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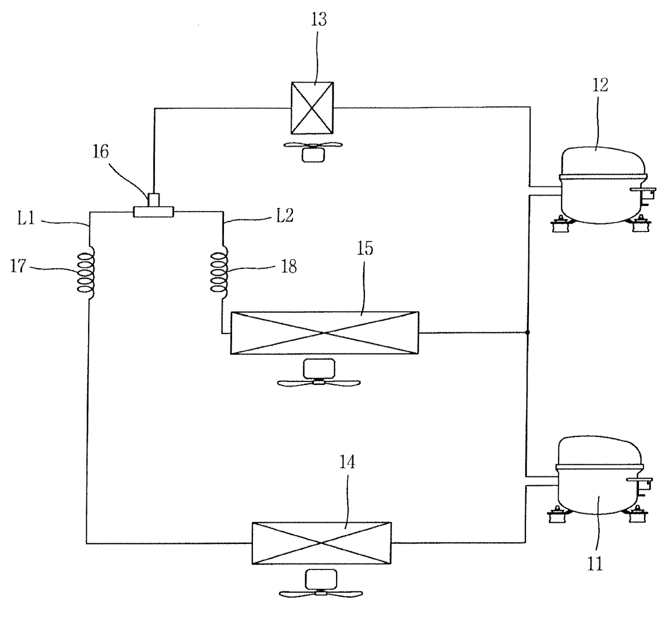
(54) **Refrigerator and driving method thereof**

(57) A refrigerator and a driving method thereof are disclosed. The number of vibration of each compressor, evaporation temperature of each evaporator, or an open time of a refrigerant switching valve is detected to determine whether the flow of refrigerant is biased so as to adjust a cooling capability of the compressor or an open value or open time of a refrigerant switching valve, thereby uniformly distributing the refrigerant into first and second evaporators. Accordingly, the refrigerator can be driven with an independent refrigeration cycle corresponding to a load of a freezing chamber or a refrigerating chamber, resulting in reduction of unnecessary power consumption of the refrigerator.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] This specification relates to a refrigerator and a method for driving the same, and particularly, to a refrigerator having a refrigeration cycle with a plurality of compressors and evaporators, and a method for driving the same.

2. Background of the Invention

[0002] In general, a refrigerator is an apparatus for keeping an inside of the refrigerator at low temperature using a refrigeration cycle having a compressor, a condenser, an expansion apparatus and an evaporator. The compressor of the refrigerator is lubricated using oil for protection from a mechanical friction, and the oil within the compressor is allowed to circulate a refrigeration cycle forming a closed loop together with high temperature and high pressure refrigerant gas discharged out of the compressor.

[0003] If such oil is aggregated (accumulated) in the condenser, the evaporator and pipes of the refrigeration cycle, the performance of the refrigeration cycle may be lowered. If the oil does not smoothly flow back into the compressor, the lack of oil within the compressor may be caused, resulting in a damage of the compressor.

[0004] The refrigeration cycle applied to the refrigerator may be classified, according to the number of compressors and evaporators, into an 1Eva-cycle having a single compressor and a single evaporator, a parallel 2Eva cycle in which a plurality of evaporators are connected in parallel to an inlet of a single compressor, a 1Comp 2Stage cycle in which a plurality of evaporators are connected to a single 2-stage compressor, a serial cycle having a plurality of evaporators connected to the single compressor in series, a bypass serial cycle in which a plurality of evaporators are selectively connected to a single compressor in series.

SUMMARY OF THE INVENTION

[0005] In the refrigerator having the related art refrigeration cycle, when one evaporator is connected to one compressor, a refrigerating chamber is overcooled and thereby power consumption is increased. When a plurality of evaporators are connected to one compressor in parallel or in series, the refrigerating chamber and the freezing chamber can be separately driven, which allows power consumption to be lowered to some degree. However, the power consumption is still increased as compared with required cooling capability and additionally the compressor should be configured as a two-stage compressor.

[0006] Therefore, an aspect of the detailed description is to provide a refrigerator capable of reducing power consumption with simultaneously driving a freezing chamber and a refrigerating chamber and being facilitated for fabrication.

[0007] To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, a refrigerator may include a plurality of compressors sequentially connected to perform a multi-stage compression for a refrigerant, a condenser connected to an outlet side of a secondary compressor of the plurality of compressors, the secondary compressor located at a downstream based on the flowing direction of the refrigerant, a first evaporator diverged from the condenser and connected to an inlet side of a primary compressor of the plurality of compressors, the primary compressor located at an upstream based upon the flowing direction of the refrigerant, a second evaporator diverged from the condenser together with the first evaporator and connected between an outlet side of the primary compressor and an inlet side of the secondary compressor, a refrigerant switching valve installed such that an inlet side of the first evaporator and an inlet side of the second evaporator are connected to an outlet side of the condenser in parallel and configured to control the flowing direction of the refrigerant toward the first evaporator or the second evaporator, a refrigerant amount detecting unit configured to detect an amount of refrigerant introduced into the first or second evaporator, and a refrigerant amount adjusting unit configured to adjust amounts of refrigerant flowing toward the first and second evaporators, respectively, according to the result detected by the refrigerant amount detecting unit.

[0008] In accordance with one exemplary embodiment, a driving method for a secondary compressors sequentially connected to each other, determining whether the flow secondary compressors sequentially connected to each other, determining whether the flow of refrigerant is biased by comparing the detected number of vibration with a reference value set in a micom, and increasing a cooling capability of a compressor, to which it is determined more refrigerant flows.

[0009] In accordance with another exemplary embodiment, a driving method for a refrigerator may include detecting evaporation temperatures of first and second evaporators connected to a condenser in parallel, determining whether or not a flow of refrigerant is biased by comparing the detected evaporation temperatures with a reference temperature, and adjusting an open value of a refrigerant switching valve to reduce the amount of refrigerant introduced into an evaporator to which it is determined more refrigerant flows.

