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(54) **REFRIGERATOR AND METHOD FOR CONTROLLING SAME**

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(57) **ABSTRACT**

A refrigerator and a method for controlling the same are provided. A refrigerator according to an embodiment includes a cabinet forming a storage space and a machine room; a compressor disposed in the machine room and configured to compress refrigerant; a condenser disposed in the machine room and configured to condense the refrigerant compressed in the compressor; an output pipe connected to the condenser and configured to discharge the refrigerant from the condenser; a machine room sensor coupled to the output pipe to measure the temperature of the output pipe; and a control unit configured to control an operating frequency of the compressor based on the temperature measured by the machine room sensor.

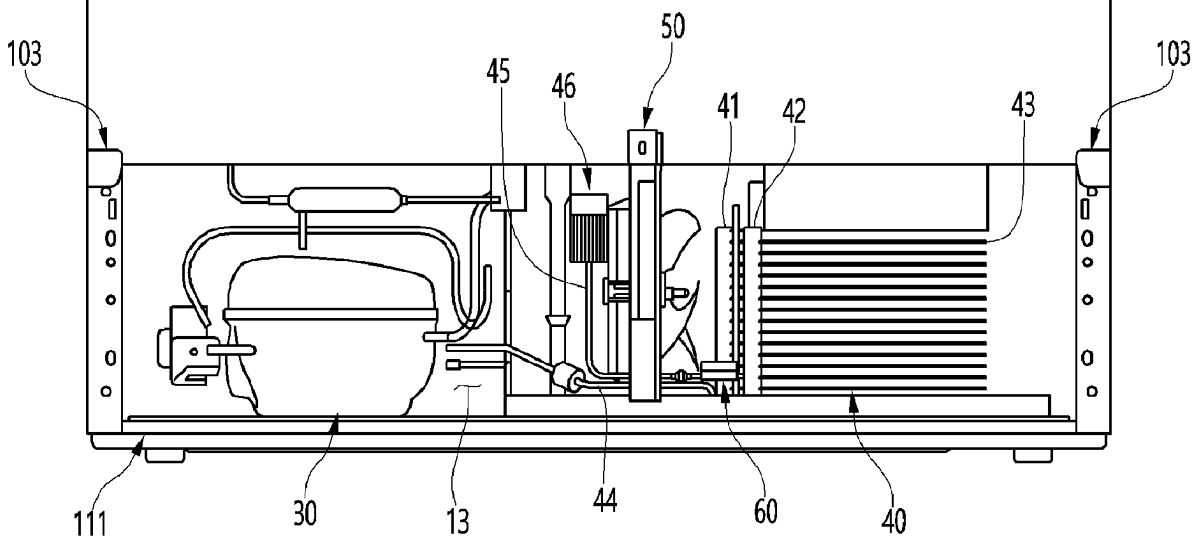


FIG. 1

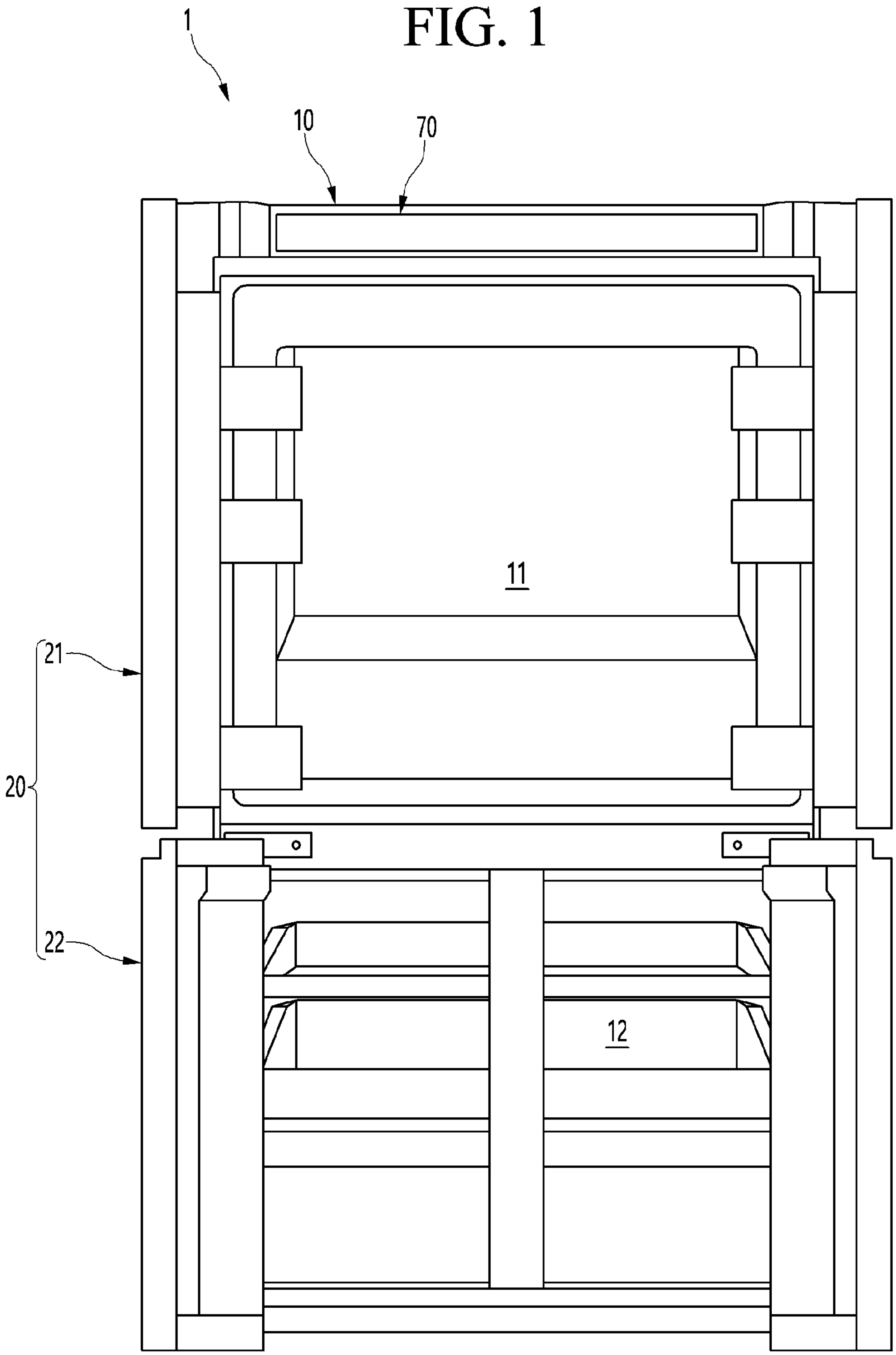


FIG. 2

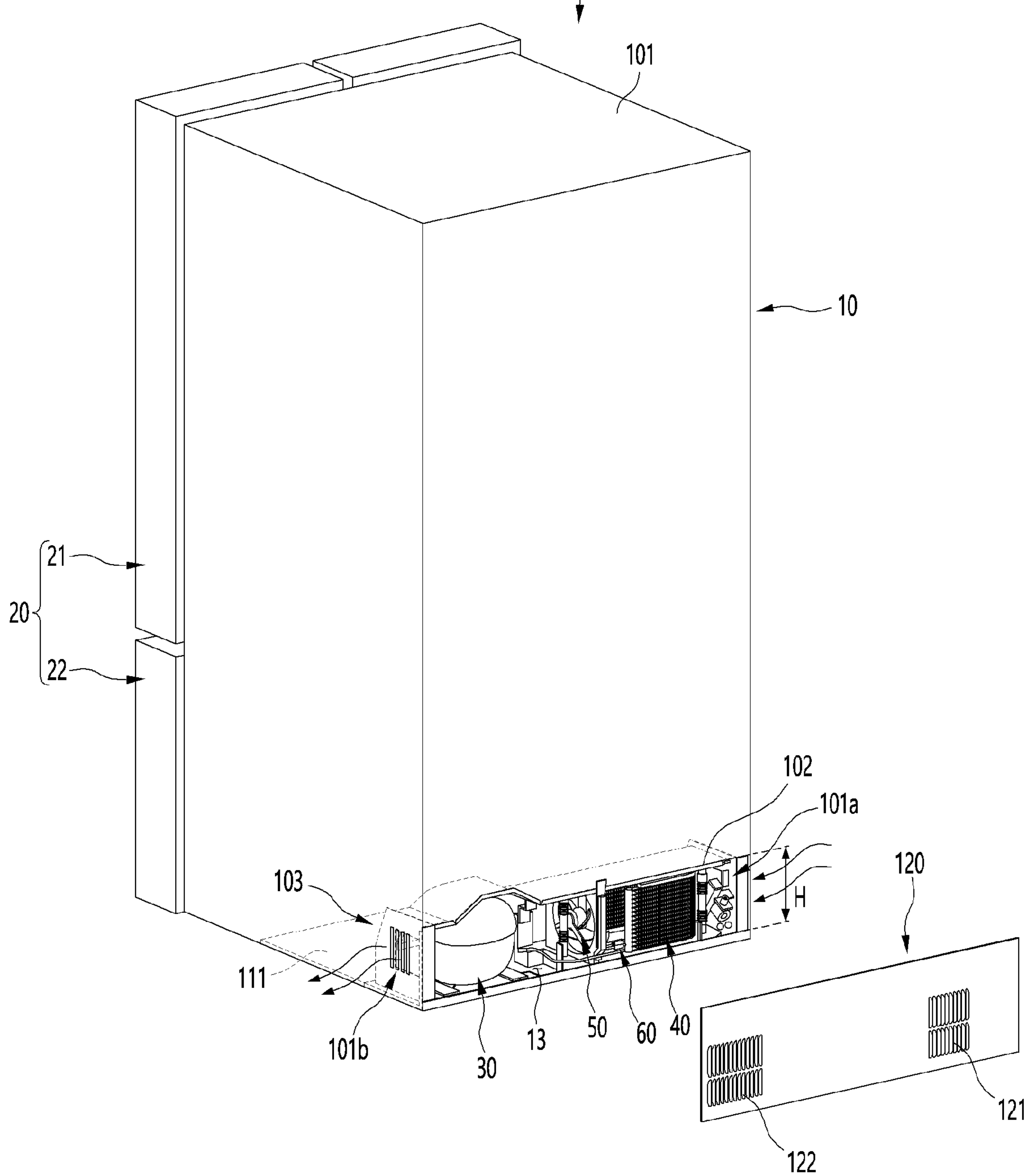


FIG. 3

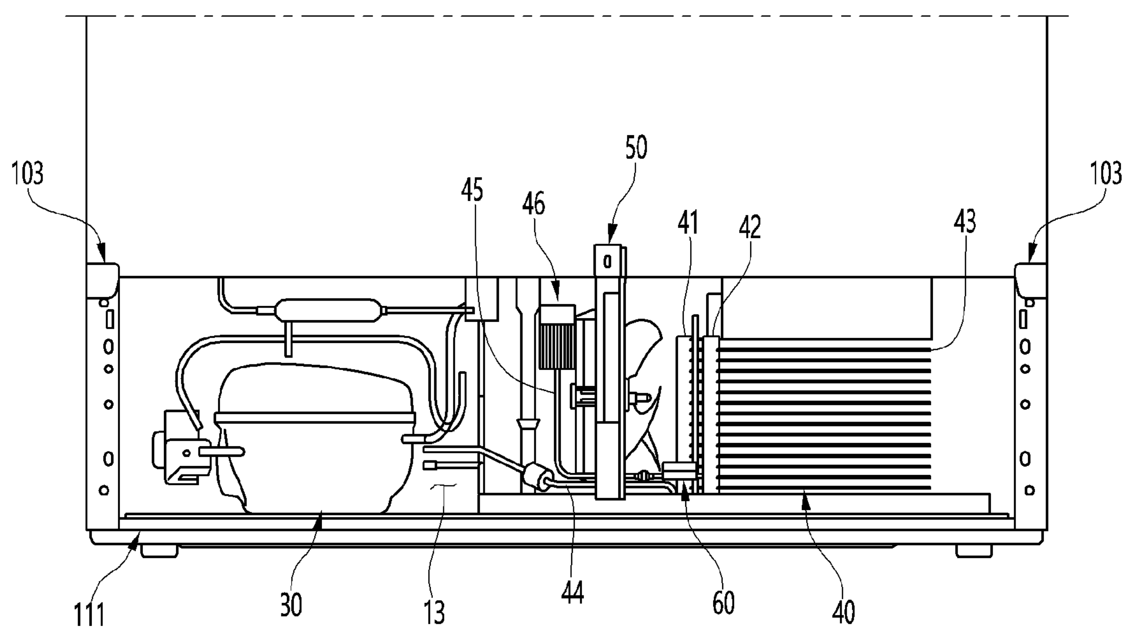


FIG. 4

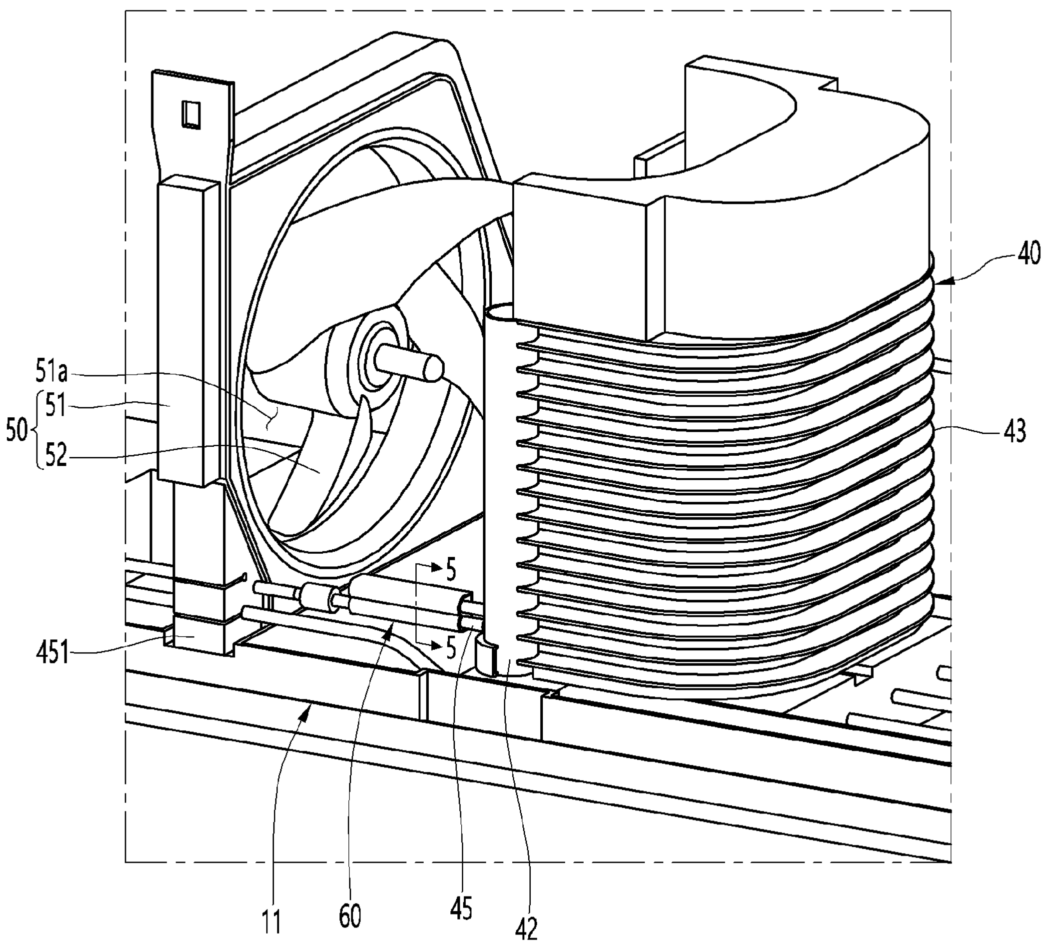


FIG. 5

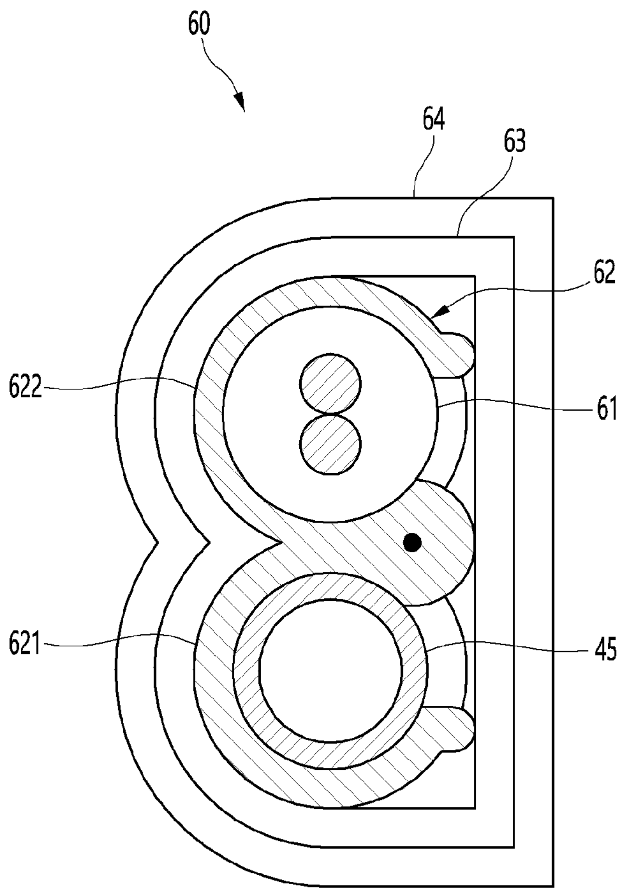


FIG. 6

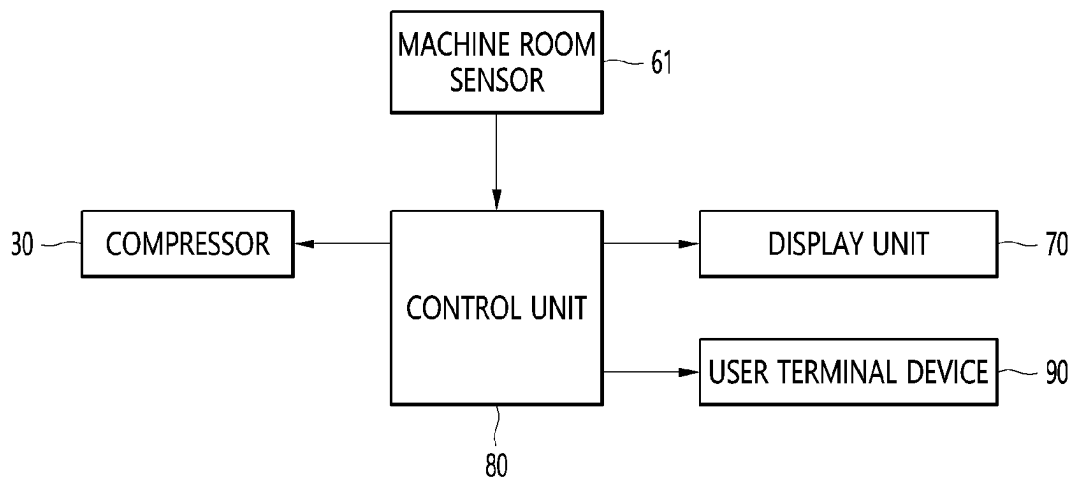

MACHINE ROOM SENSOR
61
30
COMPRESSOR
CONTROL UNIT
DISPLAY UNIT
70
USER TERMINAL DEVICE
90
80

FIG. 7

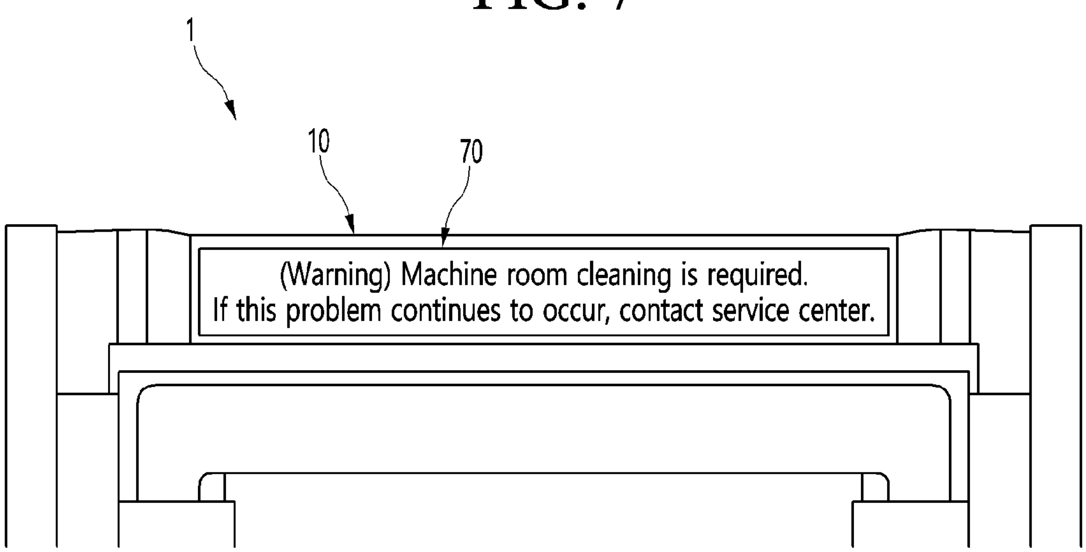
