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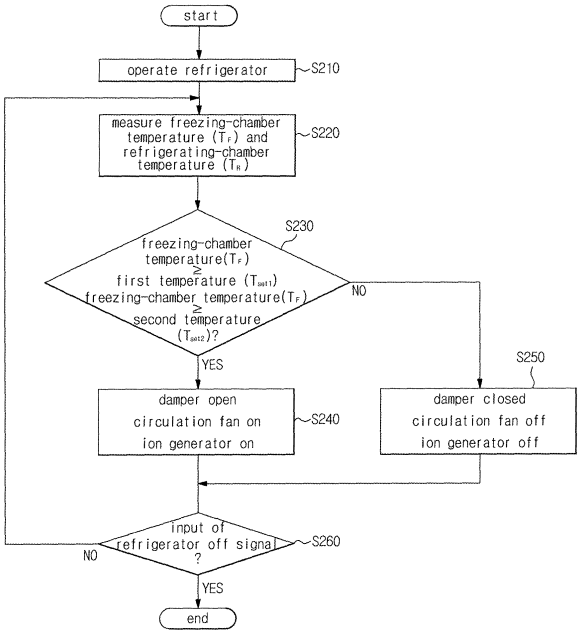
(54) Refrigerator with ion generator and method of controlling the same

(57) Disclosed are a refrigerator equipped with an ion generator (40) and a method for controlling the same, capable of maintaining the density of ozone, which is generated together with ions, to a level less than a predetermined level. The refrigerator and the method for controlling the same can adjust the density of ozone in the refrigerator without employing additional equipment or the control for the equipment such that the ozone is not harmful to a human body by incorporating an operational pattern of a damper operating according to the temperatures of both a freezing chamber (11) and a refrigerating chamber (12) with the operation of the ion generator (40) in order to control the density of the ozone generated from the insides of plural storage rooms by the operation of the ion generator.

Fig.3



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Description

BACKGROUND

1. Field

[0001] The present invention relates to a refrigerator and a method of controlling the same, and more particularly to a refrigerator equipped with an ion generator and a method of controlling the same, capable of maintaining the density of ozone, which is generated together with ions, to a level lower than a predetermined level.

2. Description of the Related Art

[0002] A conventional refrigerator mainly includes a compressor, a condenser, an expansion device, an evaporator, and an accumulator that form a refrigeration cycle to keep various kinds of foods in a fresh state for a long period of time. In such a refrigerator, a liquid-phase refrigerant flowing in the evaporator absorbs ambient heat when the liquid-phase refrigerant is evaporated so that cold air is provided to a refrigerating chamber and a freezing chamber.

[0003] Since the foods stored in the refrigerator are exposed to external air when a door of the refrigerator is open, the refrigerator has a problem in that various kinds of bacteria are introduced into storage rooms of the refrigerator and then are propagated in the storage rooms. In order to solve this problem, recently, technologies have been developed to provide an ion generator in the storage room of the refrigerator so as to sterilize the storage room by ions or ozone generated from the ion generator.

[0004] The conventional refrigerator includes an ion generator having a discharger, which discharges a high voltage generated from a high-voltage generator to the atmosphere, in order to generate ions. The ion generator using the high voltage additionally generates ozone when generating ions.

[0005] The ozone generated together with ions sterilizes and deodorizes the inside of the storage room at a desirable density. However, if the ozone is continuously accumulated in a sealed space such as the inside of a storage room, a great amount of ozone is distributed in the storage room so that a user may feel displeasure, or a bad effect may be exerted on a human body when the door of the refrigerator is open.

[0006] In order to solve this problem, an ozone removing unit is installed in the storage room such that the ozone removing unit operates if the density of ozone exceeds a predetermined level. However, in this case, additional equipment and a control unit must be provided for the ozone removing unit, so that the manufacturing costs of the refrigerator may increase. In addition, if both the ion generator and the ozone removing unit are installed in the refrigerator, high power consumption results.

SUMMARY

[0007] Accordingly, the present embodiment has been made to solve above-mentioned problems occurring in the prior art, and an aspect of the present embodiment is to provide a refrigerator and a method of controlling the same, capable of adjusting a density of ozone in the refrigerator such that the ozone may not exert a negative effect on a human body by incorporating a normal operational pattern of the refrigerator with the operation of an ion generator without employing additional equipment or a controller for the equipment.