[0010] In accordance with another exemplary embodiment, a driving method for a refrigerator may include detecting an open time of a refrigerant switching valve with respect to each of first and second evaporators, the refrigerant switching valve installed to allow the first and second evaporators to be connected to a condenser in parallel, determining whether a flow of refrigerant is biased by comparing the detected open time with a reference open time, and adjusting the open time of the refrigerant switching valve to reduce the amount of refrigerant introduced into an evaporator to which more refrigerant flows.

[0011] In accordance with another exemplary embodiment, a driving method for a refrigerator having a freezing chamber refrigeration cycle comprising a plurality of compressors sequentially connected to each other, and a refrigerating chamber refrigeration cycle comprising a compressor located at a downstream of the plurality of compressors, the method may be configured such that one of the number of vibration, evaporation temperatures or a flow of refrigerant is measured with respect to the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle, to control the amount of refrigerant flowing between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle.

[0012] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be embodiments of the invention, are given by way of illustration only, since various changes embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

[0014] In the drawings:

FIG. 1 is a perspective view schematically showing a refrigerator in accordance with the present disclosure;

FIG. 2 is a block diagram showing one exemplary embodiment of a refrigeration cycle according to FIG. 1;

FIGS. 3 and 4 are a block diagram and a flowchart each showing a driving method for a refrigerator using a vibration sensor in the refrigerator of FIG. 1;

FIGS. 5 and 6 are a block diagram and a flowchart each showing a driving method for a refrigerator using a temperature sensor in the refrigerator of FIG. 1; and

FIGS. 7 and 8 are a block diagram and a flowchart each showing a driving method for a refrigerator using a timer in the refrigerator of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Description will now be given in detail of a refrigerator according to the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

[0016] FIG. 1 is a perspective view schematically showing a refrigerator in accordance with the present disclosure, and FIG. 2 is a block diagram showing one exemplary embodiment of a refrigeration cycle according to FIG. 1.

[0017] As shown in FIGS. 1 and 2, a refrigerator may include a refrigerator main body 1 having a freezing chamber and a refrigerating chamber, and a freezing chamber door 2 and a refrigerating chamber door 3 for opening or closing the freezing chamber and the refrigerating chamber of the refrigerator main body 1, respectively.

[0018] A lower side of the refrigerator main body 1 may be shown having a machine chamber, in which a refrigeration cycle for generating cold air is disposed. The refrigeration cycle may be implemented in various configurations according to a type of refrigerator. The refrigeration cycle according to this exemplary embodiment may include a plurality of compressors and a plurality of evaporators and be divided into a freezing chamber refrigeration cycle and a refrigerating chamber refrigeration cycle. The freezing chamber refrigeration cycle may be a closed loop cycle formed by connecting a primary compressor 11, a secondary compressor 12, a condenser 13 and a first evaporator 14, while the refrigerating chamber side refrigeration cycle may be a closed loop cycle formed by connecting the secondary compressor 12, the condenser 13 and a second evaporator 15.

[0019] The plurality of compressors 11 and 12 and the condenser 13 may be installed in the machine chamber. The plurality of compressors 11 and 12 may be connected to each other in series. Namely, an outlet of the primary compressor 11 may be connected to an inlet of the secondary compressor 12 such that a refrigerant, which underwent a primary (one-stage) compression in the primary compressor 11, then experiences a secondary (two-stage) compression in the secondary compressor 12. An outlet of the secondary compressor 12 may be connected to an inlet of the condenser 13. The primary and secondary compressors 11 and 12 may be designed to have the same capacity. For a typical refrigerator, a refrigerating chamber driving mode is run more frequently, so it may also be possible that the secondary compressor 12, operatively in association with the refrigerating chamber driving mode, is designed to have a capacity twice larger than that of the primary compressor 11.

[0020] The plurality of evaporators 14 and 15 configuring a part of the refrigeration cycle may be connected to each other in parallel by a first branch pipe L 1 and a second branch pipe L2 diverged near the outlet of the condenser 13. A refrigerant switching valve 16 for control of a flowing direction of a refrigerant may be installed at the diverged point between the first and second branch pipes L 1 and L2. A first expansion apparatus 17 and a second expansion apparatus 18 each for expanding a refrigerant may be installed in the middle of the branch pipes L 1 and L2, respectively, namely, near inlets of both evaporators 14 and 15.

[0021] The refrigerant switching valve 16 may be implemented as a 3-way valve. For example, the refrigerant switching valve 16 may have a structure that the outlet of the condenser selectively communicates with one of the evaporators or simultaneously communicates with both the evaporators.

[0022] The refrigerator having the configuration may have the following operational effects.

[0023] That is, the refrigerant switching valve 16 may control the refrigerant to flow toward the first evaporator or the second evaporator according to a driving mode of the refrigerator, thereby implementing a simultaneous driving mode for simultaneously driving the refrigerating chamber and the freezing chamber, a freezing chamber driving mode for driving only the freezing chamber, or a refrigerating chamber driving mode for driving only the refrigerating chamber.

[0024] For example, in the simultaneous driving mode of the refrigerator, the refrigerant switching valve 16 is all open such that a refrigerant can circulate the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle. That is, a refrigerant flowed through the condenser 13 may flow by being distributed into the first evaporator 14 and the second evaporator 15. Simultaneously, the primary compressor 11 and the secondary compressor 12 start to be driven.

[0025] Accordingly, a refrigerant, which is sucked into the primary compressor 11 via the first evaporator 14, experiences a primary compression in the primary compressor 11. The primarily compressed refrigerant, which is discharged out of the primary compressor 11, is introduced into the secondary compressor 12. Here, a refrigerant, which flows through the second evaporator 15, is mixed with the primarily compressed refrigerant discharged out of the primary compressor 11, thereby being introduced into the secondary compressor 12.

[0026] The primarily compressed refrigerant and the refrigerant flowed through the second evaporator 15 are compressed in the secondary compressor 12 and discharged. The refrigerant discharged out of the secondary compressor 12 flows into the condenser 13 to be condensed. The condensed refrigerant in the condenser 13 is re-distributed toward the first evaporator 14 and the second evaporator 15 by means of the refrigerant switching valve 16 for circulation. Such series of processes are repeated.