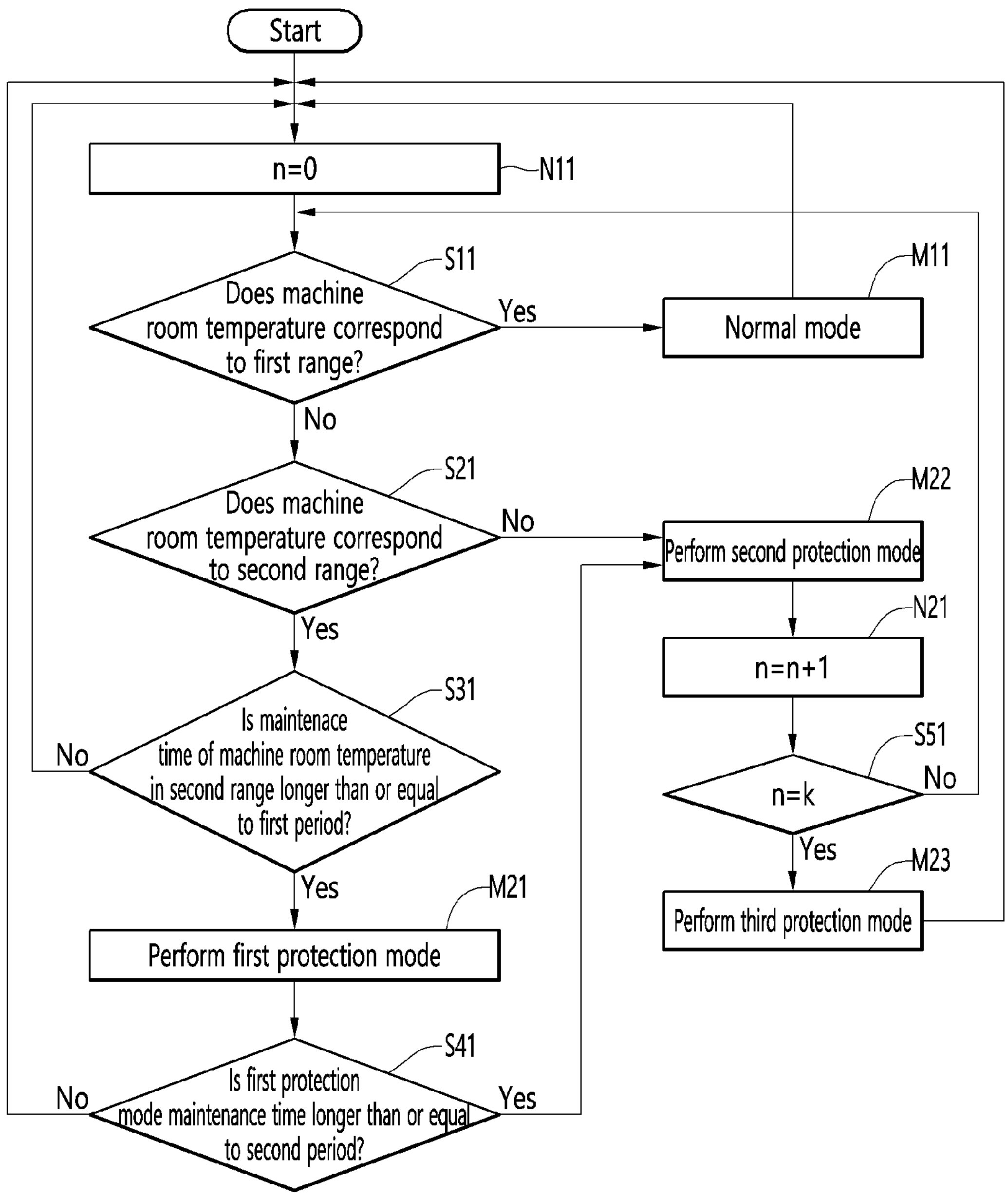

1
10
70
(Warning) Machine room cleaning is required.
If this problem continues to occur, contact service center.

FIG. 8



Start
n=0
N11
S11
Does machine room temperature correspond to first range?
Yes
Normal mode
M11
No
S21
Does machine room temperature correspond to second range?
No
Perform second protection mode
M22
Yes
N21
n=n+1
S31
Is maintenace time of machine room temperature in second range longer than or equal to first period?
No
S51
n=k
No
Yes
M23
Perform third protection mode
Yes
M21
Perform first protection mode
S41
Is first protection mode maintenance time longer than or equal to second period?
No
Yes

