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(54) **MULTI-SPLIT SYSTEM AND TIME-SHARING DEHUMIDIFICATION METHOD THEREFOR**

(57) A multi-split system time-sharing dehumidification method, comprising: within one control cycle during a one-time time-sharing dehumidification process, control at least one dehumidification indoor unit among dehumidification indoor units in a plurality of dehumidification indoor units which have not run a dehumidification state during the current time-sharing dehumidification process to run the dehumidification state, the sum of the volumes of the evaporators of said at least one indoor dehumidification unit not exceeding the sum of the volumes of the condensers of currently running indoor heating units, wherein said one-time time-sharing dehumidification process comprises at least two control cycles. Said one-time time-sharing dehumidification process comprises sequentially running said at least two control cycles until each dehumidification indoor unit in said plurality of dehumidification indoor units runs the dehumidification state one time.

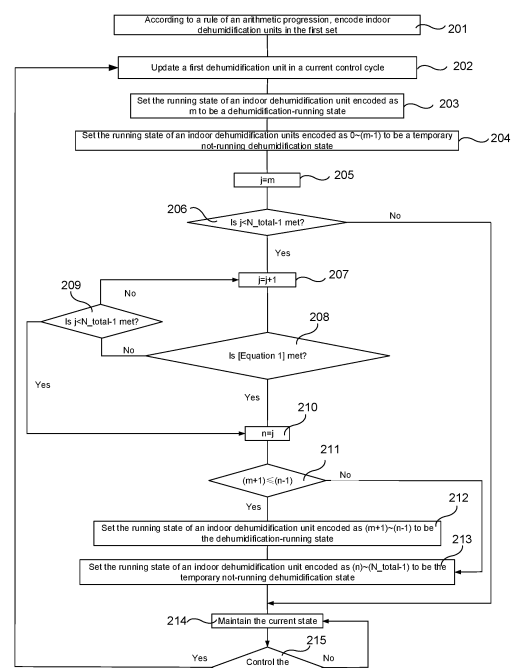


FIG. 3

Description

[0001] This application claims priority to and the benefit of Chinese Patent Application No. 201810233694.1, filed with the Chinese Patent Office on March 21, 2018, titled "TIME-SHARING DEHUMIDIFICATION METHOD AND DEVICE FOR MULTI-SPLIT SYSTEM, AND COMPUTER STORAGE MEDIUM", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of air conditioners, and in particular, to a multi-split system and a time-sharing dehumidification method therefor.

BACKGROUND

[0003] A multi-split system, commonly known as "multi-split", means that one outdoor unit is connected to two or more indoor units via pipes. Compared with a plurality of household air conditioners, in the multi-split system, the outdoor unit is shared, which may effectively reduce a cost on equipment, and may realize a centralized management for the indoor units. One indoor unit may be turned on separately, or a plurality of indoor units may be simultaneously turned on, which makes the multi-split system more flexible to be controlled. Therefore, the multi-split system becomes an important trend among air conditioners.

SUMMARY

[0004] In a first aspect, some embodiments of the present disclosure provide a time-sharing dehumidification method for a multi-split system. The time-sharing dehumidification method for the multi-split system includes: in a control cycle of a time-sharing dehumidification process, controlling at least one dehumidification indoor unit of a plurality of dehumidification indoor units that have not operate in a dehumidification mode in the time-sharing dehumidification process to operate in the dehumidification mode; and setting an operation mode of each remaining dehumidification indoor unit to be a temporary non-dehumidification mode, a total volume of an evaporator of the at least one dehumidification indoor unit being not greater than a total volume of condensers of current heating indoor unit(s), wherein the time-sharing dehumidification process includes at least two control cycles, and the time-sharing dehumidification process includes sequentially performing the at least two control cycles until each dehumidification indoor unit in the plurality of dehumidification indoor units operates in the dehumidification mode once.

[0005] In a second aspect, some embodiments of the present disclosure provide a multi-split system including a memory and a processor. The memory stores computer programs capable of running on the processor, and the processor is configured to run the computer programs to cause the multi-split system to:

[0006] in a control cycle in a time-sharing dehumidification process, control at least one dehumidification indoor unit of dehumidification indoor units that have not operate in a dehumidification mode in a plurality of dehumidification indoor units in the time-sharing dehumidification process to operate in the dehumidification mode; set an operation mode of each remaining dehumidification indoor unit to be a temporary non-dehumidification mode, a total volume of evaporator of the at least one dehumidification indoor unit being not greater than a total volume of condensers of current heating indoor unit(s), wherein the time-sharing dehumidification process includes at least two control cycles, and the time-sharing dehumidification process includes sequentially performing the at least two control cycles until each dehumidification indoor unit in the plurality of dehumidification indoor units operates in the dehumidification mode once.

[0007] In a third aspect, some embodiments of the present disclosure provide a multi-split system including an outdoor unit, heating indoor unit(s), and dehumidification indoor unit(s). The outdoor unit is provided with a first end, a second end and a third end which are used for refrigerant flow, and each heating indoor unit includes a first heat exchanger and a second heat exchanger, and each dehumidification indoor unit include a third heat exchanger and a fourth heat exchanger.