[0027] On the other hand, when the refrigerator is in the freezing chamber driving mode, the refrigerant switching valve 16 blocks the direction toward the second evaporator 15 as the refrigerating chamber refrigeration cycle, and opens only the direction toward the first evaporator 14 as the freezing chamber refrigeration cycle, such that a refrigerant flowed through the condenser 13 can move only toward the first evaporator 14. However, the primary compressor 11 and the secondary compressor 12 are driven simultaneously. Accordingly, the refrigerant flowed through the first evaporator 14 can circulate with being secondarily compressed sequentially via the primary and secondary compressors 11 and 12.

[0028] When the refrigerator is in the refrigerating chamber driving mode, on the other hand, the refrigerant switching valve 16 blocks the direction toward the first evaporator 14 as the freezing chamber refrigeration cycle and opens the direction toward the second evaporator 15 as the refrigerating chamber refrigeration cycle. Also, only the secondary compressor 12 starts to be driven with the primary compressor 11 stopped.

[0029] Accordingly, a refrigerant flowed through the condenser 13 flows only toward the second evaporator 15 to be introduced into the secondary compressor 12. The refrigerant, which is discharged after being compressed in the secondary compressor 12, flows into the condenser 13 to be condensed. Such series of processes are repeated.

[0030] Consequently, the refrigerator can be driven with the refrigeration cycles, which are independently run in correspondence with the load of the freezing chamber or the refrigerating chamber, which allows reduction of unnecessary power consumption of the refrigerator, thereby remarkably improving efficiency of the refrigerator.

[0031] However, with the configuration of the refrigerator, as the plurality of refrigeration cycles are connected to one pipe, a refrigerant may be biased to any one side according to loads of the freezing chamber and the refrigerating chamber when the refrigerator is driven in the simultaneous driving mode or the freezing chamber driving mode. However, when preventing this, the temperature of the refrigerator may not reach a target temperature, accordingly, an operating factor is increased to make the refrigerator consecutively driven, which may further increase power consumption.

[0032] FIGS. 3 to 8 are block diagrams each showing a micom, which is capable of preventing a refrigerant from being biased toward one evaporator in the refrigerator, and flowcharts showing a driving method for the refrigerator using the micom.

[0033] Referring to FIGS. 3 and 4, vibration sensors 21 may be installed at the primary compressor 11 and the secondary compressor 12, respectively. A micom 30 may be electrically connected to the vibration sensors 21 so as to vary a cooling capability of one of the compressors according to the number of vibration of each of the primary and secondary compressors 11 and 12, detected by the vibration sensors 21.

[0034] The vibration sensor 21 may be installed on an inner surface or an outer surface of a hermetic case (reference numeral not given) of each compressor 11, 12.

[0035] The micom 30 may include an input part 31 for receiving the number of vibration of each of the primary compressor 11 and the secondary compressor 12, a determination part 32 connected to the input part 31 for comparing the number of vibration of each compressor 11, 12 with a reference value to determine to which evaporator the flow of the refrigerant is biased (inclined, more refrigerant flows), and an instruction part 33 connected to the determination part 32 to instruct an increase in a cooling capability of a compressor connected to the corresponding evaporator to which the flow of the refrigerant is biased.

[0036] Hereinafter, a driving method for the refrigerator will be described with reference to FIG. 3.

[0037] First, the vibration sensor 21 provided at the primary compressor 11 may detect the number of vibration of the primary compressor 11 so as to input to the input part 31 of the micom 30.

[0038] The determination part 32 may then compare the detected number of vibration with a reference number of vibration (i.e. reference value) to determine whether the flow of the refrigerant is biased toward the first evaporator 14 (namely, whether or not a uniform distribution of the refrigerant is needed).

[0039] If it is determined the refrigerant is biased toward the first evaporator 14, the cooling capability of the primary compressor 11 may be increased so as to mostly circulate the refrigerant biased toward the first evaporator 14. Accordingly, the amount of refrigerant discharged out of the first evaporator 14 may be increased while the amount of refrigerant discharged out of the second evaporator 15 may be relatively decreased. Hence, the refrigerants at both the evaporators 14, 15 may be added and reduced with each other to be balanced.

[0040] However, if it is determined that the flow of the refrigerant is not biased toward the first evaporator 14, the vibration sensor 21 provided at the secondary compressor 12 may be used to determine whether or not the flow of the refrigerant is biased toward the second evaporator 15. If it is determined the flow of refrigerant is biased toward the second evaporator 15, the cooling capability of the second evaporator 15 may be increased to mostly circulate the refrigerant biased toward the second evaporator 15. Accordingly, the amount of refrigerant discharged out of the second evaporator 15 may be increased while the amount of refrigerant discharged out of the first evaporator 14 may be relatively decreased. Hence, the refrigerants at both the evaporators 14, 15 may be added and reduced with each other so as to be balanced.

[0041] In the meantime, the driving method for the refrigerator shown in FIGS. 5 and 6 may be configured to balance the amount of refrigerant by adjusting an open value of a refrigerant switching valve. That is, temperature sensors 22 may be installed at the first and second evaporators 14 and 15, respectively, to detect an evaporation temperature of the first evaporator 14 (i.e., a temperature difference between the inlet and the outlet of the first evaporator) and an evaporation temperature of the second evaporator (i.e., a temperature difference between the inlet and the outlet of the second evaporator). The refrigerant switching valve 16 and the temperature sensors 22 may be electrically connected to the micom 30, respectively, to control an open value of the refrigerant switching valve 16 according to each evaporation temperature detected by the temperature sensors 22.

[0042] The temperature sensors 22 may be installed at both inlet and outlet of the first evaporator 14 to detect a temperature difference therebetween, and also at both inlet and outlet of the second evaporator 15 to detect a temperature difference therebetween.

[0043] The micom 30 may include an input part 31 electrically connected to the temperature sensors 22 to receive the respective evaporation temperatures of the first and second evaporators 14 and 15, a determination part 32 connected to the input part 31 to compare the received evaporation temperature of each evaporator 14, 15 with a reference temperature to determine to which evaporator the flow of the refrigerant is biased, and an instruction part 33 connected to the determination part 32 to instruct an opening or closing of the refrigerant switching valve 16.