FIG. 9

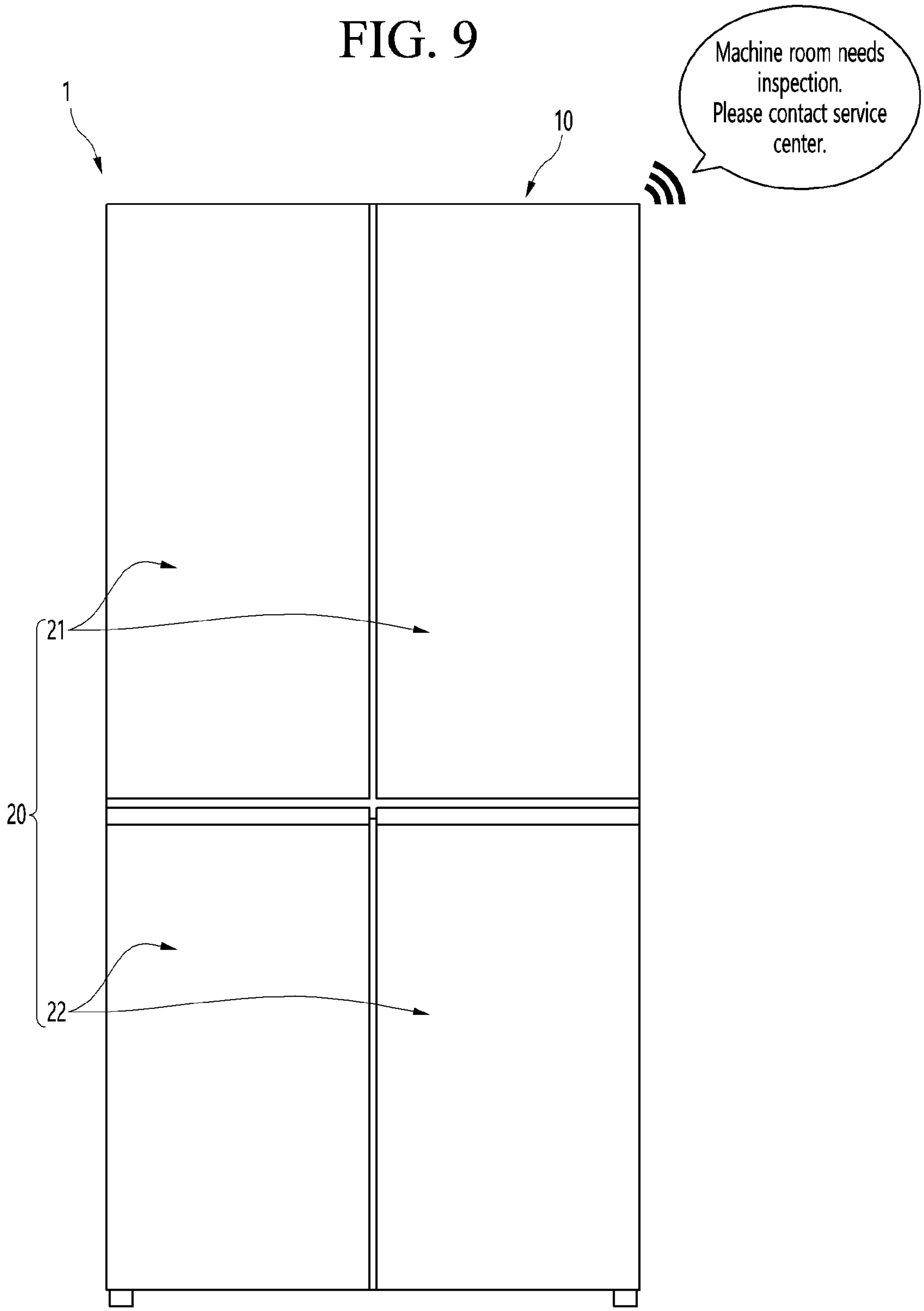

Machine room needs inspection.
Please contact service center.
1
10
21
20
22

FIG. 10

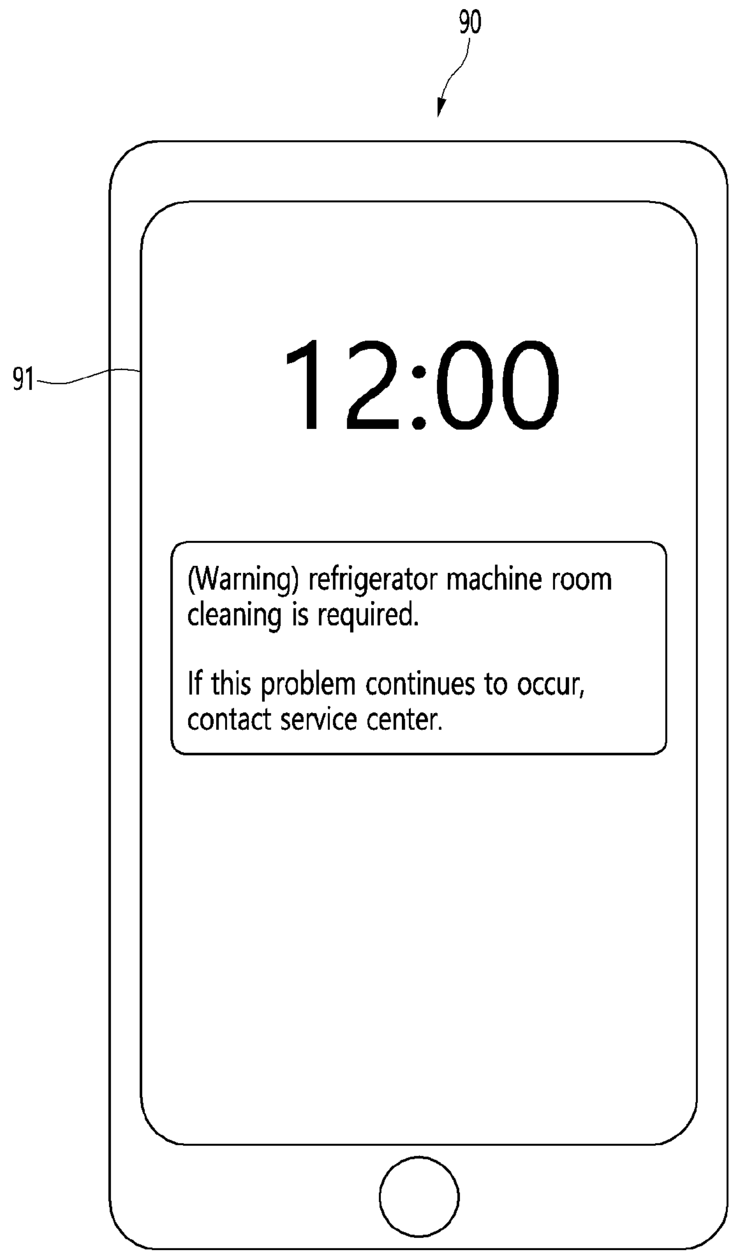
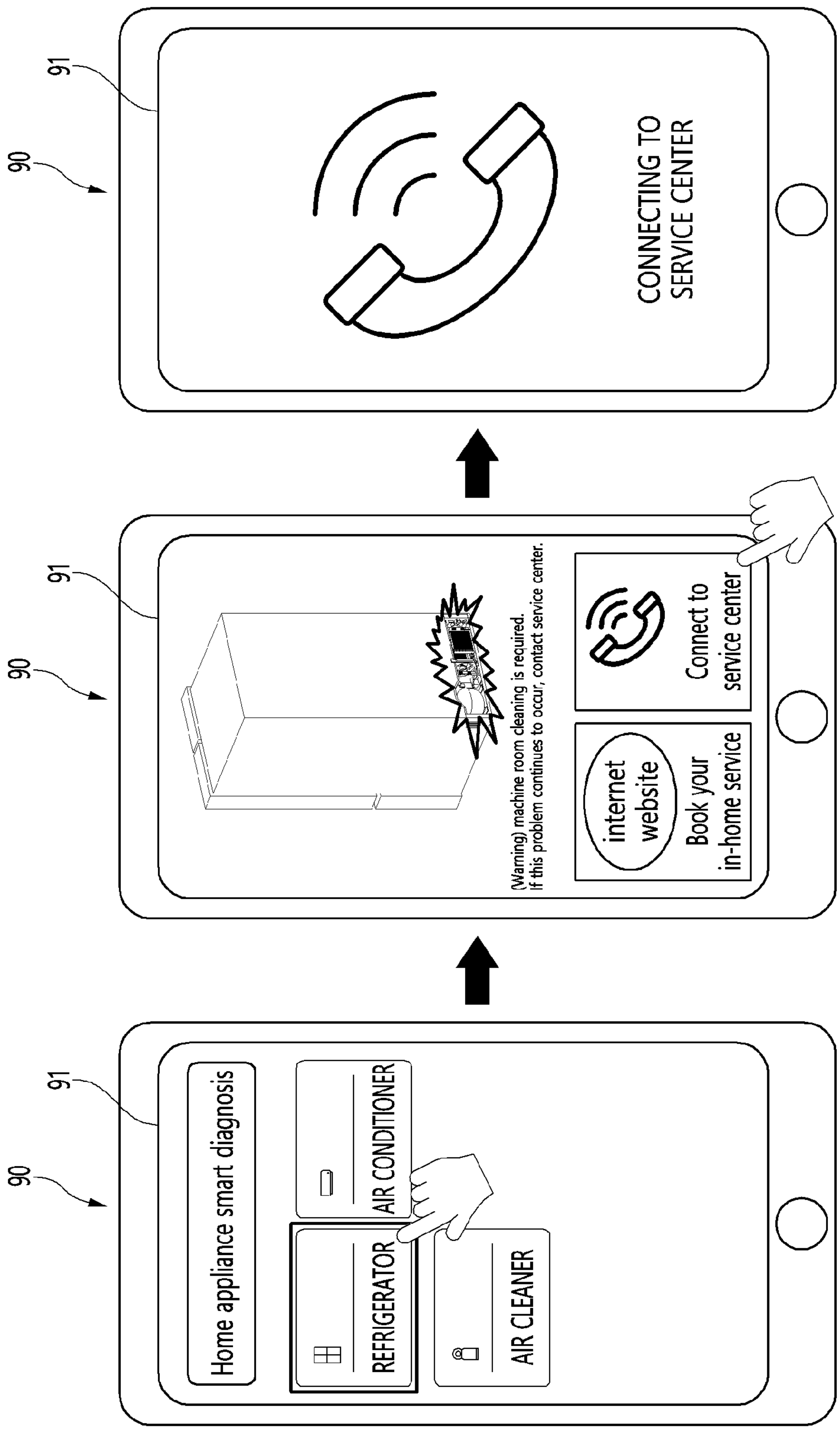

90
91
12:00
(Warning) refrigerator machine room cleaning is required.
If this problem continues to occur, contact service center.

FIG. 11


90
91
Home appliance smart diagnosis
REFRIGERATOR
AIR CONDITIONER
AIR CLEANER
90
91
(Warning) machine room cleaning is required.
If this problem continues to occur, contact service center.
internet website
Book your in-home service
Connect to service center
90
91
CONNECTING TO SERVICE CENTER

REFRIGERATOR AND METHOD FOR CONTROLLING SAME

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority under 35 U.S.C. § 119 to Korean Application No. 10-2024-0019950 filed in Korea on Feb. 8, 2024, whose entire disclosure(s) is/are hereby incorporated by reference.

BACKGROUND

1. Field

[0002] The present disclosure relates to a refrigerator and a method for controlling the same.

2. Background

[0003] A refrigerator is a home appliance that allows food to be stored at low temperatures in an internal storage space shielded by a door and is designed to keep stored food in optimal condition by cooling the inside of the storage space using cold air generated through heat exchange with the refrigerant circulating in the refrigeration cycle.

[0004] A machine room in which a refrigeration cycle device is provided may be formed in the lower portion of the cabinet. The refrigeration cycle device can keep food fresh by maintaining the inside of the refrigerator in a frozen/refrigerated state by using the property of absorbing external heat while changing low-pressure liquid refrigerant to gaseous refrigerant.

[0005] The refrigeration cycle device includes a compressor that compresses gaseous refrigerant to high temperature and high pressure, a condenser that cools the compressed refrigerant and condenses it into a liquid state, an expansion valve that expands the condensed refrigerant, and an evaporator that evaporates the refrigerant to generate cold air.

[0006] If the refrigerator is continuously used in a high temperature and high humidity environment, the blower fan in the machine room may not operate smoothly or dust may accumulate in the machine room, preventing the condenser from dissipating heat smoothly. In this case, the load on the compressor may rapidly increase, which may accelerate wear of the compressor's internal components. To prevent this, it is necessary to control the operating frequency of the compressor in preparation for situations where the load on the compressor increases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

[0008] FIG. **1** is a front view illustrating a refrigerator according to one embodiment;

[0009] FIG. **2** is a rear perspective view illustrating a refrigerator according to one embodiment;

[0010] FIG. **3** is an enlarged view illustrating the machine room of a refrigerator according to one embodiment;

[0011] FIG. **4** is an enlarged perspective view illustrating a portion where a machine room sensor is disposed in a refrigerator according to an embodiment;

[0012] FIG. **5** is a cross-sectional view taken along line **5-5** in FIG. **4**;

[0013] FIG. **6** is a block diagram illustrating the flow of control signals of a refrigerator according to one embodiment;

[0014] FIG. **7** is a schematic diagram illustrating a display unit that outputs a warning text according to a control signal of a refrigerator according to an embodiment;

[0015] FIG. **8** is a flowchart illustrating a method of controlling a refrigerator according to an embodiment;

[0016] FIG. **9** is a schematic diagram illustrating a refrigerator that outputs a warning sound according to a control signal of the refrigerator according to an embodiment;

[0017] FIG. **10** is a schematic diagram illustrating a terminal device that outputs a warning text according to a control signal from a refrigerator according to an embodiment; and

[0018] FIG. **11** is a schematic diagram illustrating a screen for diagnosing a refrigerator using a terminal device.