[0008] The first end of the outdoor unit is connected to an end of the first heat exchanger via a first indoor electronic expansion valve, to an end of the second heat exchanger via a second indoor electronic expansion valve, to an end of the third heat exchanger via a third indoor electronic expansion valve, and to an end of the fourth heat exchanger via a fourth indoor electronic expansion valve; another end of the first heat exchanger is connected to the third end of the outdoor unit, another end of the third heat exchanger is connected to the third end of the outdoor unit; another end of the second heat exchanger is connected to the second end of the outdoor unit, and another end of the fourth heat exchanger is connected to the second end of the outdoor unit.

[0009] The first indoor electronic expansion valve in the heating indoor unit are closed, and the second indoor electronic expansion valve in the heating indoor unit is opened, so that a refrigerant flows into the second end of the outdoor unit

from the second indoor heat exchanger via the second indoor electronic expansion valve.

[0010] The fourth indoor electronic expansion valve in the dehumidification indoor unit is closed.

[0011] The third indoor electronic expansion valve in the dehumidification indoor unit is configured to be opened when the indoor unit operates in a dehumidification mode, so that the refrigerant flows into the third end of the outdoor unit from the third indoor heat exchanger via the third indoor electronic expansion valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In order to describe technical solutions in embodiments of the present disclosure or the related art more clearly, the accompanying drawings to be used in the description of the embodiments or the related art will be introduced briefly below. Obviously, the accompanying drawings to be described below are merely some embodiments of the present disclosure, and a person of ordinary skill in the art can obtain other drawings according to these drawings without paying any creative effort.

FIG. 1 is a schematic diagram showing a structure of a multi-split system, in accordance with some embodiments of the present disclosure;

FIG. 2 is a flow diagram of a time-sharing dehumidification method for a multi-split system, in accordance with some embodiments of the present disclosure;

FIG. 3 is a schematic diagram showing some implementations of the time-sharing dehumidification method shown in FIG. 2;

FIG. 4 is a schematic diagram showing an operating state of the multi-split system shown in FIG. 1 in a first control cycle in the time-sharing dehumidification process of the time-sharing dehumidification method shown in FIG. 2;

FIG. 5 is a schematic diagram showing an operating state of the multi-split system shown in FIG. 1 in a second control cycle in the time-sharing dehumidification process of the time-sharing dehumidification method shown in FIG. 2;

FIG. 6 is a schematic diagram showing an operating state of the multi-split system shown in FIG. 1 in a third control cycle in the time-sharing dehumidification process of the time-sharing dehumidification method shown in FIG. 2;

FIG. 7 is a diagram showing a flow path in a system of an dehumidification indoor unit and an heating indoor unit, in accordance with some embodiments of the present disclosure; and

FIG. 8 is a multi-split system, in accordance with some embodiments of the present disclosure.

DETAILED DESCRIPTION

[0013] The technical solutions in embodiments of the present disclosure will be described clearly and completely with reference to the accompanying drawings in the embodiments of the present disclosure. Obviously, the described embodiments are merely some but not all embodiments of the present disclosure. All other embodiments obtained by a person of ordinary skill in the art, based on the embodiments of the present disclosure, without paying any creative effort shall be included in the protection scope of the present disclosure.

[0014] The terms such as "first" and "second" are used for descriptive purposes only and are not to be construed as indicating or implying the relative importance or implicitly indicating the number of indicated technical features. Thus, features defined as "first" and "second" may explicitly or implicitly include one or more of the features. In the description of the present disclosure, the term "a plurality of" means two or more unless otherwise specified.

[0015] In a multi-split system, an outdoor unit is usually connected to two or more indoor units. For example, the multi-split system shown in FIG. 1 includes one outdoor unit and six indoor units. In a case where an indoor unit needs to operate in a heating mode (for example, the heating mode of the indoor unit is turned on by a user with a remote controller, a wire controller, or a control panel on a housing of the indoor unit), the indoor unit is referred to as a heating indoor unit. Similarly, in a case where an indoor unit needs to operate in a dehumidification mode, the indoor unit is referred to as a dehumidification indoor unit. In a case where the multi-split system includes at least one dehumidification indoor unit (i.e., one or more dehumidification indoor units) and at least one heating indoor unit (i.e., one or more heating indoor units), a refrigerant (also called refrigerant) will circulate between an evaporator of the at least one dehumidification indoor unit and a condenser of the at least one heating indoor unit. When a total volume of evaporators of dehumidification indoor units is matched with a total volume of condensers of heating indoor units, it is considered that the current heating indoor units may support the dehumidification indoor units to simultaneously operate in the dehumidification mode, with each dehumidification indoor unit having good dehumidification performance. The total volume of the evaporators of the dehumidification indoor units may not be matched with the total volume of the condensers of the heating indoor units (a mismatch often occurs in a case where a number of the dehumidification indoor units is greater than a number of the heating indoor units). For example, as shown in FIG. 1, the indoor units B, D, E and F enter the dehumidification mode while the indoor units A and C enter the heating mode, that is, there are four dehumidification indoor units and only two

heating indoor units, and the total volume of the evaporators of the dehumidification indoor units is greater than the total volume of the condensers of the heating indoor units. In this case, in the related art, the dehumidification indoor units need to simultaneously operate in the dehumidification mode, which will make the dehumidification performance of the dehumidification indoor units relatively poor, and even a problem that part of the dehumidification indoor units cannot perform dehumidification arises.