[0008] Another aspect of the present embodiment is to provide a refrigerator and a method of controlling the same, capable of optimizing a sterilization function of a storage room by uniformly distributing ions and ozone generated from an ion generator in a storage room.

[0009] Additional aspects and/or advantages will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0010] The foregoing and/or other aspects are achieved by providing a refrigerator including a plurality of storage rooms, a circulation fan circulating cold air in the storage rooms through a cold air path, a damper provided in a predetermined portion of the cold air path and controlling an opening degree of the cold air path connecting the storage rooms, an ion generator generating ions inside the storage rooms, and a controller controlling operation of the ion generator according to the opening degree of the damper to adjust a density of ozone created in the storage rooms.

[0011] In addition, the ion generator is provided in at least one of the storage rooms.

[0012] Further, the storage rooms include a freezing chamber and a refrigerating chamber, and the ion generator is provided in the refrigerating chamber.

[0013] The controller operates the ion generator when the damper is opened, and stops operation of the ion generator when the damper is closed.

[0014] The refrigerator further includes a temperature sensor module measuring temperatures of the refrigerating chamber and the freezing chamber, wherein the controller opens the damper when the temperatures of the refrigerating chamber and the freezing chamber measured in the temperature sensor module are equal to or greater than set temperatures of the refrigerating chamber and the freezing chamber, respectively.

[0015] In addition, the controller operates the circulation fan when the damper is opened.

[0016] The foregoing and/or other aspects are achieved by providing a method of controlling a refrigerator including a plurality of storage rooms and a circulation fan that circulates cold air in the storage rooms through a cold air path, including controlling an operation of an ion generator according to an opening degree of a damper which controls an opening degree of a cold air path connecting to the storage rooms, to adjust a density

of ozone created by the ion generator generating ions in the storage rooms.

[0017] In addition, the controller operates the ion generator when the damper is opened, and stops operation of the ion generator when the damper is closed.

[0018] Further, internal temperatures of the storage rooms are measured in order to compare the internal temperatures with preset temperatures of each of the storage rooms, and then the damper is opened if the internal temperatures of the storage rooms are greater than or equal to the preset temperatures of each of the storage rooms, respectively.

[0019] The circulation fan is operated when the damper is opened.

[0020] The foregoing and/or other aspects are achieved by providing a refrigerator, including a plurality of storage rooms; a cold air path connecting the storage rooms; a damper provided in a predetermined portion of the cold air path and controlling an opening degree of the cold air path connecting the storage rooms; an ion generator generating ions inside at least one of the storage rooms; and a controller controlling operation of the ion generator according to measured temperatures of the storage rooms.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The above and other aspects, features and advantages will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side sectional view showing the structure of a refrigerator according to an embodiment of the present invention;

FIG. 2 is a block diagram showing the structure for controlling the operation of a refrigerator according to an embodiment of the present invention; and

FIG. 3 is a flowchart showing the control procedure of a refrigerator according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0023] FIG. 1 is a side sectional view showing the structure of a refrigerator according to an embodiment.

[0024] The refrigerator shown in FIG. 1 includes a freezing chamber 11 formed at an inner upper portion of a refrigerator body 10 and a refrigerating chamber 12 formed at an inner lower portion of the refrigerator body 10. A freezing chamber door 13 and a refrigerating chamber door 14 are installed on front portions of the freezing chamber 11 and the refrigerating chamber 12, respectively, to open/close the freezing chamber 11 and the refrigerating chamber 12.

[0025] A typical evaporator 15 is installed at an inner rear portion of the freezing chamber 11 to create cold air, and a circulation fan 16 is installed above the evaporator 15 to forcefully circulate internal air of the freezing chamber 11 and the refrigerating chamber 12.