DETAILED DESCRIPTION

[0019] Hereinafter, specific embodiments of the present disclosure will be described in detail along with the drawings. However, the present disclosure cannot be said to be limited to the embodiments in which the idea of the present disclosure is presented, and other disclosures that are regressive or other embodiments included within the scope of the present disclosure can be easily suggested by adding, changing, or deleting other components.

[0020] Before explaining, the direction is defined. In an embodiment of the present disclosure, the direction in which a front surface of the door illustrated in FIG. **1** faces may be referred to as a front direction, the direction toward the cabinet based on the front surface of the door may be referred to as a rear direction, the direction toward the floor where the refrigerator is installed may be referred to as a lower direction, and the direction away from the floor may be referred to as an upper direction.

[0021] FIG. **1** is a front view illustrating a refrigerator according to one embodiment, and FIG. **2** is a rear perspective view illustrating a refrigerator according to one embodiment. Referring to FIGS. **1** and **2**, a refrigerator **1** according to an embodiment may include a cabinet **10** forming a storage space and a door **20** opening and closing the storage space of the cabinet **10**. For example, the cabinet **10** may form a storage space divided into upper and lower sections, and a refrigerating chamber **11** may be formed at the upper portion and a freezing chamber **12** may be formed at the lower portion.

[0022] The door **20** may include a refrigerating chamber door **21** that opens and closes the refrigerating chamber **11** and a freezing chamber door **22** that opens and closes the freezing chamber **12**. For example, the refrigerating chamber door **21** may be referred to as a first door, and the freezing chamber door **22** may be referred to as a second door.

[0023] The refrigerating chamber door **21** is connected to the cabinet **10** by a hinge (not illustrated) and may be a rotary door that opens and closes the refrigerating chamber **11** by rotation. Additionally, the refrigerating chamber doors **21** may be disposed in pairs on both left and right sides. The refrigerating chamber **11** may be opened and closed by a pair of refrigerating chamber doors **21**. As an example, the refrigerating chamber door **21** may include a first refrigerating chamber door that opens and closes the left portion of the refrigerating chamber **11** and a second refrigerating chamber door that opens and closes the right portion of the refrigerating chamber **11**.

[0024] The freezing chamber door **22** is connected to the cabinet **10** by a hinge (not illustrated) and may be a rotary door that opens and closes the freezing chamber **12** by rotation. For example, the freezing chamber door **22** may be composed of a pair of doors that rotate on both left and right sides, like the refrigerating chamber door **21**. Additionally, in another embodiment, the freezing chamber door **22** may be formed as a drawer-type door configured to open and close the freezing chamber **12** by being pulled in and out in a drawer-type manner.

[0025] Of course, in this embodiment, for convenience of explanation and understanding, the refrigerator **1** is described as an example in which the refrigerating chamber **11** is disposed at the top and the freezing chamber **12** is disposed at the bottom. However, the present disclosure is not limited to the form of the refrigerator **1** and may be applied to any type of refrigerator **1** equipped with a door.

[0026] The cabinet **10** may include an outer case **101** that forms the outer appearance, and an inner case that forms a storage space inside the outer case **101**. Additionally, an insulating material is filled between the outer case **101** and the inner case, so that the storage space can be insulated.

[0027] A machine room **13** may be formed at the rear bottom of the cabinet **10**. The machine room **13** may be equipped with components that form a refrigeration cycle for cooling the storage space. For example, the machine room **13** may include a compressor **30** that compresses and supplies refrigerant at high temperature and high pressure, a condenser **40** that dissipates heat from the high temperature and high pressure refrigerant supplied from the compressor **30**, and a blower fan unit **50** that forces the air inside the machine room **13** to flow.

[0028] The machine room **13** forms a space where a number of electrical components are placed, and can be divided from the storage space to form an independent space. The machine room **13** is in communication with an external space so that the components inside the machine room **13** may be cooled or heat exchanged.

[0029] The machine room **13** may further be provided with a bottom plate **111** forming a floor surface. The compressor **30**, condenser **40**, and blower fan unit **50** inside the machine room **13** may be provided on the bottom plate **111**. The compressor **30**, condenser **40**, and blower fan unit **50** may be mounted directly or indirectly on the bottom plate **111**.

[0030] The interior of the machine room **13** may be divided into left and right sides based on the blower fan unit **50**. Inside the machine room **13**, a condenser **40** may be placed on one side and a compressor **30** may be disposed on the other side. The area where the condenser **40** is disposed may be referred to as a suction part where external air is sucked in, and the area where the compressor **30** is disposed may be referred to as a discharge part where external air is discharged.

[0031] A machine room cover **120** may be installed in the machine room opening **102** formed at the rear surface of the machine room **13**. The machine room cover **120** may form the rear outer appearance of the machine room **13** and the outer appearance of a portion of the rear surface of the refrigerator **1**. The machine room cover **120** may shield the machine room opening **102** and prevent components inside the machine room **13** from being exposed to the outside.

[0032] The machine room cover **120** may be provided with a cover suction port **121** through which external air is sucked in and a cover discharge port **122** through which air inside the machine room **13** is discharged to the outside. As an example, the cover suction port **121** may be formed in a position corresponding to the condenser **40**, and the cover discharge port **122** may be formed in a position corresponding to the compressor **30**.

[0033] Therefore, when the blower fan unit **50** is driven, the external air flowing in through the cover suction port **121** may cool the condenser **40** while passing through the condenser **40**, be blown toward the compressor **30** to cool the compressor **30**, and then be discharged to the outside through the cover discharge port **122**.

[0034] A cabinet suction port **101***a* and a cabinet discharge port **101***b* may be disposed on both sides of the cabinet **10** corresponding to both sides of the machine room **13**. For example, the cabinet suction port **101***a* and the cabinet discharge port **101***b* may be formed in the outer case **101**. External air is sucked in through the cabinet suction port **101***a*, and the cabinet suction port **101***a* may be formed to communicate with the area where the condenser **40** is disposed. The air inside the machine room **13** is discharged to the outside through the cabinet discharge port **101***b*, and the cabinet discharge port **101***b* may be formed to communicate with the area where the compressor **30** is disposed.

[0035] Accordingly, when the blower fan unit **50** is driven, the external air flowing in through the cabinet suction port **101***a* may cool the condenser **40** while passing through the condenser **40**, be blown toward the compressor **30** to cool the compressor **30**, and then be discharged to the outside through the cabinet discharge port **101***b*.

[0036] The interior of the machine room **13** is divided into a suction part and an discharge part on both sides by the blower fan unit **50**, so that suction and discharge of air can be performed three-dimensionally. The refrigerator **1** according to one embodiment may be provided with a guide member **103** configured to allow air to flow in and out of the machine room **13**. One side of the guide member **103** may be mounted on one side of the outer case **101**, and the other side thereof may be mounted on the machine room **13** to form a suction flow path and a discharge flow path.

[0037] Accordingly, when the blower fan unit **50** is driven, the external air flowing in through the cabinet suction port **101***a* may cool the condenser **40** while passing through the condenser **40** through the guide member **103**, be blown to the side to cool the compressor **30** to cool the compressor **30**, and then pass through the guide member **103** to be discharged to the outside through the cabinet discharge port **101***b*.

[0038] The refrigerator **1** according to one embodiment may further include a refrigerator display unit **70** that displays the status of the refrigerator **1** in real time. As an example, the refrigerator display unit **70** may be provided at the front top of the cabinet **10**.

[0039] The refrigerator display unit **70** may provide the user with information about the current state of the refrigerator **1**, such as the set temperature and current temperature of the refrigerator **1**. In addition, the refrigerator display unit **70** can display an error state of the refrigerator **1**. The user can take appropriate action on the refrigerator **1** based on the error information provided through the refrigerator display unit **70**.

[0040] FIG. **3** is an enlarged view illustrating the machine room of a refrigerator according to one embodiment, FIG. **4** is an enlarged perspective view illustrating a portion where a machine room sensor is disposed in a refrigerator according to an embodiment, and FIG. **5** is a cross-sectional view taken along line **5-5** in FIG. **4**. Referring to FIGS. **3** to **5**, as described above, the machine room **13** of the refrigerator **1** according to one embodiment may be equipped with a compressor **30**, a condenser **40**, and a blower fan unit **50**.

[0041] The condenser **40** according to one embodiment may include a pair of first header **41** and second header **42**, and a tube **43** connecting between the first header **41** and the second header **42**. Although not illustrated, the condenser **40** may further include heat exchange fins connecting the tubes **43** disposed above and below. This type of configuration is a structure usually referred to as a micro channel condenser, may have a relatively compact size, and have excellent heat exchange performance.

[0042] The condenser **40** may receive refrigerant from the compressor **30** through the input pipe **44**. The input pipe **44** is connected to the first header **41** and may supply refrigerant to the first header **41**. The condenser **40** may supply refrigerant to an expansion device or valve **46** through the output pipe **45**. The output pipe **45** is connected to the second header **42** and may supply refrigerant to the expansion device **46**.

[0043] The blower fan unit **50** according to one embodiment may include a blower fan housing **51** and a blower fan blade **52** coupled to the blower fan housing **51**. The blower fan housing **51** may be mounted on the bottom plate **111**. The blower fan housing **51** may define a laterally opened blower hole **51***a*. A blower fan blade **52** may be disposed in the blower hole **51***a*. The opening shape of the blower hole **51***a* may be circular. Based on the blower hole **51***a*, the compressor **30** may be placed on one side, and the condenser **40** may be placed on the other side.

