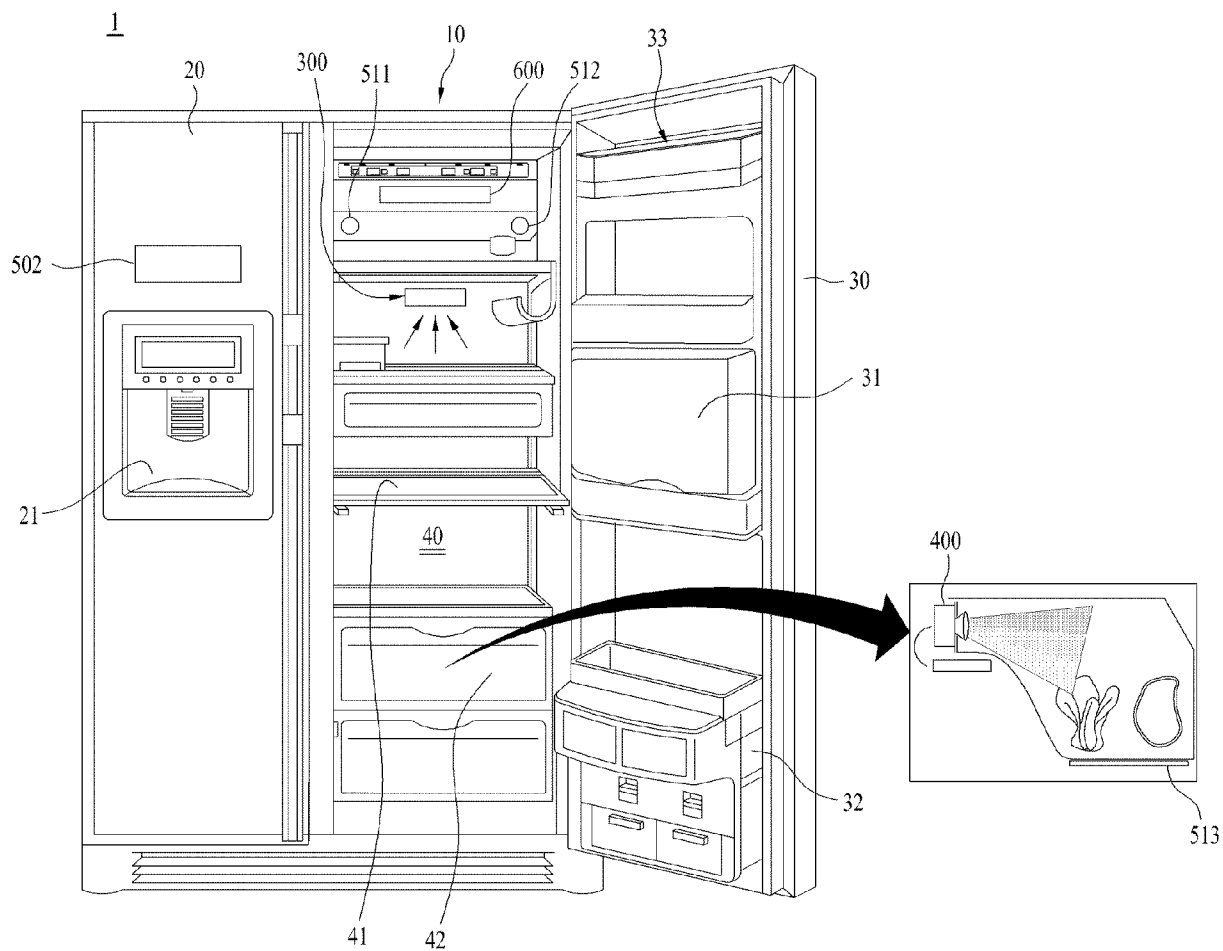
[Fig. 16]