[0026] In addition, a first inner plate 17 is installed at an inner rear portion of the freezing chamber 11 in order to separate an inner space of the freezing chamber 11 from a space in which the evaporator 15 is installed, and a box-shaped cold air duct 19 is installed at the back of the first inner plate 17 to form a first cold air path 18 together with the first inner plate 17. In addition, a plurality of cold-air exhaust holes 17a are formed in the first inner plate 17 such that cold air guided through the first cold air path 18 can be supplied into the freezing chamber 11.

[0027] The refrigerating chamber 12 includes a second inner plate 21, which is installed at an inner rear portion of the refrigerating chamber 12 in order to form a second cold air path 20 connected to the first cold air path 18, and a plurality of cold-air exhaust holes 21 a are formed in the second inner plate 21.

[0028] An intermediate wall 22 separating the freezing chamber 11 from the refrigerating chamber 12 is formed with a communication path 24, which connects the first cold air path 18 to the second cold air path 20, and a cold-air return path 25 allowing cold air supplied into the freezing chamber 11 and the refrigerating chamber 12 to return to the evaporator 15.

[0029] In addition, a damper 30 is installed at the side of an outlet of the communication path 24 such that the temperature of the refrigerating chamber 12 can be properly maintained by adjusting an amount of cold air flowing toward the refrigerating chamber 12 from the freezing chamber 11 through the opening/closing of the outlet of the communication path 24.

[0030] Further, a temperature sensor module 120 including a first temperature sensor 120a and a second temperature sensor 120b is installed at the inside of the freezing chamber 11 and the refrigerating chamber 12 in order to measure the temperatures of the freezing chamber 11 and the refrigerating chamber 12, and an ion generator 40 is installed at the inside of the refrigerating chamber 12 to generate ions.

[0031] The damper 30 adjusts the opening degree of the outlet of the communication path 24 while rotating in a forward direction or a backward direction through the driving of a step motor (not shown), so that the temperature of the refrigerating chamber 12 can be properly maintained.

[0032] Meanwhile, the ion generator 40 according to the present embodiment, which generates ions according to the discharge of high voltage, can be preferably realized through one of well-known technologies.

[0033] FIG. 2 is a block diagram showing the structure controlling the operation of a refrigerator according to an

embodiment.

[0034] If an operational signal of the refrigerator is input through an input module 110, a controller 100 controls the operation of the refrigerator according to an operation program previously stored in a memory 130 based on temperature information about the inside of the freezing chamber 11 and the refrigerating chamber 12 delivered from a temperature sensor module 120.

[0035] If the controller 100 delivers a control signal used to drive the circulation fan 16 to a fan driving module 140 in order to supply cold air into the freezing chamber 11 and the refrigerating chamber 12, the circulation fan 16 is driven according to the control signal so that air that has been cooled through the evaporator 15 is supplied to the first cold air path 18, and then supplied into the freezing chamber 11 through the cold-air exhaust holes 17a of the first inner plate 17.

[0036] In addition, the cold air of the first cold air path 18 partially flows into the second cold air path 20 through the communication path 24 of the intermediate wall 22, so that the cold air is supplied into the refrigerating chamber 12 through the refrigerating chamber cold air-holes 21 a. In addition, the internal air of the freezing chamber 11 and the refrigerating chamber 12 is continuously circulated while returning to the evaporator 15 through the cold-air return path 25 of the intermediate wall 24.

[0037] When such a cold air circulation operation is achieved, the controller 100 delivers a control signal used to control the opening degree of the damper 30 to a damper driving module 150 in order to adjust the flow rate of the cold air according to the temperatures of the freezing chamber 11 and the refrigerating chamber 12, and the flow rate of the cold air flowing into the second cold air path 20 from the first cold air path 18 is adjusted due to the operation of the damper 30 according to the control signal.

[0038] Meanwhile, the controller 100 delivers a signal used to operate the ion generator 40 to an ion generator driving module 160 according to the operation program previously stored in the memory 130 during the operation of the refrigerator, and then ions and ozone are generated to sterilize and deodorize stored foods through the operation of the ion generator 40 according to the signal.

[0039] FIG. 3 is a flowchart showing the control procedure of the refrigerator according to an embodiment.

[0040] If an operational signal of the refrigerator is input to the input module 110, the controller 100 having received the operation signal outputs a signal used to operate the refrigerator according to the operation signal, thereby operating the refrigerator (S210).