[0044] A blower fan blade **52** may be mounted on the blower fan housing **51**. The blower fan blade **52** may rotate to form an airflow. As an example, the blower fan blade **52** may form an airflow moving in a direction from the condenser **40** toward the compressor **30**. The airflow formed by the blower fan blade **52** may generally move along the shape of the blower hole **51***a*. Accordingly, a strong airflow may be formed in the area corresponding to the blower hole **51***a* within the machine room **13**. Accordingly, the area corresponding to the blower hole **51***a* within the machine room **13** may be cooler than the surrounding area. For example, a strong airflow is formed in the area corresponding to the blower hole **51***a* in the compressor **30** and the condenser **40**, and the area may be cooler than the surrounding area.

[0045] The machine room **13** may be equipped with a sensor assembly **60** including a machine room sensor **61** configured to measure the internal temperature. As an example, the sensor assembly **60** may be coupled to the output pipe **45** through which refrigerant is discharged from the condenser **40**. The operating frequency of the compressor **30** can be controlled based on the temperature measured through the sensor assembly **60**.

[0046] For example, when the blower fan unit **50** does not operate smoothly or dust accumulates inside the machine room **13** and thus heat dissipation is not performed well, the temperature inside the machine room **13** may increase. In this case, the load on the compressor **30** may rapidly increase, thereby accelerating wear of internal components of the compressor. Therefore, when the internal temperature of the machine room **13** overheats above a certain level, it is necessary to lower the frequency of the compressor **30** or stop the operation.

[0047] In general, the temperature inside the machine room **13** may rise when the condenser **40** does not dissipate heat smoothly. Therefore, it may be important to check whether a problem has occurred in the heat dissipation performance of the condenser **40**. For example, in order to reliably check the heat dissipation performance of the condenser **40**, it may be desirable to measure the temperature of the output pipe **45** through which the refrigerant is discharged from the condenser **40** to the expansion device **46**. In other words, by measuring the temperature of the output pipe **45** through which the refrigerant discharged to the outside through the condenser **40** moves, the heat dissipation performance of the condenser **40** may be indirectly checked. Accordingly, the sensor assembly **60** can be combined to surround the output pipe **45**.

[0048] The output pipe **45** may extend from the lower end of the second header **42** toward the blower fan unit **50**. The output pipe **45** may extend to the outside of the blower fan housing **51**. For example, a support member **451** is disposed on the outside of the blower fan housing **51**, and the output pipe **45** may extend through the support member **451** to the expansion device **46**. The support member **451** is disposed between the blower fan housing **51** and the lower surface of the machine room **13** and can support the blower fan unit **50**. The sensor assembly **60** and the support member **451** may be disposed to overlap in the left and right direction of the machine room **13**. In other words, the sensor assembly **60** and the support member **451** may overlap in the direction in which the blower fan unit **50** and the condenser **40** face each other. Additionally, the sensor assembly **60** may be disposed between the support member **451** and the second header **42**.

[0049] Since the sensor assembly **60** is coupled to the output pipe **45**, the sensor assembly can be located outside the blower fan unit **50**. The sensor assembly **60** and the blower fan unit **50** may be disposed to non-overlap in the left and right direction of the machine room **13**. In other words, the sensor assembly **60** and the blower fan unit **50** may non-overlap in a direction where the blower fan unit **50** and the condenser **40** face each other.

[0050] The sensor assembly **60** may be located outside the area corresponding to the air blower hole **51***a*. The sensor assembly **60** and the blower fan blade **52** may be disposed to non-overlap in the left and right direction of the machine room **13**. In other words, the sensor assembly **60** and the blower fan blade **52** may non-overlap in a direction where the blower fan unit **50** and the condenser **40** face each other.

[0051] The sensor assembly **60** may be located outside the area corresponding to the blower fan housing **51**. The sensor assembly **60** and the blower fan housing **51** may be disposed to non-overlap in the left and right direction of the machine room **13**. In other words, the sensor assembly **60** and the blower fan housing **51** may non-overlap in directions where the blower fan unit **50** and the condenser **40** face each other.

[0052] The influence of the airflow formed by the blower fan unit **50** on the sensor assembly **60** may be minimized. In other words, the sensor assembly **60** can be prevented from being directly cooled by the airflow formed by the blower fan unit **50**. The reliability of the temperature of the output pipe **45** measured by the sensor assembly **60** may be improved.

[0053] Hereinafter, the detailed structure of the sensor assembly **60** will be described. The sensor assembly **60** may include a machine room sensor **61**, a sensor holder **62** that secures the machine room sensor **61** to the output pipe **45**, an insulation member **63** surrounding the sensor holder **62**, and a sensor housing **64** surrounding the insulation member **63**.

[0054] The machine room sensor **61** can measure the temperature of the output pipe **45** through which the refrigerant discharged from the condenser **40** flows. The machine room sensor **61** may be fixed to the output pipe **45** by a sensor holder **62**. Accordingly, the relative position of the machine room sensor **61** with respect to the output pipe **45** can be maintained. Temperature information measured by the machine room sensor **61** may be provided to the control unit **80**, which will be described later.

[0055] The sensor holder **62** can fix the machine room sensor **61** to the output pipe **45**. As an example, the sensor holder **62** may include a first holder part **621** coupled to the output pipe **45** and a second holder part **622** coupled to the machine room sensor **61**. The first holder part **621** and the second holder part **622** are formed as one body and may fix the machine room sensor **61** and the output pipe **45**.

[0056] The sensor holder **62** may be surrounded by an insulation member **63**. The insulation member **63** may be provided to minimize temperature changes due to external factors. In other words, the reliability of the temperature of the output pipe **45** measured by the machine room sensor **61** through the insulation member **63** can be improved. For example, the insulation member **63** may be composed of gasket foam.

[0057] A sensor housing **64** may be disposed outside the insulation member **63**. The sensor housing **64** may form the outer appearance of the sensor assembly **60**. The sensor housing **64** may minimize the influence of the machine room sensor **61** by airflow inside the machine room **13**. In other words, the sensor housing **64** may prevent the temperature measured by the machine room sensor **61** from changing due to airflow formed inside the machine room **13**. Accordingly, the reliability of the temperature of the output pipe **45** measured by the machine room sensor **61** may be improved.

[0058] FIG. **6** is a block diagram illustrating the flow of control signals of a refrigerator according to one embodiment, and FIG. **7** is a schematic diagram illustrating a display unit that outputs a warning text according to a control signal of a refrigerator according to an embodiment. Referring to FIGS. **6** and **7**, the refrigerator **1** according to one embodiment may include a control unit **80**. The control unit **80** may control the overall operation of the refrigerator **1** or the operation of some of the components constituting the refrigerator **1**.

[0059] As an example, the control unit **80** may control the operating frequency of the compressor **30** based on temperature information provided from the machine room sensor **61**. For example, when a situation in which the temperature measured by the machine room sensor **61** is higher than the standard continues for a certain period of time, the control unit **80** may lower the operating frequency of the compressor **30** or stop the operation. Through this, it is possible to prevent accelerated wear of internal components of the compressor **30** due to a rapid increase in the load on the compressor **30** due to an increase in the temperature inside the machine room **13**.

[0060] Additionally, the control unit **80** may provide the user with information about the internal state of the machine room **13** based on temperature information provided from the machine room sensor **61**. For example, when a situation in which the temperature measured by the machine room sensor **61** is higher than the standard continues for a certain period of time, the control unit **80** may provide the user with information about the internal state of the machine room **13**.

[0061] As an example, the control unit **80** may provide information about the internal state of the machine room **13** to the user through the refrigerator display unit **70** provided in the refrigerator **1**. The control unit **80** may display that there is a problem with the heat dissipation state of the machine room **13** through the refrigerator display unit **70**.

[0062] FIG. **8** is a flowchart illustrating a method of controlling a refrigerator according to an embodiment. Referring to FIG. **8**, a method for controlling the compressor **30** based on the temperature of the machine room **13** measured through the machine room sensor **61** will be described. Controlling the compressor **30** includes controlling the operating frequency of the compressor **30**, and may be performed by the control unit **80**. The method for controlling the compressor **30** according to an embodiment may include a normal mode M**11**, a first protection mode M**21**, a second protection mode M**22**, and a third protection mode M**23**, which are classified according to the operating frequency of the compressor **30**.

[0063] First, a step N**11** of setting the counting variable n to 0 may be performed. The counting variable n may be a variable that counts and stores the number of consecutive executions of the second protection mode M**22**, which will be described later.

[0064] A step S**11** may be performed to determine whether the machine room temperature corresponds to the first range. The temperature of the machine room **13** is measured by the machine room sensor **61** described above, and the control unit **80** may determine whether the temperature of the machine room **13** corresponds to the first range. The first range may mean a range below the first reference temperature. For example, the first reference temperature may be 65° C. or more and 75° C. or less.

[0065] If the machine room temperature corresponds to the first range, the normal mode M**11** may be performed. The normal mode M**11** may mean a state where the compressor **30** operates normally, and may mean a state where the operating frequency of the compressor **30** has a first frequency. When the compressor **30** is operated in the normal mode M**11**, it may return to the step N**11** of setting the counting variable n to 0.

[0066] If the machine room temperature does not correspond to the first range, a step S**21** of determining whether the machine room temperature corresponds to the second range may be performed. The second range may mean a range the first reference temperature or more and less than the second reference temperature. For example, the second reference temperature may be 70° C. or more and less than 80° C. In other words, the second range may mean a range of 70° C. or more and less than 75° C.

[0067] In the step S**21** of determining whether the machine room temperature corresponds to the second range, when the machine room **13** temperature corresponds to the second range, the control unit **80** may measure the maintenance time that the machine room **13** temperature corresponds to the second range. When the maintenance time that the machine room **13** temperature corresponds to the second range is less than the first period, the process may return to a step N**11** of setting the counting variable n to 0. When the maintenance time that the machine room **13** temperature corresponds to the second range is the first period or more, the first protection mode M**21** may be performed.