[0044] In accordance with the driving method for the refrigerator, first, the temperature sensors 22 located at the inlet and outlet of the first evaporator 14 detect the evaporation temperatures (i.e., temperature difference) of the first evaporator 14 and input the detected evaporation temperatures to the input part 31 of the micom 30.

[0045] The determination part 32 compares the evaporation temperatures of the first evaporator 14 with a reference temperature to determine whether the flow of the refrigerant is biased toward the first evaporator 14 (i.e., whether a uniform distribution of refrigerant (refrigerant balancing) is needed).

[0046] If it is determined the flow of the refrigerant is biased toward the first evaporator 14, the refrigerant switching valve 16 is kept open in the direction toward the refrigerating chamber, namely, toward the second evaporator 15, and varies an open level in the direction toward the freezing chamber, namely, toward the first evaporator 14 so as to control the amount of refrigerant flowing toward the first evaporator 14, thereby balancing the flow of refrigerant (the amount of refrigerant).

[0047] On the other hand, if it is determined the flow of the refrigerant is not biased toward the first evaporator 14, whether the flow of the refrigerant is biased toward the second evaporator 15 is determined by the temperature sensors 22 located at the inlet and outlet of the second evaporator 15. If it is determined that the flow of the refrigerant is biased toward the second evaporator 15, the refrigerant switching valve 16 is kept open toward the first evaporator 14, and varies the open level toward the second evaporator 15 so as to control the amount of refrigerant flowing toward the second evaporator 15, thereby balancing the flow of refrigerant (the amount of refrigerant).

[0048] In the meantime, to which of the first and second evaporators the refrigerant is biased may also be determined by detecting an open time of the refrigerant switching valve, which will be described as follows with reference to FIGS. 7 and 8.

[0049] That is, the micom 30 may further include a timer 23 electrically connected to the refrigerant switching valve 16 to detect an open time of the refrigerant switching valve 16. For example, the micom 30 may include an input part 31 electrically connected to the timer 23 to receive the detected open time of the refrigerant switching valve 16, a determination part 32 connected to the input part 31 to compare the received open time of the refrigerant switching valve 16 with a reference open time (reference value) so as to determine or predict to which evaporator the flow of refrigerant is biased (more refrigerant flows), and an instruction part 33 connected to the determination part 32 to instruct the controlling of the open time of the refrigerant switching valve 16.

[0050] According to the driving method for the refrigerator, the balancing of the amount or flow of refrigerant can be achieved by detecting the open time of the refrigerant switching valve 16, comparing the detected open time with the reference value to determine or predict the biasing of the flow of the refrigerant, and controlling the open time of the refrigerant switching valve 16 such that less refrigerant is introduced into the passage toward the side determined as the flow of refrigerant is biased.

[0051] Here, the determination of the open time of the refrigerant switching valve 16 may be performed in the order of determining whether the open time in the direction toward the first evaporator 14 exceeds a preset open time, and determining whether the open time in the direction toward the second evaporator 15 exceeds the preset open time when determined the open time in the direction toward the first evaporator 14 did not exceed the preset open time.

[0052] The uniform distribution (balancing) of refrigerant is similar to the second exemplary embodiment, so detailed description thereof will be omitted. In this case, the use of the timer 23 allows the open time to be periodically adjusted after a predetermined time, accordingly, the control process can be more simplified.

[0053] In accordance with the refrigerator and the driving method thereof, the refrigerant can be uniformly distributed toward first and second evaporators by several methods, such as changing a cooling capability of a compressor according to a detected number of vibration of the compressor, detecting evaporation temperatures of each evaporator to vibration of the compressor, detecting evaporation temperatures of each evaporator to control a refrigerant switching valve for controlling the flowing direction of refrigerant, or detecting an open time of the refrigerant switching valve to control the open time of the refrigerant switching valve. Consequently, the refrigerator can be driven with refrigeration cycles, which are independently run in correspondence with the load of the freezing chamber or the refrigerating chamber, resulting in reduction of unnecessary power consumption of the refrigerator.

[0054] Meanwhile, although not shown, an open value or open time of the refrigerant switching valve can be adjusted by detecting the number of vibration of the compressor, and also the capability of the compressor can be controlled by detecting the evaporation temperatures of the evaporators or the open time of the refrigerant switching valve. The thusly-expected operational effects are like/similar to the foregoing exemplary embodiments, so detailed description thereof will be omitted.

[0055] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

[0056] As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A refrigerator comprising:

a plurality of compressors 11 and 12 sequentially connected to perform a multi-stage compression for a refrigerant;

a condenser 13 connected to an outlet side of a secondary compressor 12 of the plurality of compressors, the secondary compressor 12 located at a downstream based on the flowing direction of the refrigerant;

a first evaporator 14 diverged from the condenser and connected to an inlet side of a primary compressor 11 of the plurality of compressors, the primary compressor 11 located at an upstream based upon the flowing direction of the refrigerant;

a second evaporator 15 diverged from the condenser together with the first evaporator and connected between an outlet side of the primary compressor and an inlet side of the secondary

compressor;
a refrigerant switching valve 16 installed such that an inlet side of the first evaporator and an inlet side of the second evaporator are connected to an outlet side of the condenser in parallel and configured to control the flowing direction of the refrigerant toward the first evaporator or the second evaporator;
a refrigerant amount detecting unit 21, 22, 23 configured to detect an amount of refrigerant introduced into the first or second evaporator; and
a refrigerant amount adjusting unit configured to adjust amounts of refrigerant flowing toward the first and second evaporators, respectively, according to the result detected by the refrigerant amount detecting unit.

2. The refrigerator of claim 1, wherein the refrigerant amount detecting unit 21 comprises a plurality of vibration sensors 21 installed at the primary compressor and the secondary compressor, respectively, to detect changes in the number of vibration of each of the primary and secondary compressors.