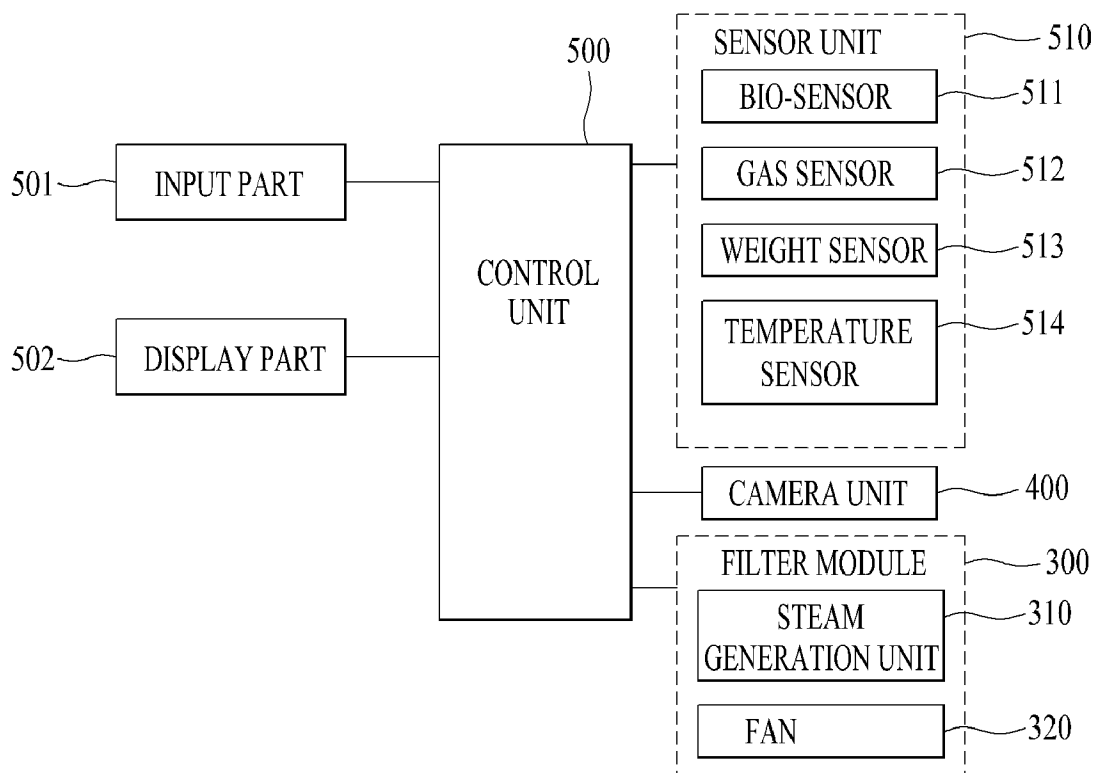
[Fig. 17]



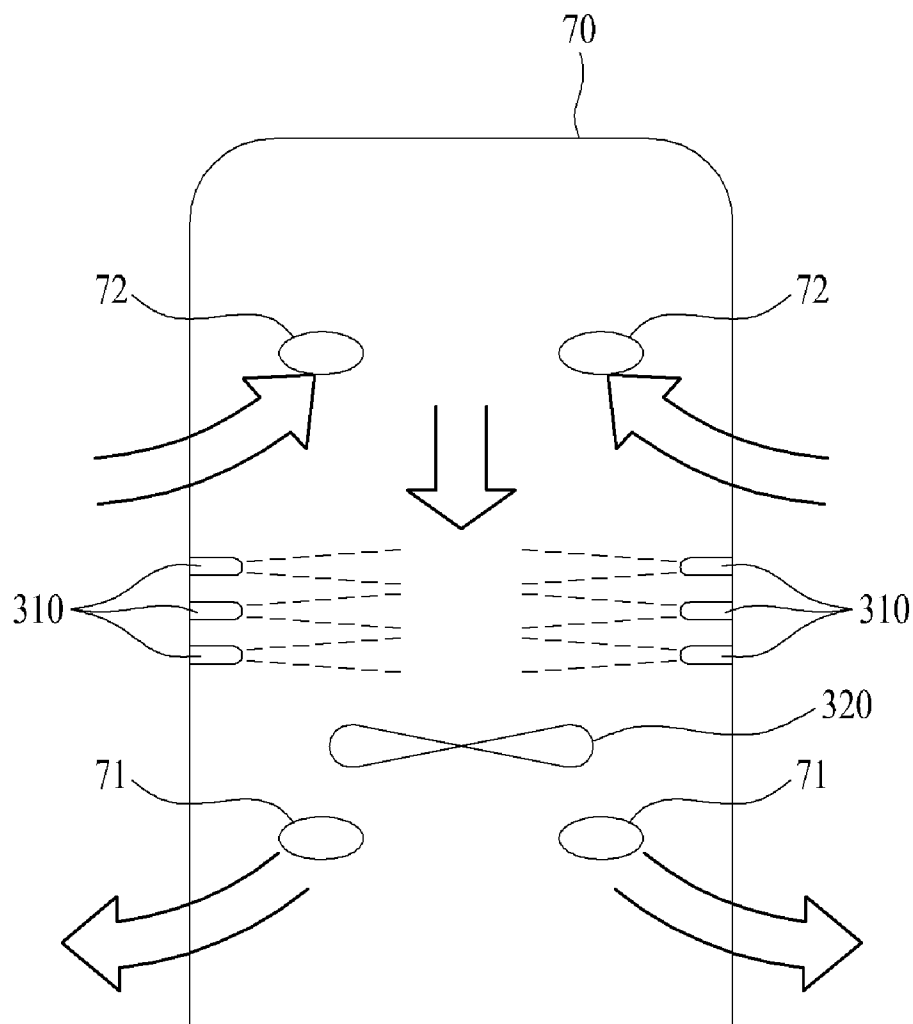
[Fig. 18]