[0016] In the multi-split system, a case where the number of the dehumidification indoor units is greater than the number of the heating indoor units is described as follows. When there are a large number of users' rooms, some rooms are used as basements. In seasons such as transitional seasons or winter, when the humidity is large, the basements are prone to get moldy, so the basements need to be dehumidified. Therefore, a part of rooms may need to be heated, and another part of rooms may need to be dehumidified. When the volumes of the condensers of the heating indoor units and the evaporators of the dehumidification indoor units (i.e., volumes of heat exchangers used for containing the refrigerant) are not matched in the multi-split system, for example, in a case where the number of the dehumidification indoor units is greater than the number of the heating indoor units due to a large dehumidification demand, it is possible to cause the poor dehumidification performance of the dehumidification indoor units.

[0017] Some embodiments of the present disclosure provide a time-sharing dehumidification method for the multi-split system, in which a plurality of dehumidification indoor units are controlled to operate in the dehumidification mode at different periods. For example, in a control cycle of a time-sharing dehumidification process, the dehumidification indoor units B and D are controlled to operate in the dehumidification mode; and in another control cycle of the time-sharing dehumidification process, the dehumidification indoor units E and F are controlled to operate in the dehumidification mode. In this way, it is ensured that in one control cycle of the time-sharing dehumidification process, the total volume of evaporators of dehumidification indoor units that operate in the dehumidification mode is matched with the total volume of the condensers of the heating indoor units that operate in the heating state (for example, the total volume of the evaporators is less than or equal to the total volume of the condensers), which makes the dehumidification performance of the dehumidification indoor units that operate in the dehumidification mode good.

[0018] The time-sharing dehumidification method for the multi-split system provided by some embodiments of the present disclosure will be described in detail below. The following embodiments are described by taking an example in which in the multi-split system shown in FIG. 1, the indoor units A and C are used as the heating indoor units, and the indoor units B, D, E and F are used as the dehumidification indoor units.

[0019] As shown in FIG. 2, the time-sharing dehumidification method for the multi-split system provided by some embodiments of the present disclosure includes the following steps.

[0020] In step 101, in a control cycle of the time-sharing dehumidification process, in a first collection, for dehumidification indoor units that have not performed dehumidification in the time-sharing dehumidification process: an operation mode of a first dehumidification indoor unit is set to be the dehumidification mode; a maximum number of second dehumidification indoor unit(s) that the current heating indoor units in the multi-split system are further capable of supporting besides the first dehumidification indoor unit is determined; and if there exist the second dehumidification indoor unit(s), an operation mode of each second dehumidification indoor unit is set to be the dehumidification mode. Here, the first collection is composed of current dehumidification indoor units in the multi-split system.

[0021] In some embodiments, the time-sharing dehumidification is initiated in response to a coexistence of the dehumidification indoor units and the heating indoor unit(s) in the indoor units. In some embodiments, the time-sharing dehumidification is initiated in response to a situation that there are dehumidification indoor units and heating indoor unit(s) in the indoor units, and that the total volume of the heating indoor unit(s) is less than the total volume of the dehumidification indoor units.

[0022] It will be noted that, the current dehumidification indoor units refer to indoor units that need to perform the dehumidification at present in the multi-split system. For example, in some embodiments of the present disclosure, the indoor units B, D, E and F described above are the current dehumidification indoor units, and the first collection is composed of these four dehumidification indoor units. Similarly, the indoor units A and C are the current heating indoor units. The time-sharing dehumidification process refers to a process in which the indoor units B, D, E and F each operate in the dehumidification mode once. The process may include one or more control cycles, and any control cycle may be implemented according to the method provided by the embodiments. For example, a duration of the control cycle may be a preset constant, or a time period determined according to a set rule.

[0023] That each indoor unit is a three-pipe indoor unit is taken as an example. When the indoor unit operates in the dehumidification mode, one indoor heat exchanger of the indoor unit is used as an evaporator, and another indoor heat exchanger does not work; and when the indoor unit operates in the heating mode, one indoor heat exchanger of the indoor unit is used as a condenser, and another indoor heat exchanger does not work. Of course, it is also possible that the indoor unit is an indoor unit having other number of pipes. For example, in a case where the indoor unit is a two-pipe indoor unit, when the indoor unit operates in the heating mode, an indoor heat exchanger of the indoor unit is used as the condenser. It will be noted that, as shown in FIG. 7, the three-pipe indoor unit according to the embodiments of the present disclosure may include a first indoor heat exchanger 11, a second indoor heat exchanger 12, and a first

indoor electronic expansion valve 13 and a second indoor electronic expansion valve 14 that are respectively connected to the indoor heat exchangers.

[0024] There are a plurality of ways to select a dehumidification indoor unit as the first dehumidification indoor unit.