3. The refrigerator of claim 2, wherein the refrigerant amount adjusting unit comprises a micom 30 electrically connected to the vibration sensors to determine to which evaporator the amount of refrigerant is biased according to the number of vibration detected by each vibration sensor, and increase a cooling capability of a compressor having an inlet side connected to the outlet side of an evaporator, to which more refrigerant flows.

4. The refrigerator of claim 1, wherein the refrigerant amount detecting unit 22 comprises a plurality of temperature sensors 22 installed at the first and second evaporators, respectively, and configured to detect temperature changes of the first and second evaporators.

5. The refrigerator of claim 4, wherein the refrigerant amount adjusting unit comprises a micom 30 electrically connected to the temperature sensors to determine to which evaporator the amount of refrigerant is biased according to evaporation temperatures of the respective evaporators detected by the temperature sensors, and control an open value of the refrigerant switching valve to reduce the amount of refrigerant introduced into an evaporator, to which it is determined more refrigerant flows.

6. The refrigerator of claim 1, wherein the refrigerant amount detecting unit 23 comprises a timer 23 electrically connected to the refrigerant switching valve and configured to detect an open time of the refrigerant switching valve.

7. The refrigerator of claim 6, wherein the refrigerant amount adjusting unit comprises a micom 30 electrically connected to the timer to determine to which evaporator the amount of refrigerant is biased according to the open time of the refrigerant switching valve detected by the timer, and control the open time of the refrigerant switching valve to reduce the amount of refrigerant introduced into an evaporator to which it is determined more refrigerant flows.

8. The refrigerator of claim 1, wherein the secondary compressor 12 is large in capacity than the primary compressor 11.

9. The refrigerator of claim 1, wherein the first evaporator 14 is installed to supply cold air into a freezing chamber, and the second evaporator 15 is installed to supply cold air into a refrigerating chamber.

10. A driving method for a refrigerator having a freezing chamber refrigeration cycle comprising a plurality of compressors 11 and 12 sequentially connected to each other, and a refrigerating chamber refrigeration cycle comprising a compressor 12 located at a downstream of the plurality of compressors,
wherein one of the number of vibration, evaporation temperatures or a flow of refrigerant is measured with respect to the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle, to control the amount of refrigerant flowing between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle.

11. The method of claim 10, wherein the number of vibration of each of the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle is obtained by measuring the number of vibration of each of the plurality of compressors 11 and 12.

12. The method of claim 10, wherein the evaporation temperatures of the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle are obtained by measuring evaporation temperatures of each evaporator 14, 15 independently connected to the plurality of compressors.

13. The method of claim 10, wherein the flow of refrigerant of the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle is obtained by measuring an open time of a valve 16, the valve 16 controlling a flowing direction of the refrigerant between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle.

14. The method of any of claims 10 to 13, wherein the flow of refrigerant between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle is controlled by adjusting a cooling capability of each compressor.

15. The method of any of claims 10 to 13, wherein the flow of refrigerant between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle is controlled by adjusting an open value or an open time of a valve 16, the valve 16 controlling the flowing direction of the refrigerant between the freezing chamber refrigeration cycle and the refrigerating chamber refrigeration cycle.