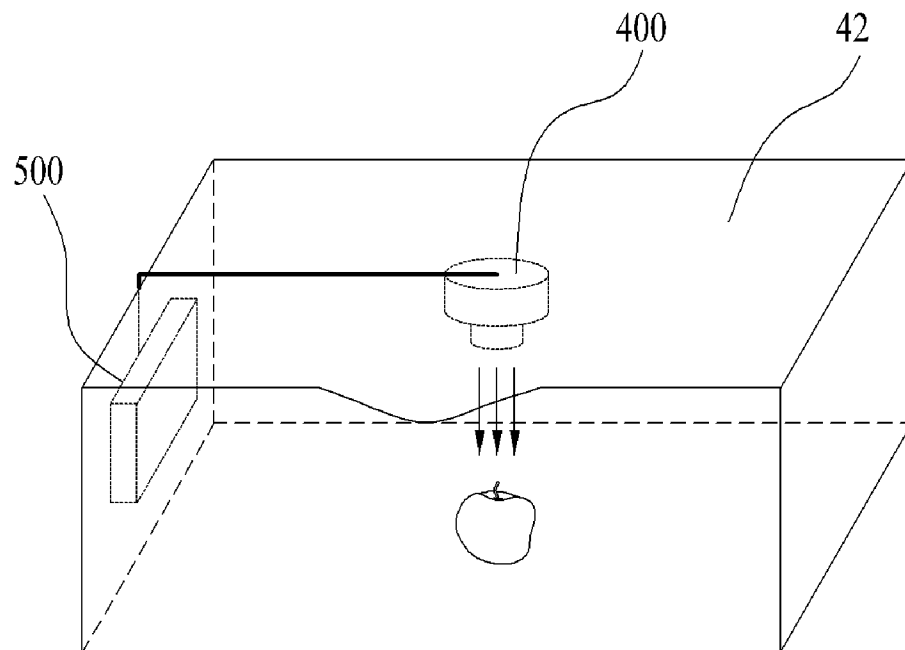
[Fig. 19]



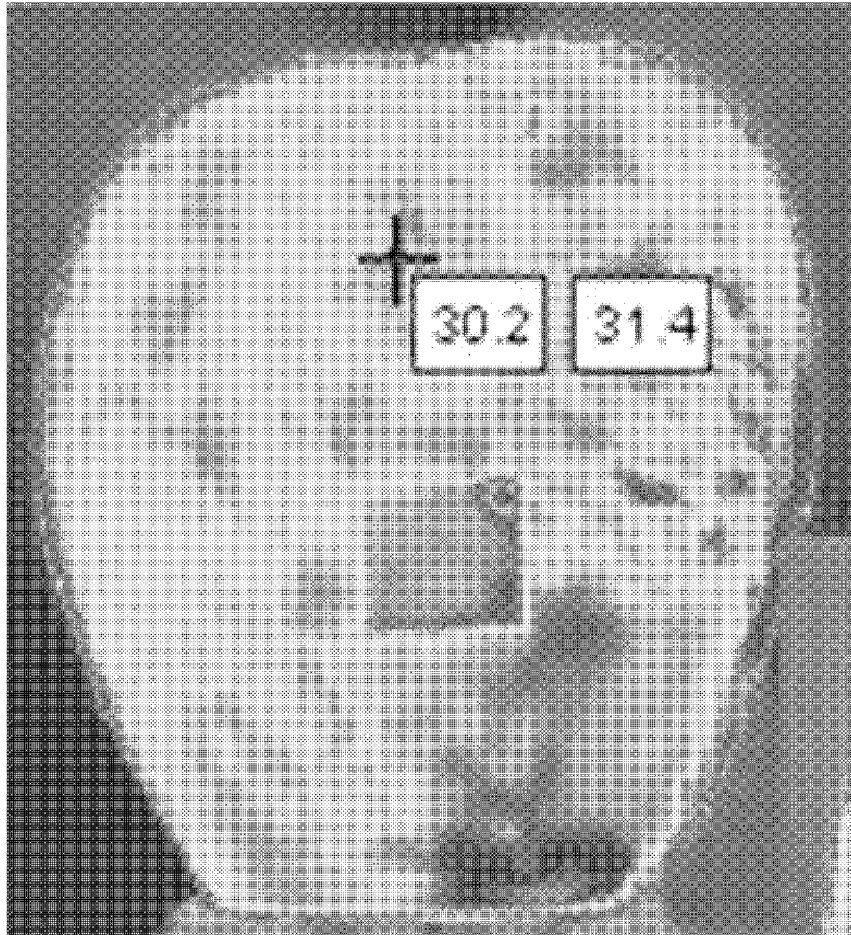
[Fig. 20]