[0025] In some embodiments, in the control cycle of the time-sharing dehumidification process, for the multi-split system shown in FIG. 1, any one selected from the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process may be used as the first dehumidification indoor unit. For example, in a first control cycle of the time-sharing dehumidification process, if none of the indoor units B, D, E and F has performed the dehumidification, any one of the indoor units B, D, E and F, for example, the indoor unit B, may be used as the first dehumidification indoor unit.

[0026] In some embodiments, in the control cycle, it is also possible that in the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process, a dehumidification indoor unit is determined to be the first dehumidification indoor unit according to a preset rule. For example, according to an arrangement order of all the dehumidification indoor units, the first dehumidification indoor unit is selected from the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process.

[0027] In the time-sharing dehumidification process, the time-sharing dehumidification method provided by some embodiments of the present disclosure may further include step 201 shown in FIG. 3. In the step 201, the dehumidification indoor units in the first collection are numbered. The dehumidification indoor units in the first collection may be numbered according to a rule of an arithmetic progression or other sorting rules. For example, with a common difference of 1, the dehumidification indoor units B, D, E and F may be numbered 0, 1, 2 and 3 starting from 0, respectively, and a dehumidification indoor unit with a smallest number is determined as the first dehumidification indoor unit from the dehumidification indoor units that have not performed the dehumidification in the current time-sharing dehumidification process.

[0028] It will be noted that, it is also possible that the dehumidification indoor units in the first collection are numbered according to other rules. For example, according to a sequence of twenty six letters, the dehumidification indoor units in the first collection are numbered with letters; or according to a rule of a geometric progression, the dehumidification indoor units in the first collection are numbered, which is not limited in the embodiments of the present disclosure. Given that an algorithm of the time-sharing dehumidification method is relatively simple when the dehumidification indoor units in the first collection are numbered according to the rule of the arithmetic progression, in some embodiments, the dehumidification indoor units in the first collection are numbered according to the rule of the arithmetic progression.

[0029] In some embodiments, the step 201 may be performed once in each time-sharing dehumidification process. Or, during a process from the multi-split system being turned on to being turned off, the step 201 may be performed once each time a distribution of the dehumidification indoor units is changed. For example, the step 201 may be performed when the number of the dehumidification indoor units is increased or reduced, or when the number of the dehumidification indoor units is unchanged, but the distribution of the dehumidification indoor units is changed (for example, the dehumidification indoor units are changed from the indoor units B, D, E and F to the indoor units B, C, E and F). In addition, if the distribution of the dehumidification indoor units is unchanged during the process from the multi-split system being turned on to being turned off, the indoor units B, D, E and F may perform the time-sharing dehumidification once or a plurality of times.

[0030] On this basis, in some embodiments, in the step 101, that in the first collection, for the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process, the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode includes the following step.

[0031] In the control cycle, in the first collection, for the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process: the dehumidification indoor unit with the smallest number is set as the first dehumidification indoor unit, for example, in combination with the above description, in the first control cycle of the time-sharing dehumidification process, the 0-numbered indoor unit B is set as the first dehumidification indoor unit; and the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode.

[0032] Of course, it is also possible that a dehumidification indoor unit with a largest number is set as the first dehumidification indoor unit. Some embodiments of the present disclosure are described by taking an example in which the dehumidification indoor unit with the smallest number is set as the first dehumidification indoor unit.

[0033] After the first dehumidification indoor unit is determined, in the step 101, in the multi-split system, there is a further need to determine the maximum number of the second dehumidification indoor unit(s) that the current heating indoor units A and C are further capable of supporting besides the first dehumidification indoor unit. The second dehumidification indoor unit(s) and the first dehumidification indoor unit are consecutively numbered. That is, the numbers of the first dehumidification indoor unit and the second dehumidification indoor unit(s) are consecutively arranged according to an order from small to large.

[0034] It will be noted that, that the second dehumidification indoor unit(s) and the first dehumidification indoor unit are consecutively numbered means that the second dehumidification indoor unit(s) are consecutively numbered, and in the control cycle, the second dehumidification indoor unit(s) and the first dehumidification indoor unit are consecutively numbered. For example, after an m-numbered dehumidification indoor unit (for example, m is equal to 0) is determined

to be the first dehumidification indoor unit, the second dehumidification indoor unit(s) are determined starting from an dehumidification indoor unit subsequent to the first dehumidification indoor unit, i.e., an dehumidification indoor unit (m+1)-numbered (for example, (m+1) is equal to 1). It is assumed that in the control cycle, the current heating indoor units A and C are further capable of supporting the indoor unit D to operate in the dehumidification mode besides the first dehumidification indoor unit (i.e., the indoor unit B), then an 1-numbered indoor unit (i.e., the indoor unit D) is set as the second dehumidification indoor unit.

[0035] On this basis, as shown in FIG. 2, the time-sharing dehumidification method for the multi-split system provided by some embodiments of the present disclosure further includes step 102: setting an operation mode of each remaining dehumidification indoor unit in the first collection to be a temporary non-dehumidification mode, the remaining dehumidification indoor unit being a dehumidification indoor unit that is not set to operate in the dehumidification mode in the control cycle.