[0068] The first protection mode M**21** may mean a state where the compressor **30** operates by reducing its operating frequency compared to the normal mode M**11**. In the first protection mode M**21**, the operating frequency of the compressor **30** may have a second frequency. For example, the second frequency may be about 40 Hz or more and 50 Hz or less. The first protection mode M**21** may be performed during the first protection time. For example, the first protection time may be about 150 minutes or more and 210 minutes or less. The first protection mode M**21** may protect the compressor **30** by reducing the operating frequency of the compressor **30** for a certain period of time. Through this, the durability of the compressor **30** may be improved and the reliability of the refrigerator **1** may be improved.

[0069] In the first protection mode M**21**, the blower fan unit **50** may be operated in the same way as in the normal mode M**11**. In the first protection mode M**21**, a warning text may be displayed on the refrigerator display unit **70**. Through this, the user can recognize an error in the heat dissipation state of the machine room **13** and solve the problem. For example, the warning text may indicate that the machine room **13** of the refrigerator **1** needs to be cleaned.

[0070] When the compressor **30** is operated in the first protection mode M**21**, a step S**41** of determining whether the first protection mode maintenance time is longer than or equal to the second period may be performed. If the maintenance time of the first protection mode M**21** is longer than or equal to the second period, the second protection mode M**22** may be performed. Details about the second protection mode M**22** will be described later. If the maintenance time of the first protection mode M**21** is less than the second period, the process may return to the step N**11** of setting the counting variable n to 0.

[0071] In the step S**21** of determining whether the machine room temperature corresponds to the second range, when the machine room **13** temperature corresponds to the second range, the second protection mode M**22** may be performed. The second protection mode M**22** may mean a state where operation of the compressor **30** is stopped for a second protection time. In other words, the operating frequency of the compressor **30** in the second protection mode M**22** may be 0 Hz. For example, the second protection time may be about 15 minutes or more and 25 minutes or less.

[0072] The second protection mode M**22** may mean a state where operation of the compressor **30** is temporarily stopped while the temperature of the machine room **13** is overheated. In other words, the second protection mode M**22** may protect the compressor **30** by stopping operation of the compressor **30** for a certain period of time. Through this, the durability of the compressor **30** may be improved and the reliability of the refrigerator **1** may be improved.

[0073] In the second protection mode M**22**, the blower fan unit **50** may be operated in the same manner as in the normal mode M**11**. Meanwhile, in the second protection mode M**22**, the operation of the fan unit in the refrigerator may be stopped together with the compressor **30** being stopped. The fan unit in the refrigerator may be a device installed in the storage space of the refrigerator **1** to supply cold air to the refrigerating chamber **11** or the freezing chamber **12**.

[0074] Additionally, a warning text may be displayed on the refrigerator display unit **70** in the second protection mode M**22**. Through this, the user can recognize the problem of the heat dissipation condition of the machine room **13** and solve the problem. The warning text may be the same as the warning text displayed in the first protection mode M**21**, but is not limited to this and a different warning text may be displayed.

[0075] After the second protection mode M**21** is performed, a step N**21** of counting the counting variable may be performed. The step N**21** of counting the counting variable may be a process of adding 1 to the previously stored counting variable n. As described above, the counting variable n is a variable that counts and stores the number of consecutive executions of the second protection mode M**22**, so the step N**21** of counting the counting variable may be a process which stores the fact that the second protection mode M**22** is performed once.

[0076] After the step N**21** of counting the counting variable, a step S**41** of determining whether the counting variable corresponds to the reference repetition number may be performed. The step S**41** of determining whether the counting variable corresponds to the reference repetition number may be performed to determine whether to perform the third protection mode M**23** to further protect the compressor **30**. In other words, when the counting variable n corresponds to the reference repetition number k, the third protection mode M**23** is performed, and when the counting variable n does not correspond to the reference repetition number k, it may return to the step S**11** of determining whether the machine room temperature corresponds to the first range. For example, the reference repetition number k may be 5.

[0077] The third protection mode M**23** may mean a state where operation of the compressor **30** is stopped for a third protection time. In other words, the operating frequency of the compressor **30** in the third protection mode M**23** may be 0 Hz. The third protection time may be longer than the second protection time. For example, the third protection time may be about 100 minutes or more and 140 minutes or less.

[0078] In the third protection mode M**23**, the blower fan unit **50** may be operated in the same way as in the normal mode M**11**. Meanwhile, in the third protection mode M**23**, the operation of the fan unit in the refrigerator may be stopped together with the compressor **30** being stopped.

[0079] Additionally, a warning text may be displayed on the refrigerator display unit **70** in the third protection mode M**23**. Through this, the user may recognize the problem of the heat dissipation condition of the machine room **13** and solve the problem. The warning text may be the same as the warning text displayed in the first protection mode M**21** and the second protection mode M**22**, but is not limited thereto and a different warning text may be displayed.

[0080] After the third protection mode M**23** is performed, the process may return to step N**11** of setting the counting variable n to 0. The third protection mode M**23** can further protect the compressor **30** by stopping operation of the compressor **30** for a longer period of time when the second protection mode M**22** is continuously performed. Through this, the durability of the compressor **30** may be improved and the reliability of the refrigerator **1** may be improved.

[0081] According to the method for controlling the refrigerator **1** according to an embodiment, the operating frequency of the compressor **30** may be controlled based on the internal temperature of the machine room **13** measured by the machine room sensor **61**. Through this, if the operation of the blower fan unit **50** in the machine room **13** is not smooth, or the heat dissipation of the condenser **40** is not performed smoothly due to dust accumulating in the machine room **13**, causing the internal temperature of the machine room **13** to rise, it is possible to effectively prevent a load occurring on the compressor **30**. Accordingly, wear of internal components due to a rapid increase in the load of the compressor **30** can be prevented, durability of the compressor **30** may be improved, and reliability of the refrigerator **1** may be improved.

[0082] Hereinafter, in the method for controlling the refrigerator **1**, another embodiment of a method of informing the user of information about the status of the refrigerator **1** will be described. FIG. **9** is a schematic diagram illustrating a refrigerator that outputs a warning sound according to a control signal of the refrigerator according to an embodiment.

[0083] Referring to FIG. **9**, the control unit **80** may control a warning sound to be generated when a problem occurs in the internal state of the refrigerator **1**. Although not illustrated, the refrigerator **1** may be equipped with an audio output unit (not illustrated) that outputs a warning sound.

[0084] For example, the refrigerator **1** may generate a warning sound in the first protection mode M**21**, the second protection mode M**22**, and the third protection mode M**23**. Through this, the user can recognize an error in the heat dissipation state of the machine room **13** and solve the problem.

[0085] The warning sounds generated in the first protection mode M**21**, the second protection mode M**22**, and the third protection mode M**23** may be the same, respectively, but the present disclosure is not limited thereto, and different warning sounds may be generated for each.

[0086] For example, the warning sound may be a sound output of the text displayed on the refrigerator display unit **70** described with reference to FIG. **7**. Without being limited to this, the refrigerator **1** may output a simple warning sound instead of the warning sound.

[0087] FIG. **10** is a schematic diagram illustrating a terminal device that outputs a warning text according to a control signal from a refrigerator according to an embodiment. Referring to FIG. **10**, the control unit **80** may indicate to the user terminal device **90** connected to the refrigerator **1** through remote communication that there is a problem with the heat dissipation state of the machine room **13**.

[0088] For example, the terminal display unit **91** of the user terminal device **90** may output a warning text in the first protection mode M**21**, the second protection mode M**22**, and the third protection mode M**23**. Through this, the user can recognize an error in the heat dissipation state of the machine room **13** and solve the problem.

[0089] For example, a warning text indicating that the machine room **13** of the refrigerator **1** needs to be cleaned may be displayed on the terminal display unit **91** of the user terminal device **90**. The warning texts output in the first protection mode M**21**, the second protection mode M**22**, and the third protection mode M**23** may be the same, respectively, but are not limited thereto, and different warning texts may be output for each.

[0090] FIG. **11** is a schematic diagram illustrating a screen for diagnosing a refrigerator using a terminal device. Referring to FIG. **11**, the user may diagnose the state of the refrigerator **1** using the user terminal device **90**. For example, an application program that can control and diagnose home appliances is installed in the user terminal device **90**, and the user can select and perform a status diagnosis on the refrigerator **1**.

[0091] If there is a problem with the condition of the refrigerator **1**, the user terminal device **90** may provide a menu that may connect to a homepage or a service center where a service visit can be reserved through the installed application. Through this, users can easily diagnose the status of home appliances and, when a problem is recognized, contact is made and then repair service may be requested immediately.

[0092] An aspect of an embodiment of the present disclosure is to provide a refrigerator that can control the operating frequency of the compressor by monitoring the overheating state of the condenser in real time, and a method for controlling the same. An aspect of an embodiment of the present disclosure is to provide a refrigerator equipped with a temperature sensor disposed to minimize the influence of wind provided by a blower fan in the machine room and configured to accurately measure the temperature of the condenser, and a method for controlling the same. An aspect of an embodiment of the present disclosure is to provide a refrigerator that can provide real-time information to a user when an overheating state of the condenser is detected, and a method for controlling the same.

[0093] A refrigerator according to an embodiment to solve the above problem includes a cabinet forming a storage space and a machine room; a compressor disposed in the machine room and configured to compress refrigerant; a condenser disposed in the machine room and configured to condense the refrigerant compressed in the compressor; an output pipe connected to the condenser and configured to discharge the refrigerant from the condenser; a machine room sensor coupled to the output pipe to measure the temperature of the output pipe; and a control unit configured to control an operating frequency of the compressor based on the temperature measured by the machine room sensor.

[0094] The control unit may be configured to: when the measured temperature corresponds to a first range less than a first reference temperature, control the compressor to perform a normal mode in which the compressor is operated at a first frequency, and when the measured temperature corresponds to a second range greater than or equal to the first reference temperature and less than a second reference temperature, control the compressor to perform a first protection mode in which the compressor is operated at a second frequency lower than the first frequency.