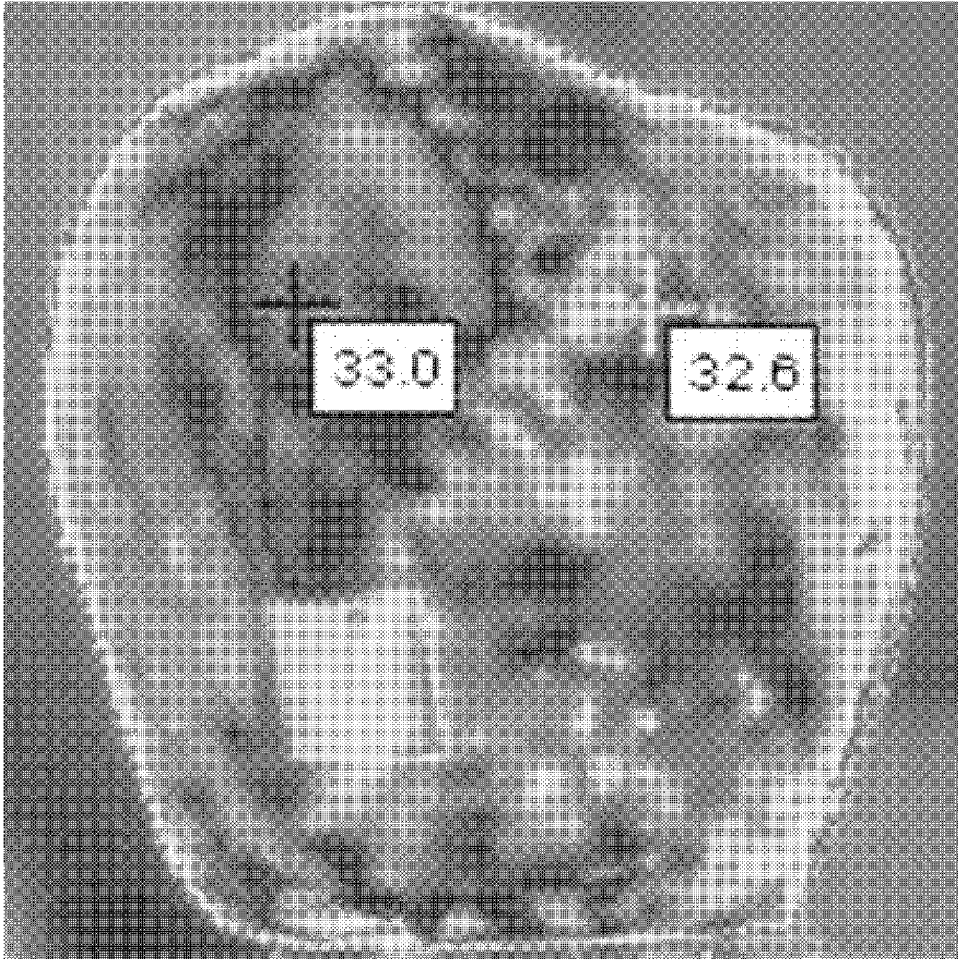
[Fig. 21]