FIG. 1

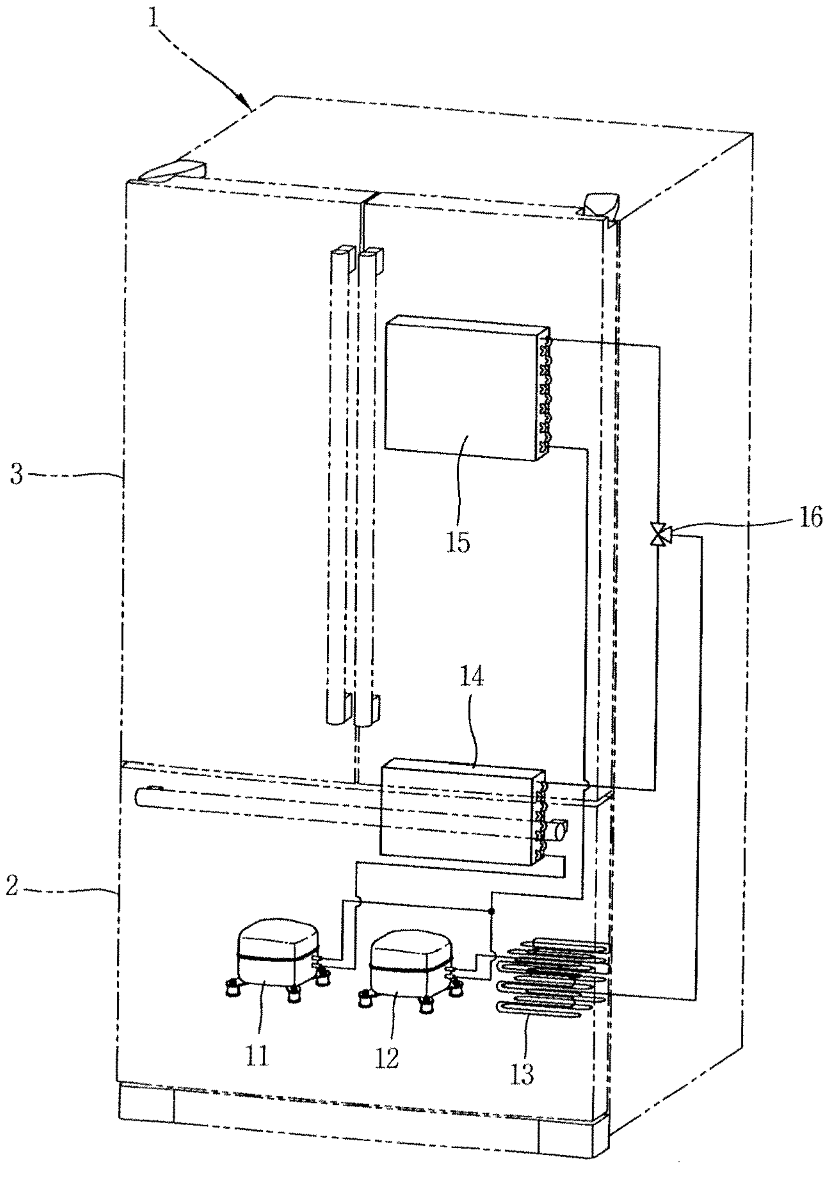


FIG. 2

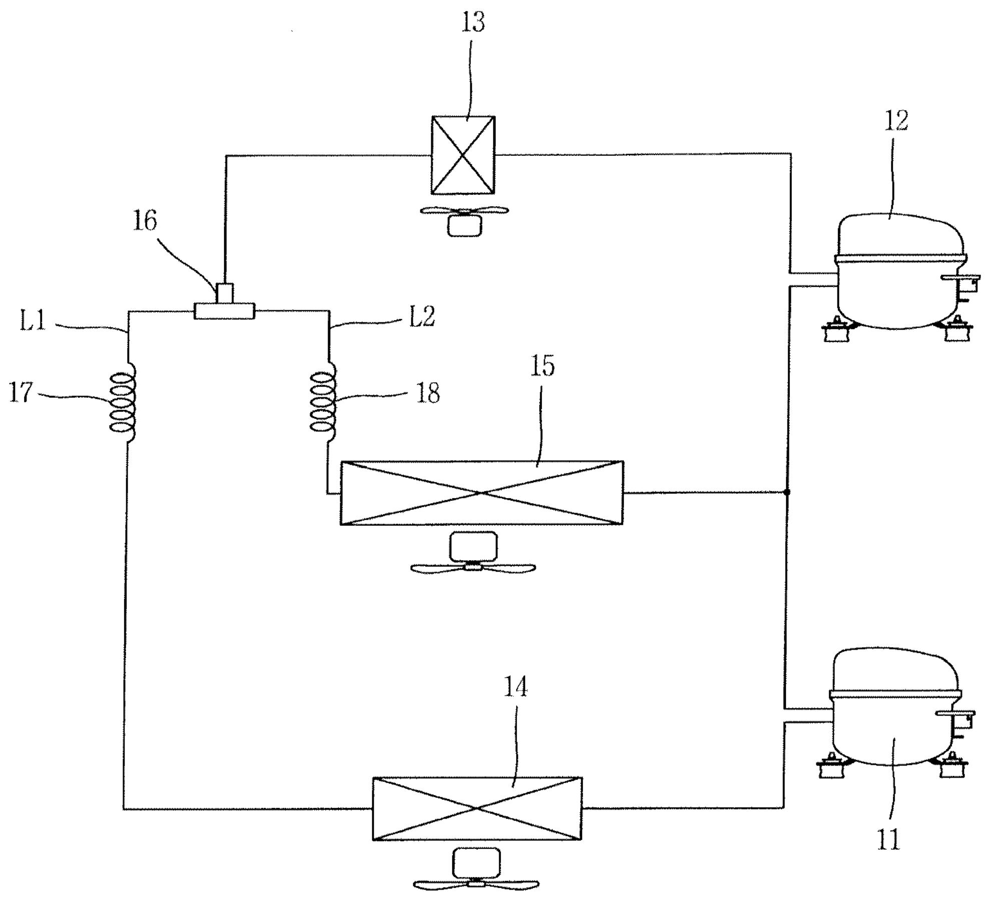


FIG. 3

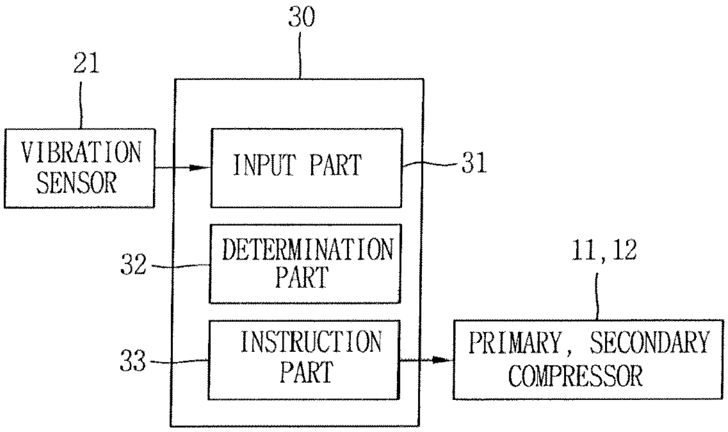

30
21
VIBRATION SENSOR
INPUT PART
31
32
DETERMINATION PART
11,12
33
INSTRUCTION PART
PRIMARY, SECONDARY COMPRESSOR

FIG. 4

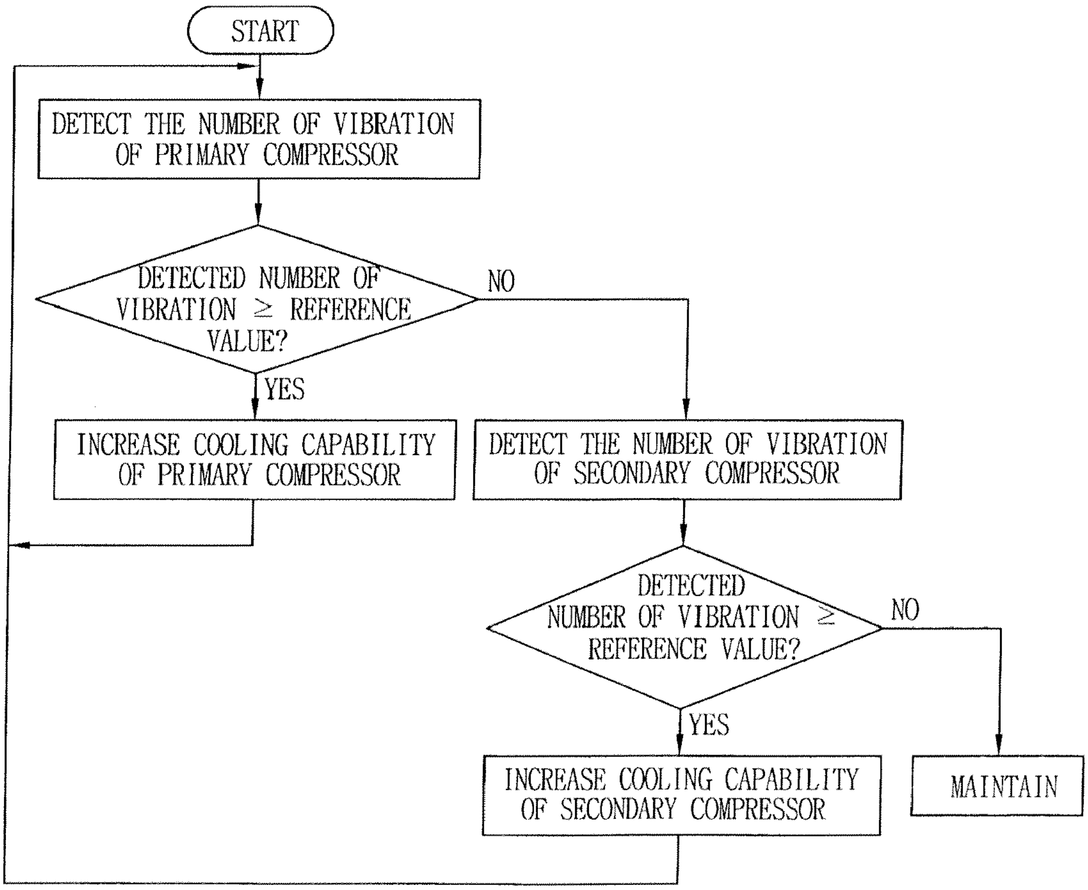

START
DETECT THE NUMBER OF VIBRATION OF PRIMARY COMPRESSOR
DETECTED NUMBER OF VIBRATION ≥ REFERENCE VALUE?
NO
YES
INCREASE COOLING CAPABILITY OF PRIMARY COMPRESSOR
DETECT THE NUMBER OF VIBRATION OF SECONDARY COMPRESSOR
DETECTED NUMBER OF VIBRATION ≥ REFERENCE VALUE?
NO
YES
INCREASE COOLING CAPABILITY OF SECONDARY COMPRESSOR
MAINTAIN