[0095] The control unit may be configured to: when a time for which the measured temperature maintains the second range is less than a first period, control to perform the normal mode, and when the time for which the measured temperature maintains the second range is greater than or equal to the first period, control to perform the first protection mode. The second frequency may be 40 Hz or more and 50 Hz or less. The first protection mode may be performed during a first protection time, and the first protection time may be 150 minutes or more and 210 minutes or less.

[0096] The control unit may be configured to: when the measured temperature corresponds to a third range greater than or equal to the second reference temperature, control the compressor to perform a second protection mode in which the compressor is operated at a third frequency lower than the second frequency.

[0097] The second protection mode may be performed during a second protection time, and the control unit may be configured to: count the number of consecutive executions of the second protection mode, when the number of times the second protection mode is performed corresponds to the reference repetition number, control so that the compressor performs the third protection mode operated at the third frequency, and control so that the third protection mode is performed for a third protection time longer than the second protection time.

[0098] The second protection time may be 15 minutes or more and 25 minutes or less, and the third protection time may be 100 minutes or more and 140 minutes or less. The first reference temperature may be smaller than the second reference temperature, the first reference temperature may be 65° C. or more and less than 75° C., and the second reference temperature may be 70° C. or more and less than 80° C. The third frequency may be 0 Hz.

[0099] The refrigerator may further include a refrigerator display unit configured to output a current state of the refrigerator, in which the control unit may be configured to: when the first protection mode or the second protection mode is performed, control to display a warning text on the refrigerator display unit.

[0100] The control unit may be configured to: when the first protection mode or the second protection mode is performed, control the refrigerator to output a warning sound. The control unit may be configured to: when the first protection mode or the second protection mode is performed, control to output a warning text to a user terminal device connected to the refrigerator.

[0101] According to an embodiment to solve the above problem, a method for controlling a refrigerator in which the refrigerator includes a cabinet forming a storage space and a machine room; a compressor disposed in the machine room and configured to compress refrigerant; a condenser disposed in the machine room and configured to condense the refrigerant compressed in the compressor; an output pipe connected to the condenser and configured to discharge the refrigerant from the condenser; a machine room sensor coupled to the output pipe to measure the temperature of the output pipe; and a control unit configured to control an operating frequency of the compressor based on the temperature measured by the machine room sensor, the method includes measuring temperature through the machine room sensor; and adjusting the operating frequency of the compressor based on the temperature measured by the machine room sensor.

[0102] The adjusting the operating frequency of the compressor based on the measured temperature may include when the measured temperature corresponds to a first range less than a first reference temperature, controlling the compressor to perform a normal mode operated at a first frequency, and when the measured temperature corresponds to a second range greater than or equal to the first reference temperature and less than a second reference temperature, controlling the compressor to perform a first protection mode in which the compressor is operated at a second frequency lower than the first frequency.

[0103] When a time for which the measured temperature maintains the second range is less than a first period, the normal mode may be performed, and when the time for which the measured temperature maintains the second range is greater than or equal to the first period, the first protection mode may be performed.

[0104] The adjusting the operating frequency of the compressor based on the measured temperature may further include when the measured temperature corresponds to a third range greater than or equal to the second reference temperature, performing a second protection mode in which the compressor is operated at a third frequency lower than the second frequency.

[0105] The method may further include counting the number of times the second protection mode is continuously performed; and when the number of times the second protection mode is performed corresponds to the reference repetition number, performing a third protection mode in which the compressor is operated at the third frequency, in which the second protection mode may be performed for a second protection time, and the third protection mode may be performed for a third protection time longer than the second protection time.

[0106] The second protection time may be 15 minutes or more and 25 minutes or less, and the third protection time may be 100 minutes or more and 140 minutes or less. The first reference temperature may be smaller than the second reference temperature, the first reference temperature may be 65° C. or more and less than 75° C., and the second reference temperature may be 70° C. or more and less than 80° C.

[0107] The following effects can be expected from a refrigerator and a method for controlling the same according to the proposed embodiment. According to an embodiment of the present disclosure, the sensor in the machine room is disposed to minimize the influence of wind provided by the blower fan so that the temperature of the condenser may be accurately measured.

[0108] According to an embodiment of the present disclosure, the operating frequency of the compressor may be controlled in real time by monitoring the overheating state of the condenser. According to an embodiment of the present disclosure, the reliability of the refrigerator may be improved by providing real-time information to the user when an overheating state of the condenser is detected.

[0109] It will be understood that when an element or layer is referred to as being "on" another element or layer, the element or layer can be directly on another element or layer or intervening elements or layers. In contrast, when an element is referred to as being "directly on" another element or layer, there are no intervening elements or layers present. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0110] It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

[0111] Spatially relative terms, such as "lower", "upper" and the like, may be used herein for ease of description to describe the relationship of one element or feature to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "lower" relative to other elements or features would then be oriented "upper" relative to the other elements or features. Thus, the exemplary term "lower" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0112] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0113] Embodiments are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate structures). As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0114] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0115] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0116] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. A refrigerator comprising:

a cabinet that forms a storage space and a machine room;

a compressor this is provided in the machine room and is configured to compress a refrigerant;

a condenser that is provided in the machine room and is configured to condense the refrigerant received from the compressor;

an output pipe that is fluidly connected to the condenser and configured to discharge the refrigerant from the condenser;

a sensor that is configured to measure a temperature at the output pipe; and

a control unit that is configured to control an operating frequency of the compressor based on the temperature measured by the sensor.

2. The refrigerator of claim **1**,

wherein the control unit is configured to:

in response to determining that the measured temperature is within a first range that is less than a first reference temperature, perform a normal mode that includes operating the compressor at a first frequency, and

in response to determining that the measured temperature is within a second range that is greater than or equal to the first reference temperature and less than a second reference temperature, perform a first protection mode that includes operating the compressor at a second frequency that is lower than the first frequency.

3. The refrigerator of claim **2**,

wherein the control unit is configured to:

perform the normal mode further in response to determining that a time during which the measured temperature is within the second range is less than a first period, and

perform the first protection mode further in response to determining that the time during which the measured temperature is within the second range is greater than or equal to the first period.

4. The refrigerator of claim **2**,

wherein the second frequency is 40 Hz or more and 50 Hz or less.

5. The refrigerator of claim **2**,

wherein the first protection mode is performed for a first protection time, and

wherein the first protection time is 150 minutes or more and 210 minutes or less.

6. The refrigerator of claim **2**,

wherein the control unit is configured to:

in response to determining that the measured temperature is in a third range that is greater than or equal to the second reference temperature, perform a second protection mode that includes operating the compressor at a third frequency lower than the second frequency.

7. The refrigerator of claim 6,
wherein the second protection mode is performed for a second protection time, and
wherein the control unit is configured to:
count a number of times that the second protection mode is consecutively performed,
in response to determining that the number of times that the second protection mode is consecutively performed corresponds to a reference repetition number, perform the third protection mode that includes operating the compressor at the third frequency for a third protection time longer than the second protection time.

8. The refrigerator of claim 7,
wherein the second protection time is 15 minutes or more and 25 minutes or less, and
wherein the third protection time is 100 minutes or more and 140 minutes or less.

9. The refrigerator of claim 6,
wherein the first reference temperature is less than the second reference temperature,
wherein the first reference temperature is 65° C. or more and less than 75° C., and
wherein the second reference temperature is 70° C. or more and less than 80° C.

10. The refrigerator of claim 6,
wherein the third frequency is 0 Hz.

11. The refrigerator of claim 6, further comprising:
a display configured to output an indication of a current state of the refrigerator,
wherein the control unit is configured to:
in response to performing at least one of the first protection mode or the second protection mode is performed, control the display to output a warning message.

12. The refrigerator of claim 6,
wherein the control unit is configured to:
in response to performing at least one of the first protection mode or the second protection mode, control the refrigerator to output a warning sound.

13. The refrigerator of claim 6,
wherein the control unit is configured to:
in response to performing at least one of the first protection mode or the second protection mode, control the refrigerator to output a warning message to a user terminal device connected to the refrigerator.

14. A method for controlling a refrigerator that includes a machine room; a compressor provided in the machine room; and a condenser provided in the machine room, the method comprising:
measuring, by a sensor, a temperature at a pipe that discharges refrigerant from the condenser; and
managing, by a control unit, an operating frequency of the compressor based on the temperature measured by the sensor.

15. The method of claim 14,
wherein managing the operating frequency of the compressor based on the temperature includes:
in response to determining that the temperature is less than a first reference temperature, controlling the compressor to operate at a first frequency, and
in response to determining that the measured temperature is greater than or equal to the first reference temperature and less than a second reference temperature, controlling the compressor to operate at a second frequency lower than the first frequency.

16. The method of claim 15,
wherein managing the operating frequency of the compressor based on the temperature further includes:
controlling the compressor to operate at the first frequency further in response to determining that a time during which the temperature is greater than or equal to the first reference temperature and less than the second reference temperature is less than a first period, and
controlling the compressor to operate at the second frequency further in response to determining that the time during which the temperature is greater than or equal to the first reference temperature and less than the second reference temperature is greater than or equal to the first period.

17. The method of claim 15,
wherein managing the operating frequency of the compressor based on the temperature further includes:
in response to determining that the temperature is greater than or equal to the second reference temperature, operating the compressor at a third frequency lower than the second frequency.

18. The method of claim 17,
wherein managing the operating frequency of the compressor based on the temperature further includes:
counting a number of times, consecutively, that the compressor is operated at the second frequency; and
in response to determining that the number of times that the compressor is operated at the second frequency corresponds to a reference repetition number, operating the compressor at the third frequency,
wherein the compressor is operated at the second frequency for a second protection time, and
wherein the compressor is operated at the third frequency for a third protection time longer than the second protection time.

19. The method of claim 18,
wherein the second protection time is 15 minutes or more and 25 minutes or less, and
wherein the third protection time is 100 minutes or more and 140 minutes or less.

20. The method of claim 17,
wherein the first reference temperature is smaller than the second reference temperature,
wherein the first reference temperature is 65° C. or more and less than 75° C., and
wherein the second reference temperature is 70° C. or more and less than 80° C.

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