[0036] It will be noted that the temporary non-dehumidification mode is the opposite of the dehumidification mode. The temporary non-dehumidification mode refers to a mode in which the current dehumidification indoor unit does not perform the dehumidification in the current control cycle. In the control cycle, except the first dehumidification indoor unit and each second dehumidification indoor unit whose operation modes are the dehumidification mode, other dehumidification indoor unit(s) (the remaining dehumidification indoor unit(s)) have the operation modes that are the temporary non-dehumidification mode. The remaining dehumidification indoor unit(s) are dehumidification indoor unit(s) except the first dehumidification indoor unit and the second dehumidification indoor unit(s) in the control cycle.

[0037] In combination with the above description, as shown in FIG. 4, it is assumed that in the first control cycle, the numbers of the dehumidification indoor units that are set to operate in the dehumidification mode are 0 and 1 (i.e., the dehumidification indoor units B and D), then the numbers of the remaining dehumidification indoor units in the first control cycle are 2 and 3. That is, the dehumidification indoor units E and F are the remaining dehumidification indoor units. It is assumed that in a second control cycle, as shown in FIG. 5, the serial number of the dehumidification indoor unit that is set to operate in the dehumidification mode is 2 (i.e., the dehumidification indoor unit E), the remaining dehumidification indoor units in the second control cycle include the 0-numbered dehumidification indoor unit, the 1-numbered dehumidification indoor unit and the 3-numbered dehumidification indoor unit. That is, the remaining dehumidification indoor units in the second control cycle include the dehumidification indoor units (numbered 0 and 1) that are set to operate in the dehumidification mode in the first control cycle and the dehumidification indoor unit (numbered 3) that has not performed the dehumidification in the time-sharing dehumidification process.

[0038] It will be noted that, in FIGS. 4, 5 and 6, a solid box with shadow indicates the dehumidification indoor unit which operates in the dehumidification mode in the control cycle. A dashed box with shadow indicates the dehumidification indoor unit which has operated in the dehumidification mode in a previous control cycle, and is in the temporary non-dehumidification mode in the current control cycle in the time-sharing dehumidification process. A dashed box without shadow indicates the dehumidification indoor unit which is in the temporary non-dehumidification mode in the control cycle.

[0039] On this basis, with reference to FIGS. 4, 5 and 6, the time-sharing dehumidification method for the multi-split system provided by some embodiments of the present disclosure is briefly described by taking an example in which the time-sharing dehumidification process of the multi-split system shown in FIG. 4 includes three control cycles. The current dehumidification indoor units include the indoor units B, D, E and F. In the first control cycle of the time-sharing dehumidification process, any one of the current dehumidification indoor units, for example, the indoor unit B, may be set as the first dehumidification indoor unit, and the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode. It is assumed that the current heating indoor units in the multi-split system are further capable of supporting the indoor unit D besides the first dehumidification indoor unit, then the indoor unit D is set as the second dehumidification indoor unit, and the operation mode of the indoor unit D is set to be the dehumidification mode. The operation modes of the dehumidification indoor units that are not set to operate in the dehumidification mode in the control cycle, that is, the operation modes of the indoor units E and F, are set to be the temporary non-dehumidification mode. In this way, in the first control cycle, the operation modes of the indoor units B and D are set to be the dehumidification mode. After the first control cycle is finished, the second control cycle of the current time-sharing dehumidification process starts.

[0040] As shown in FIG. 5, in the second control cycle of the time-sharing dehumidification process, any one of the dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process, i.e., any one of the indoor units E and F, e.g., the indoor unit E, is set as the first dehumidification indoor unit, and the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode. It is assumed that the current heating indoor units in the multi-split system are only capable of supporting the indoor unit E, that is, there is no second dehumidification indoor unit in the second control cycle, then the operation modes of the dehumidification indoor units that are not set to operate in the dehumidification mode in this control cycle, i.e., the operation modes of the indoor units B, D and F, are set to be the temporary non-dehumidification mode. In this way, in the second control cycle, the operation mode of the indoor unit E is set to be the dehumidification mode. After the second control cycle is finished, a third control cycle of the current time-sharing dehumidification process starts.

[0041] As shown in FIG. 6, in the third control cycle of the time-sharing dehumidification process, the dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process, i.e., the indoor unit F, is set as the first dehumidification indoor unit, and the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode. Since the indoor unit F is a last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process, there is no second dehumidification indoor unit in the control cycle. The operation modes of the dehumidification indoor units that are not set to operate in the dehumidification mode in this control cycle, i.e., the operation modes of the indoor units B, D and E, are set to be the temporary non-dehumidification mode. In this way, in the third control cycle, only the operation mode of the indoor unit F is set to be the dehumidification mode. After this control cycle is finished, the time-sharing dehumidification process may be finished, or the control cycles may be cyclically performed, which is not limited in the embodiments.

[0042] In this way, according to the time-sharing dehumidification method provided by some embodiments of the present disclosure, in the time-sharing dehumidification process, it may be ensured that all the current dehumidification indoor units operate in the dehumidification mode once, and it is possible to make the dehumidification performance of each dehumidification indoor unit that operates in the dehumidification mode good in each control cycle of the time-sharing dehumidification process. Therefore, in a case where the total volume of the current heating indoor unit(s) is not matched with the total volume of the current dehumidification indoor units, it is possible to avoid a problem that the dehumidification performance of the dehumidification indoor units is poor or even part of the dehumidification indoor units cannot perform the dehumidification, caused by a fact that all the current dehumidification indoor units simultaneously operate in the dehumidification mode.