FIG. 5

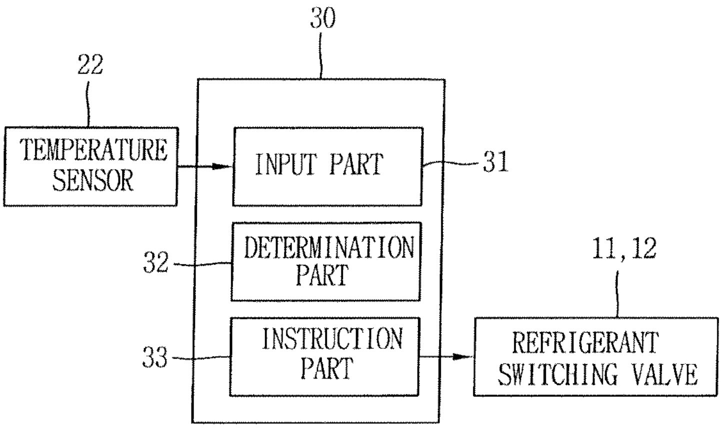

30
22
TEMPERATURE SENSOR
INPUT PART
31
DETERMINATION PART
32
11,12
INSTRUCTION PART
33
REFRIGERANT SWITCHING VALVE

FIG. 6

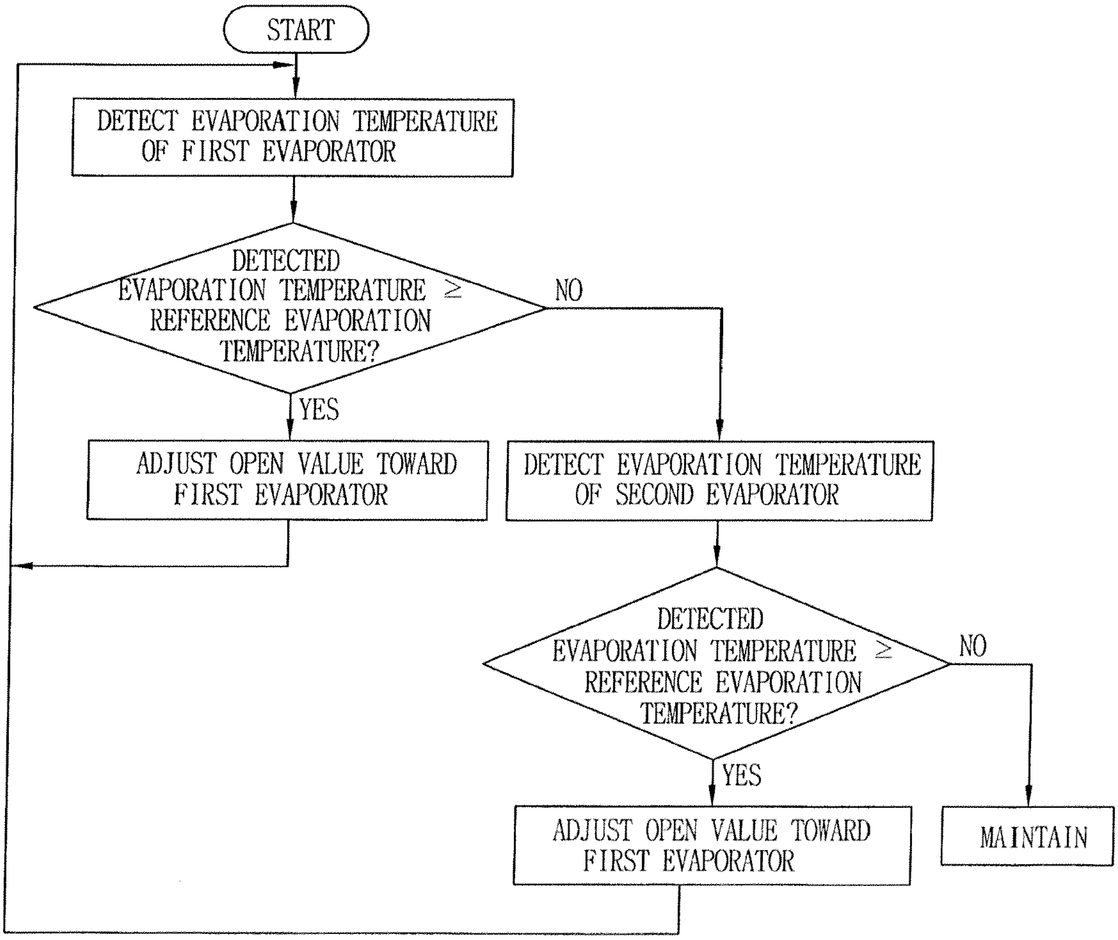

START
DETECT EVAPORATION TEMPERATURE OF FIRST EVAPORATOR
DETECTED EVAPORATION TEMPERATURE ≥ REFERENCE EVAPORATION TEMPERATURE?
NO
YES
ADJUST OPEN VALUE TOWARD FIRST EVAPORATOR
DETECT EVAPORATION TEMPERATURE OF SECOND EVAPORATOR
DETECTED EVAPORATION TEMPERATURE ≥ REFERENCE EVAPORATION TEMPERATURE?
NO
YES
ADJUST OPEN VALUE TOWARD FIRST EVAPORATOR
MAINTAIN

FIG. 7

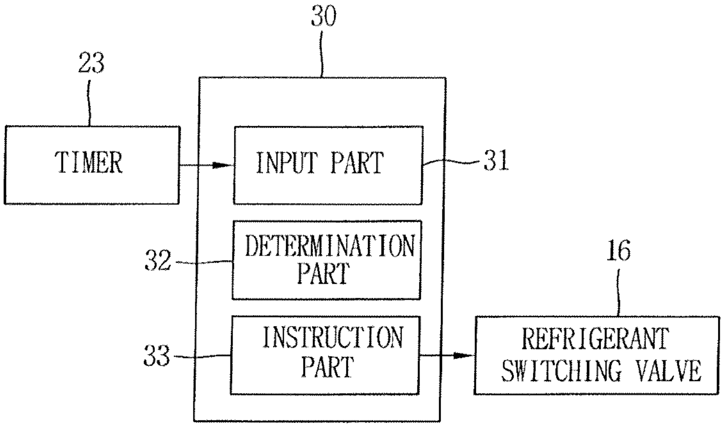
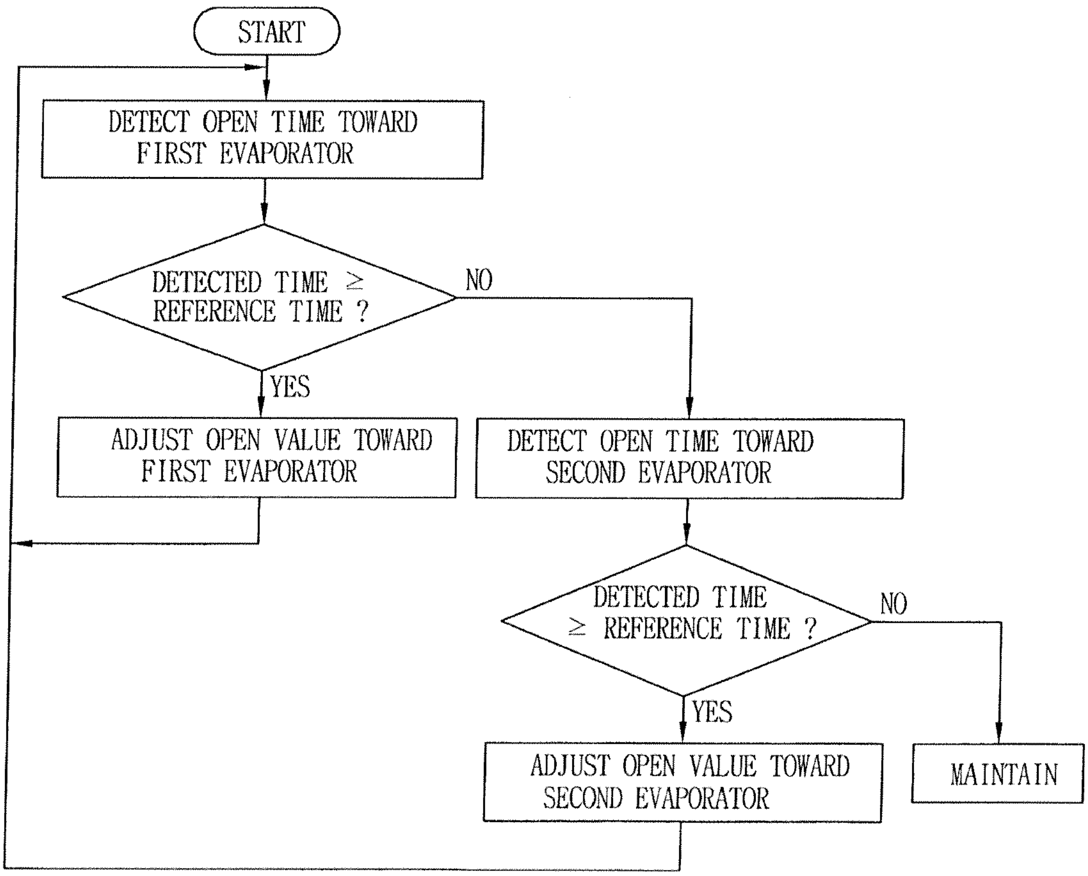

30
23
TIMER
INPUT PART
31
32
DETERMINATION PART
16
33
INSTRUCTION PART
REFRIGERANT SWITCHING VALVE

FIG. 8


START
DETECT OPEN TIME TOWARD FIRST EVAPORATOR
DETECTED TIME ≥ REFERENCE TIME ?
NO
YES
ADJUST OPEN VALUE TOWARD FIRST EVAPORATOR
DETECT OPEN TIME TOWARD SECOND EVAPORATOR
DETECTED TIME ≥ REFERENCE TIME ?
NO
YES
ADJUST OPEN VALUE TOWARD SECOND EVAPORATOR
MAINTAIN