[0041] After S21 0, the controller 100 compares the temperature T_F of the freezing chamber 11 and the temperature T_R of the refrigerating chamber 12, which are received from the temperature sensor module 120, with a first temperature T_{set1} and a second temperature T_{set2} (S220 and S230).

[0042] The first temperature T_{set1} and the second temperature T_{set2} may be set by a user. Further, generally, the first and second temperatures are set as temperatures required for foods stored in the freezing chamber 11 and the refrigerating chamber 12.

[0043] If the temperature T_F of the freezing chamber 11 is greater than or equal to the first temperature T_{set1}, and the temperature T_R of the refrigerating chamber 12 is greater than or equal to the second temperature T_{set2} in S230, the controller 100 opens the damper 30 and turns on the circulation fan 16 such that cold air created by the evaporator 15 circulates through the insides of the freezing chamber 11 and the refrigerating chamber 12 by the cold air paths 18 and 20, and the communication path 24. As a result, the internal temperatures T_F and T_R of the freezing chamber 11 and the refrigerating chamber 12 become lower than the first and second temperatures T_{set1} and T_{set2} (S240).

[0044] In addition, the controller 100 operates the ion generator 40 in step 240, so that ions and ozone generated from the ion generator 40 are uniformly distributed over the insides of the freezing chamber 11 and the refrigerating chamber 12 while circulating together with the cold air.

[0045] Meanwhile, if the temperatures T_F and T_R of the freezing chamber 11 and the refrigerating chamber 12 are less than the first and second temperatures T_{set1} and T_{set2} in 230, the controller 100 closes the damper 30 and turns off the circulation fan 16 in order to maintain the temperatures of the freezing chamber 11 and the refrigerating chamber 12 (S250).

[0046] Further, the controller 100 stops the operation of the ion generator 40 in order to prevent the concentration of ozone generated from the refrigerating chamber 12, which is equipped with the ion generator 40, by operating the ion generator 40 in a state in which the freezing chamber 11 is separated from the refrigerating chamber 12 so as to form a sealed space.

[0047] As described above, the refrigerator according to the present embodiment can prevent ozone of the freezing chamber 11 and the refrigerating chamber 12 from being concentrated without employing additional equipment or the control for the equipment by combining the operation pattern of the damper, which performs a typical operation in order to maintain the temperature of each storage room of the refrigerator, with the operation of the ion generator 40.

[0048] After S240 or S250, the controller 100 determines whether an off signal of the refrigerator is input in S260. If the off signal is input, the controller 100 terminates the control operation. If the off signal is not input, the control operation returns to S220.

[0049] As described above, a refrigerator and a method of controlling the same according to the present embodiment can adjust the density of ozone in the refrigerator without employing additional equipment or the control for the equipment such that the ozone is not harmful to a human body by incorporating an operational pattern of a damper operating according to the temperatures of both a freezing chamber and a refrigerating chamber with

the operation of the ion generator in order to control the density of the ozone generated from the insides of plural storage rooms by the operation of the ion generator.

[0050] In addition, the refrigerator and the method of controlling the same according to the present embodiment can optimally deodorize and sterilize the storage rooms without additional equipment and the controller for the equipment by uniformly distributing ions and ozone in the storage rooms using the circulation fan which is operated in a state in which the damper is opened.

[0051] Although embodiments has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A refrigerator, comprising:

a plurality of storage rooms;
a circulation fan circulating cold air in the storage rooms through a cold air path;
a damper provided in a predetermined portion of the cold air path and controlling an opening degree of the cold air path connecting the storage rooms;
an ion generator generating ions inside the storage rooms; and
a controller controlling operation of the ion generator according to the opening degree of the damper to adjust a density of ozone created in the storage rooms.

2. The refrigerator according to claim 1, wherein the ion generator is provided in at least one of the storage rooms.

3. The refrigerator according to claim 2, wherein the storage rooms include a freezing chamber and a refrigerating chamber, and the ion generator is provided in the refrigerating chamber.

4. The refrigerator according to claim 1, wherein the controller operates the ion generator when the damper is opened, and stops operation of the ion generator when the damper is closed.