[0043] On this basis, in some embodiments, on the basis of the solution that the dehumidification indoor units in the first collection are numbered according to the rule of the arithmetic progression, a control cycle in the time-sharing dehumidification method is described in detail in combination with FIG. 3, and in the control cycle, the method includes the following steps after the step 201.

[0044] In step 202, in the control cycle, the m-numbered dehumidification indoor unit is set as the first dehumidification indoor unit.

[0045] It will be noted that, this step is described by taking an example in which in the step 201, the current dehumidification indoor units in the multi-split system shown in FIG. 4 are numbered 0, 1, 2 and 3.

[0046] In combination with the above examples, in the first control cycle of the time-sharing dehumidification process, the first dehumidification indoor unit is the 0-numbered dehumidification indoor unit (i.e., the indoor unit B, where m is equal to 0). In a subsequent control cycle (not the first control cycle), the dehumidification indoor unit corresponding to the smallest serial number among the serial numbers of dehumidification indoor units that have not performed the dehumidification in the time-sharing dehumidification process is set as the first dehumidification indoor unit.

[0047] In step 203, the operation mode of the m-numbered dehumidification indoor unit is set to be the dehumidification mode. That is, the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode.

[0048] For example, a status identifier bit (i.e., an identifier bit for indicating the operation mode) of the m-numbered dehumidification indoor unit may be set to be a first identifier (e.g., 0), which is used to represent the dehumidification mode and control the m-numbered dehumidification indoor unit to operate in the dehumidification mode.

[0049] It will be noted that this step is performed after the step 202. For example, this step may be simultaneously performed with step 212.

[0050] In step 204, the operation modes of dehumidification indoor units with serial numbers less than or equal to (m - 1) (which may be expressed as $\leq m - 1$, or 0 to (m - 1)) are set to be the temporary non-dehumidification mode.

[0051] For example, status identifier bits of the 0-numbered dehumidification indoor unit to (m-1)-numbered dehumidification indoor unit may be set to be a second identifier (e.g., 1), which is used to represent the temporary non-dehumidification mode. In this case, the operation modes of these dehumidification indoor units are the temporary non-dehumidification mode.

[0052] It will be noted that in the first control cycle of the time-sharing dehumidification process, m is equal to 0, so there is no dehumidification indoor unit with the serial number less than or equal to (m - 1). In a non-first control cycle, in combination with the above examples, in the second control cycle, m is equal to 2, and then the operation modes of the dehumidification indoor units numbered 0 and 1, i.e., the operation modes of all the dehumidification indoor units that have operated in the dehumidification mode in the first control cycle, are set to be the temporary non-dehumidification mode. This step is performed after the step 202. For example, this step may be simultaneously performed with step 213.

[0053] In step 205, j is made equal to m (i.e., $j = m$).

[0054] In step 206, it is determined whether j is less than a difference between N_{total} and 1 (i.e., $(N_{total} - 1)$). N_{total} is used to represent a number of the current dehumidification indoor units, i.e., a number of the dehumidification indoor units in the first collection. The step 206 is to determine whether the accumulated dehumidification indoor units include the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process.

[0055] In combination with the above examples, N_{total} is equal to 4. In the third control cycle of the time-sharing

dehumidification process, m is equal to 3. That is, the serial number of the first dehumidification indoor unit is 3. When the step 206 is performed, j is determined to be equal to $(N_{\text{total}} - 1)$. That is, the dehumidification indoor unit numbered 3 is the last dehumidification indoor unit that has not performed the dehumidification in the current time-sharing dehumidification process. Therefore, there is no need to perform the step related to determining the second dehumidification indoor unit(s). In this control cycle, only the dehumidification indoor unit numbered 3 operates in the dehumidification mode.

[0056] If j is less than $(N_{\text{total}} - 1)$, step 207 is performed. If j is equal to $(N_{\text{total}} - 1)$, step 214 is performed.

[0057] In step 207, j is equal to a sum of j and 1 (i.e., $j = j + 1$).

[0058] It will be noted that, the step 207 is to determine a next dehumidification indoor unit other than the first dehumidification indoor unit. When the dehumidification indoor units are numbered according to the rule of the arithmetic progression, that j is equal to a sum of j and x (i.e., $j = j + x$) is performed in the step 207. Here, x represents the common difference of the arithmetic progression. In the step 206 of some embodiments of the present disclosure, an example in which the common difference is 1 is taken for illustration. When the dehumidification indoor units are numbered according to other rules, the next dehumidification indoor unit other than the first dehumidification indoor unit is determined according to an actual numbering rule, and details will not be repeated in the embodiments of the present disclosure.

[0059] In step 208, a volume of an evaporator of the first dehumidification indoor unit and volumes of evaporators of the dehumidification indoor unit(s) in the first collection that have not performed the dehumidification in the current time-sharing dehumidification process are accumulated in a way of accumulating one for each time, and it is determined

whether the accumulation result meets: $\sum_m^j \text{DH_HP} \geq [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$.