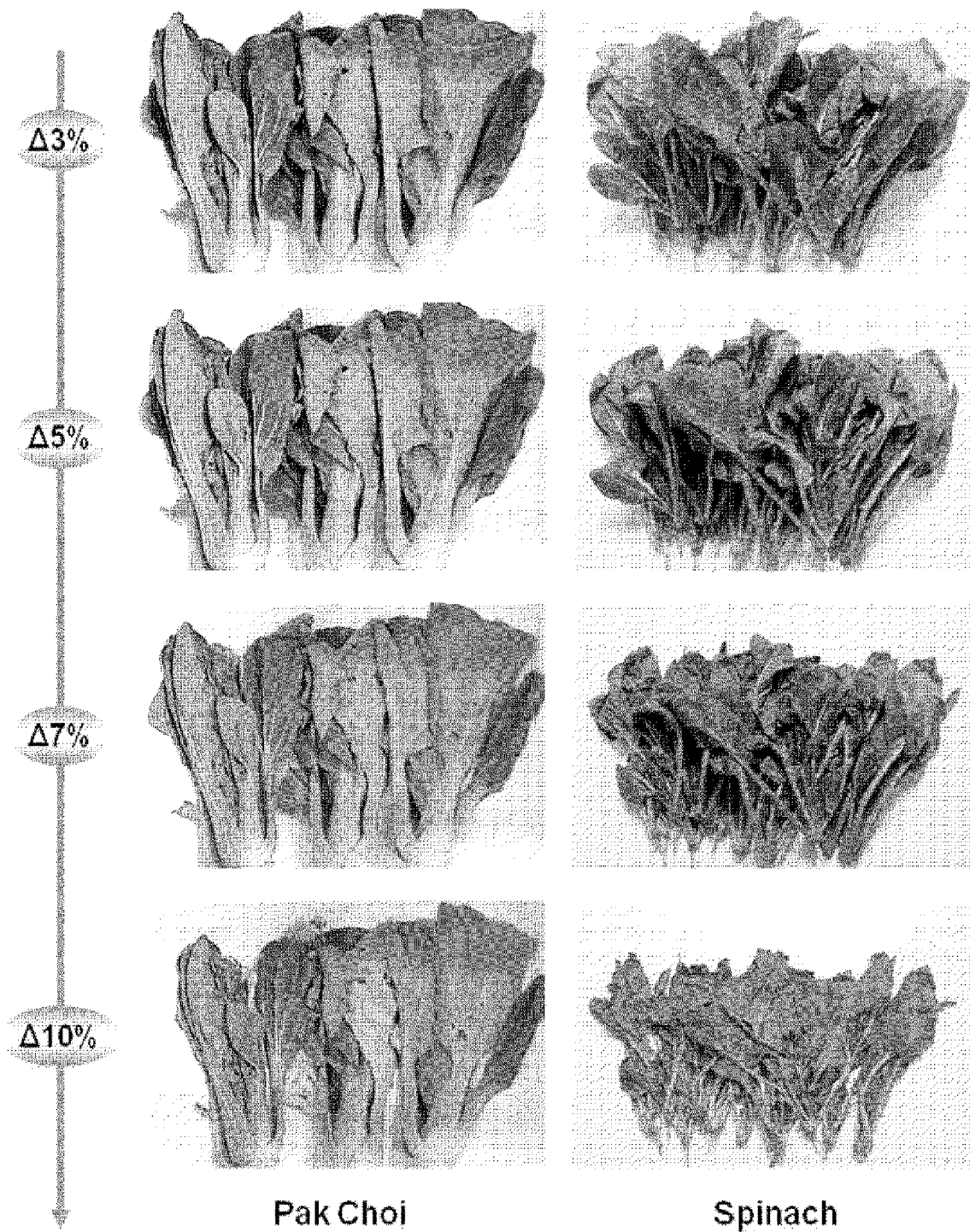
[Fig. 22]