5. The refrigerator according to claim 3, further comprising a temperature sensor module measuring temperatures of the refrigerating chamber and the freezing chamber, wherein the controller opens the damper when the temperatures of the refrigerating chamber and the freezing chamber measured by the temperature sensor module are equal to or greater than set temperatures of the refrigerating chamber and the freezing chamber, respectively.

6. The refrigerator according to claim 1, wherein the controller operates the circulation fan when the damper is opened.

7. A method of controlling a refrigerator including a plurality of storage rooms and a circulation fan that circulates cold air in the storage rooms through a cold air path, the method comprising:

controlling an operation of an ion generator according to an opening degree of a damper which controls an opening degree of a cold air path connecting to the storage rooms, to adjust a density of ozone created by the ion generator generating ions in the storage rooms.

8. The method according to claim 7, wherein a controller operates the ion generator when the damper is opened, and stops operation of the ion generator when the damper is closed.

9. The method as according to claim 8, wherein internal temperatures of the storage rooms are measured in order to compare the internal temperatures with preset temperatures of each of the storage rooms, and then the damper is opened if the internal temperatures of the storage rooms are greater than or equal to the preset temperatures of each of the storage rooms, respectively.

10. The method according to claim 9, wherein the circulation fan is operated when the damper is opened.

11. A refrigerator, comprising:

a plurality of storage rooms;
a cold air path connecting the storage rooms;
a damper provided in a predetermined portion of the cold air path and controlling an opening degree of the cold air path connecting the storage rooms;
an ion generator generating ions inside at least one of the storage rooms; and
a controller controlling operation of the ion generator according to measured temperatures of the storage rooms.

12. The refrigerator according to claim 11, wherein the controller controls the damper to control the opening degree of the cold air path to adjust a density of ozone created in the storage rooms based on the measured temperatures of the storage rooms.

13. The refrigerator according to claim 11, further comprising a circulation fan circulating cold air through

the cold air path, wherein the controller controls an operation of the circulation fan to circulate cold air through the cold air path.

14. The refrigerator according to claim 11, wherein the cold air path includes a first cold air path formed through one of the storage rooms, a second cold air path formed through another of the storage rooms, and a communication path communicating between the first cold air path and the second cold air path.

15. The refrigerator according to claim 12, wherein the damper is opened if the measured temperatures of each of the storage rooms are greater than or equal to preset temperatures of each the storage rooms.