[0060] Here, $\sum_m^j \text{DH_HP}$ represents a sum of the volume of the first dehumidification indoor unit and the volumes of the accumulated dehumidification indoor unit(s) in the first collection that have not performed the dehumidification in the current time-sharing dehumidification process; $\sum \text{Heat_HP}$ represents a total volume of the current heating indoor unit(s) in the multi-split system; and $K_{\text{DH_CAP}}$ represents a control coefficient. The control coefficient $K_{\text{DH_CAP}}$ is a ratio of the total volume of the heating indoor unit(s) to a total volume of dehumidification indoor units that can be supported. The control coefficient $K_{\text{DH_CAP}}$ may be set according to actual needs. In some embodiments, the control coefficient $K_{\text{DH_CAP}}$ is within a range from 1.3 to 3.0. In some embodiments, the control coefficient $K_{\text{DH_CAP}}$ is 1.5.

[0061] With reference to FIG. 3 and in combination with the above examples, It is assumed that in the first control cycle of the time-sharing dehumidification process, volumes of the dehumidification indoor units numbered 0 and 1 are

accumulated. If the accumulation result does not meet the condition $\sum_m^j \text{DH_HP} \geq [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$,

then step 209 is performed. Since the dehumidification indoor unit numbered 1 is not the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process, the steps 207 and 208 are performed: a volume of the dehumidification indoor unit numbered 2 is further added up. If the accumulation result

meets $\sum_m^j \text{DH_HP} = [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$, step 210, i.e., n being equal to j and equal to 2 (i.e., $n = j = 2$), is performed. In this case, besides the dehumidification indoor unit numbered 0, the number of the second dehumidification indoor unit that the current heating indoor units are further capable of supporting is 1.

[0062] It will be noted that in the step 208, it is also possible to determine whether the accumulation result meets

$\sum_m^j \text{DH_HP} > [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$. In combination with the above examples, in the first control cycle, when the volumes of the dehumidification indoor units numbered 0, 1 and 2 are accumulated, if the accumulation result

meets the condition $\sum_m^j \text{DH_HP} = [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$, then the step 209 is performed. Since the dehumidification indoor unit numbered 2 is not the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process, the steps 207 and 208 are performed: a volume of the dehumidification indoor unit numbered 3 is further added up. If the accumulation result meets

$\sum_m^j \text{DH_HP} > [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$, then the step 210, i.e., n being equal to j , and equal to 3 (i.e., $n = j = 3$), is performed. In combination with the above description, the dehumidification indoor units numbered 1 and 2 should theoretically be set as the second dehumidification indoor units. That is, in this control cycle, the dehumidification indoor units numbered 0, 1 and 2 are simultaneously set to operate in the dehumidification mode. In this case, the dehumidification indoor units, with a critical number that the current heating indoor units are capable of supporting, operate in the dehumidification mode, and the dehumidification performance of the dehumidification indoor units may be poor. There-

fore, in some embodiments, when the accumulation result meets $\sum_m^j \text{DH_HP} = [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$, a last accumulated dehumidification indoor unit is not set as the second dehumidification indoor unit. That is, in the step 208,

it is determined whether the accumulation result meets $\sum_m^j \text{DH_HP} \geq [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$.

[0063] In the step 209, it is determined whether j is equal to $(N_{\text{total}} - 1)$.

[0064] When the accumulation result does not meet $\sum_m^j \text{DH_HP} \geq [\sum \text{Heat_HP}] / K_{\text{DH_CAP}}$, it is determined whether the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process is accumulated. If the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process is accumulated, the step 210 is performed. That is, the accumulation is stopped, and the accumulated dehumidification indoor unit(s) other than the first dehumidification indoor unit are set as the second dehumidification indoor unit(s). If the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process is not accumulated, the step 207 is performed.

[0065] In the step 210, n is made equal to j (i.e., $n = j$).

[0066] In step 211, it is determined whether m and n meet a condition that a sum of m and 1 is less than or equal to a difference between n and 1 (i.e., $(m + 1) \leq (n - 1)$).

[0067] If m and n do not meet the condition $(m + 1) \leq (n - 1)$, then the step 213 is performed. If m and n meet the condition $(m + 1) \leq (n - 1)$, then the serial numbers of the second dehumidification indoor unit(s) are within a range from $(m + 1)$ to $(n - 1)$, and the step 212 is performed.

[0068] In combination with the above examples, in the first control cycle of the time-sharing dehumidification process, m is equal to 0, and j is equal to 2 (i.e., $m = 0$, and $j = 2$). Then, in the step 210, n is equal to j , j is equal to 2 (i.e., $n = j = 2$), and m and n meet the condition $(m + 1) \leq (n - 1)$. As a result, in this control cycle, the current heating indoor unit(s) are capable of supporting the dehumidification indoor units numbered 0 and 1 to operate in the dehumidification mode. In this case, the serial number of the second dehumidification indoor unit is 1.

[0069] In the second control cycle of the time-sharing dehumidification process, m is equal to 2, and j is equal to 3 (i.e., $m = 2$, and $j = 3$). Then, in the step 210, n is equal to j , j is equal to 3 (i.e., $n = j = 3$), and m and n do not meet the condition $(m + 1) \leq (n - 1)$. As a result, in this control cycle, the current heating indoor unit(s) are only capable of supporting the dehumidification indoor unit numbered 2 to operate in the dehumidification mode. In this case, there is no second dehumidification indoor unit.