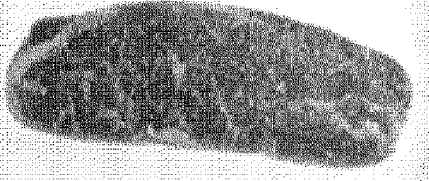
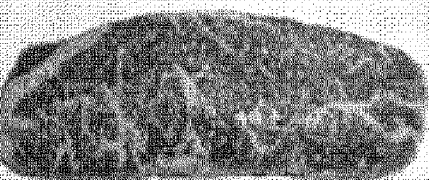
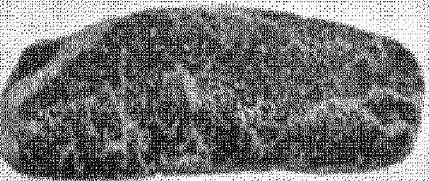
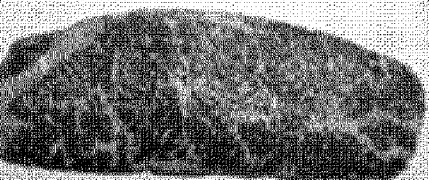
[Fig. 23]



[Fig. 24]



[Fig. 25]

0 Day			Fresh (No Significant Difference)
1 Day			Fresh
4 Days			Discoloration starts (Initial Spoiling)
5 Days			Discoloration in progress
6 Days			Severe Discoloration
6.5 Days			Discolored (Spoiled)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2011/007350**A. CLASSIFICATION OF SUBJECT MATTER*****F25D 23/06(2006.01)i, F25D 29/00(2006.01)i, F25D 23/00(2006.01)i, F25D 17/08(2006.01)i***

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D 23/06; F25D 17/08; B01D 53/86; F25D 11/00; F25D 23/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords:refrigerator,sterilization,fan

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y X A	JP 2009-030919 A (PANASONIC CORP.) 12 February 2009 See claims 1-4 and figures 1-6.	1-21, 25-27 22-24, 28-31 32-40
Y	JP 2009-047382 A (TOSHIBA CORP et al.) 05 March 2009 See claims 1-7 and figures 1-5.	1-21, 25-27
A	JP 2008-275243 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 13 November 2008 See claims 1-4 and figures 1-10.	1-40
A	JP 2005-195203 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 21 July 2005 See claims 1-5 and figures 1-7.	1-40

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

27 APRIL 2012 (27.04.2012)

Date of mailing of the international search report

27 APRIL 2012 (27.04.2012)

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Telephone No. 82-42-481-8539



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2011/007350

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2009-030919 A	12.02.2009	CN 101663052 A	03.03.2010
		CN 101663550 A	03.03.2010
		CN 101663551 A	03.03.2010
		CN 102062512 A	18.05.2011
		CN 102080915 A	01.06.2011
		CN 102080916 A	01.06.2011
		EP 2141427 A1	06.01.2010
		EP 2144021 A1	13.01.2010
		JP 04-752975 B2	03.06.2011
		JP 04-752976 B2	03.06.2011
		JP 04-835784 B2	07.10.2011
		JP 2008-284344 A	27.11.2008
		JP 2008-292143 A	04.12.2008
		JP 2008-292144 A	04.12.2008
		JP 2008-292145 A	04.12.2008
		JP 2008-292146 A	04.12.2008
		JP 2008-292147 A	04.12.2008
		JP 2008-292148 A	04.12.2008
		JP 2008-292149 A	04.12.2008
		JP 2008-292150 A	04.12.2008
		JP 2008-292151 A	04.12.2008
		JP 2008-292152 A	04.12.2008
		JP 2009-030916 A	12.02.2009
		JP 2009-030917 A	12.02.2009
		JP 2009-030918 A	12.02.2009
		JP 2009-030920 A	12.02.2009
		JP 2009-030921 A	12.02.2009
		JP 2009-030923 A	12.02.2009
		JP 2009-030925 A	12.02.2009
		JP 2011-038771 A	24.02.2011
		JP 2011-064454 A	31.03.2011
		JP 2011-064455 A	31.03.2011
		JP 4752975 B2	17.08.2011
		JP 4752976 B2	17.08.2011
		TW 200848678 A	16.12.2008
		TW 200909010 A	01.03.2009
		TW 200909010 A	01.03.2009
		TW 200912226 A	16.03.2009
		WO 2008-132807 A1	06.11.2008
		WO 2008-132815 A1	06.11.2008
JP 2009-047382 A	05.03.2009	CN 101368782 A	18.02.2009
		CN 101368782 B	22.12.2010
		JP 04-377929 B2	18.09.2009
		JP 2008-304163 A	18.12.2008
		JP 4377929 B2	02.12.2009
		TW 200848679 A	16.12.2008
JP 2008-275243 A	13.11.2008	None	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2011/007350

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005-195203 A	21.07.2005	None	