Fig.1

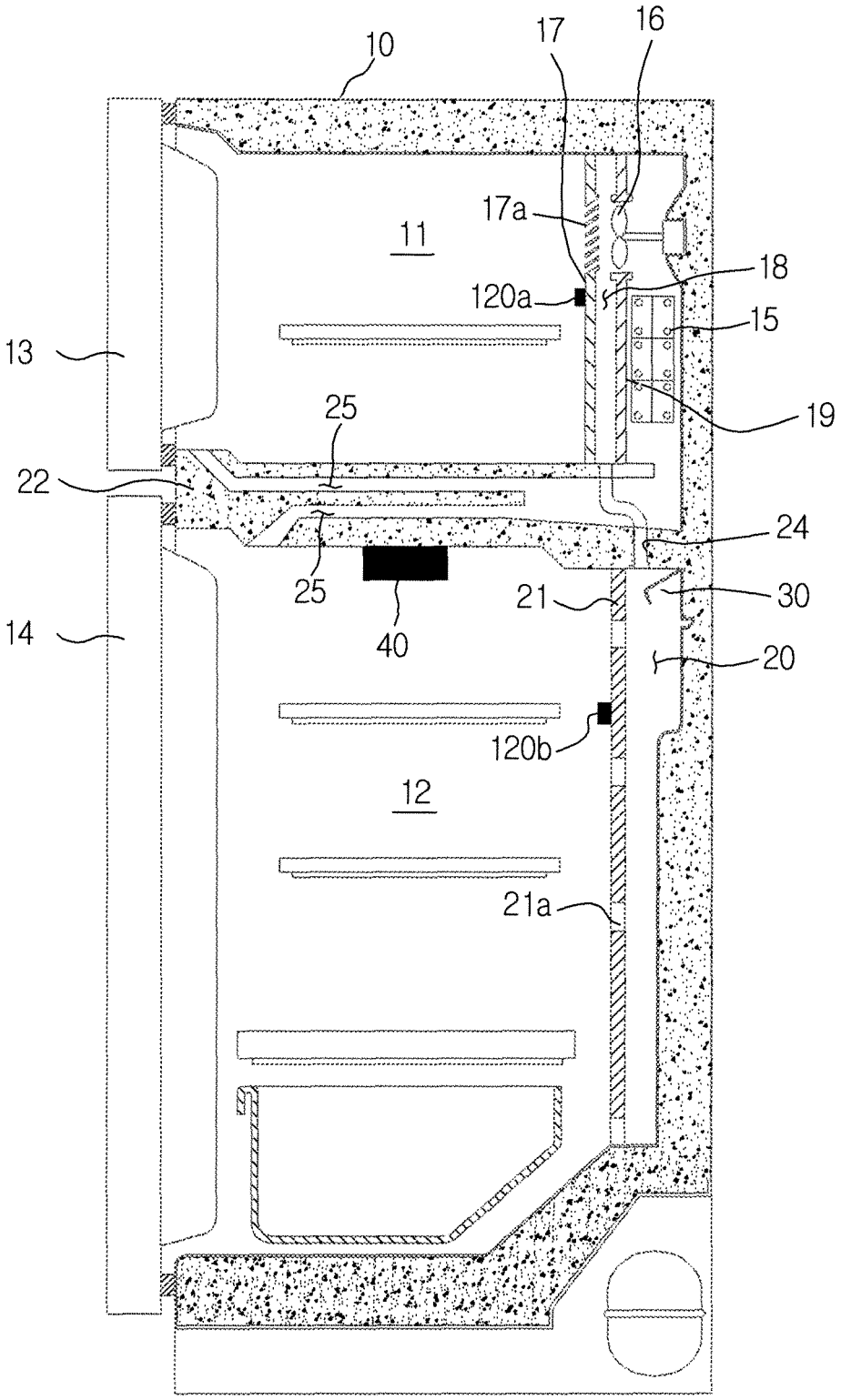

10
17
16
17a
11
18
120a
15
13
19
25
22
24
25
40
21
30
14
20
120b
12
21a

Fig.2

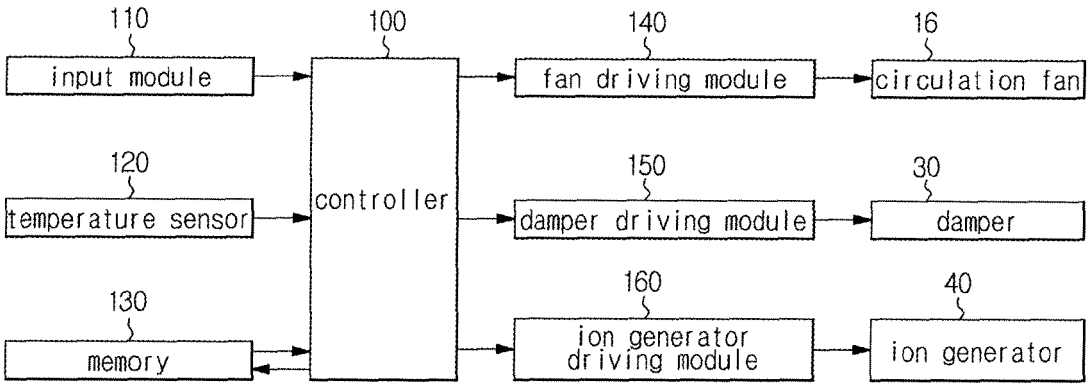
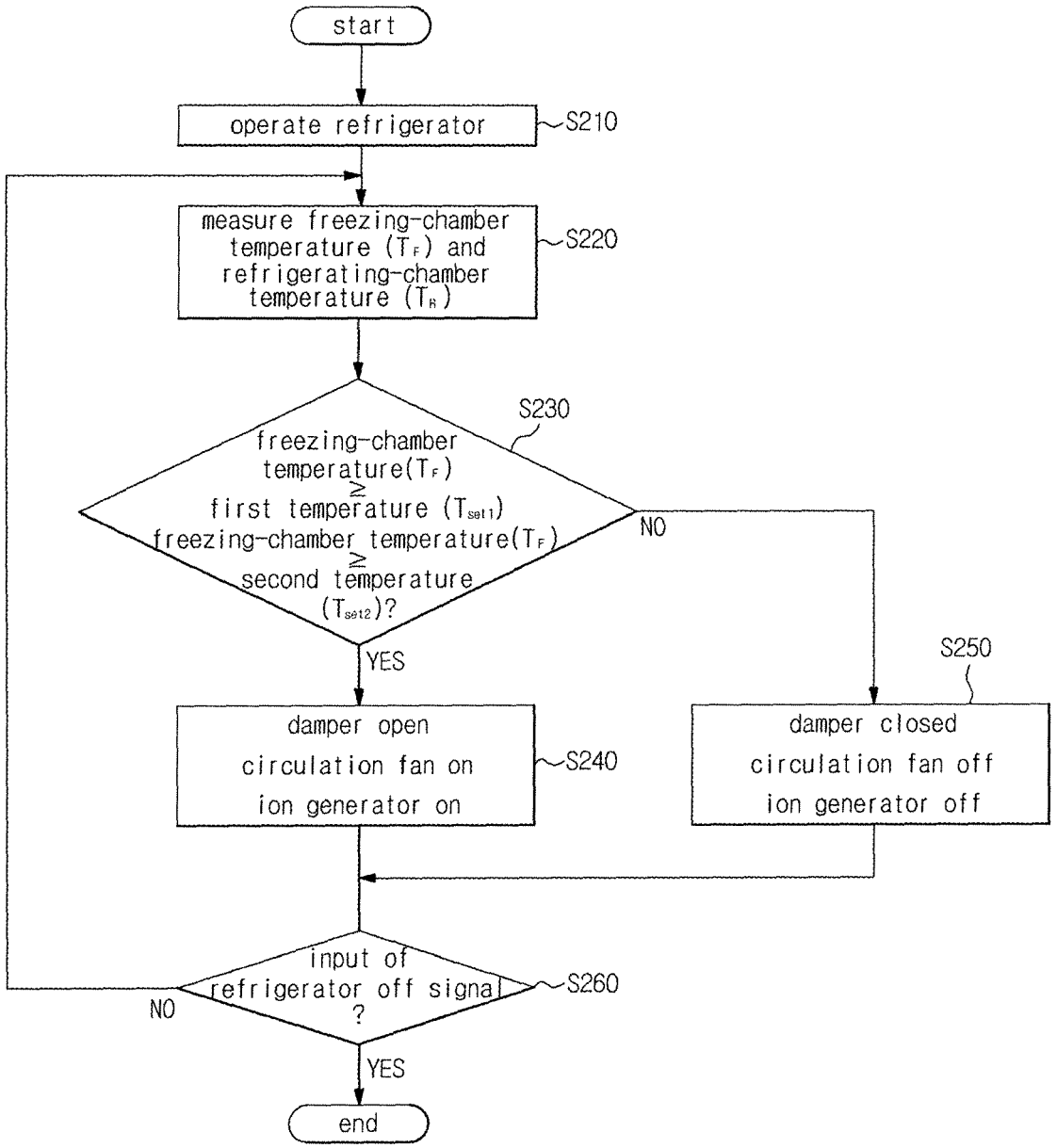

110
input module
120
temperature sensor
130
memory
100
controller
140
fan driving module
150
damper driving module
160
ion generator driving module
16
circulation fan
30
damper
40
ion generator

Fig.3


start
operate refrigerator
S210
measure freezing-chamber temperature (T_F) and refrigerating-chamber temperature (T_R)
S220
S230
freezing-chamber temperature(T_F) ≥ first temperature (T_{set1}) freezing-chamber temperature(T_F) ≥ second temperature (T_{set2})?
NO
YES
S250
damper open
circulation fan on
ion generator on
S240
damper closed
circulation fan off
ion generator off
input of refrigerator off signal ?
S260
NO
YES
end