[0070] In step 212, the operation modes of the dehumidification indoor unit(s) numbered from $(m + 1)$ to $(n - 1)$ are set to be the dehumidification mode.

[0071] In combination with the above examples, the dehumidification indoor unit(s) numbered from $(m + 1)$ to $(n - 1)$ are determined to be the second dehumidification indoor unit(s), and the operation modes of the second dehumidification indoor unit(s) are set to be the dehumidification mode.

[0072] In this way, according to the time-sharing dehumidification method provided by some embodiments of the present disclosure, it is possible to determine a maximum number of dehumidification indoor unit(s) that the current heating indoor unit(s) are capable of supporting in the control cycle, and the operation modes of the dehumidification indoor unit(s) are set to be the dehumidification mode. In this case, it may be ensured that the dehumidification performance of each dehumidification indoor unit that operates in the dehumidification mode is good in the control cycle.

[0073] In step 214, a current operation mode is maintained.

[0074] It will be noted that, in a case where the current heating indoor unit(s) and the current dehumidification indoor units are not adjusted, and the control cycle is not finished, the operation mode of each indoor unit of the multi-split system is maintained the current operation mode. When the operation mode of each indoor unit is maintained the current operation mode, no additional operation is needed.

[0075] On this basis, if the control cycle is not a last control cycle in the current time-sharing dehumidification process, then after the control cycle is finished, a next control cycle in the time-sharing dehumidification process is started.

[0076] In some embodiments, the process may be implemented through step 215 shown in FIG. 3. For example, it is determined whether the control cycle TDH is finished. If the control cycle is not the last control cycle in the current time-sharing dehumidification process, after the end of the control cycle TDH is finished, the next control cycle in the current time-sharing dehumidification process is started. That is, each step shown in FIG. 3 is performed again.

[0077] It will be noted that, after the end of the control cycle, if all the dehumidification indoor units in the first collection in the time-sharing dehumidification process have operated in the dehumidification mode, then the control cycle is regarded as the last control cycle in the time-sharing dehumidification process.

[0078] In summary, the time-sharing dehumidification method provided by some embodiments of the present disclosure is based on the numbering of dehumidification indoor units in the first collection in the way of arithmetic progression. In the time-sharing dehumidification process, the method may ensure that all the current dehumidification indoor units may

operate in the dehumidification mode once, and may make the dehumidification performance of each dehumidification indoor unit that operates in the dehumidification mode good in each control cycle of the time-sharing dehumidification process. Therefore, in a case where the volumes of the current heating indoor unit(s) are not matched with the volumes of the current dehumidification indoor units, the problem that the dehumidification performance of the dehumidification indoor units is poor or even part of the dehumidification indoor units cannot perform the dehumidification, which is caused by the fact that all the current dehumidification indoor units simultaneously operate in the dehumidification mode, is avoided.

[0079] On this basis, if the control cycle is the last control cycle of the time-sharing dehumidification process, the time-sharing dehumidification process comes to an end after the current control cycle is finished. However, in actual use, a plurality of time-sharing dehumidification processes usually need to be cyclically performed to make each current dehumidification indoor unit cyclically operates in the dehumidification mode. Therefore, in some embodiments, if the control cycle is the last control cycle in the time-sharing dehumidification process, after the control cycle is finished, a first control cycle of a next time-sharing dehumidification process is started.

[0080] It will be noted that after the time-sharing dehumidification process is finished, the serial number m is reset to be 0, so that in the first control cycle of the next time-sharing dehumidification process, the dehumidification indoor units sequentially operate in the dehumidification mode starting from the dehumidification indoor unit numbered 0.

[0081] In addition, in the time-sharing dehumidification process, the dehumidification indoor units in the first collection and/or the current heating indoor unit(s) of the multi-split system are adjusted (that is, the number of the operating rooms is changed), for example, the number of the current dehumidification indoor units or the current heating indoor units is changed, or the specific indoor units used as the dehumidification indoor units or the heating indoor unit(s) in the multi-split system are changed. In some embodiments, if in the multi-split system shown in FIG. 4, the indoor units A, B and D are changed to be used as the current dehumidification indoor units, and the indoor units E and F are used as the current heating indoor units, the maximum number of dehumidification indoor units that the current heating indoor units E and F are capable of supporting will also changes. In this case, if the time-sharing dehumidification process is still performed, it is impossible to make each current dehumidification indoor unit operate in the dehumidification mode once.

[0082] On this basis, in some embodiments, the time-sharing dehumidification method provided by the embodiments of the present disclosure further includes the following step. If in the current time-sharing dehumidification process, the dehumidification indoor units in the first collection are adjusted, or the current heating indoor units are adjusted, or the dehumidification indoor units in the first collection and the current heating indoor units are all adjusted, the next time-sharing dehumidification process will be started. In this case, in each control cycle of the new time-sharing dehumidification process, the first dehumidification indoor unit and the second dehumidification indoor unit(s) are redetermined according to the time-sharing dehumidification method described above, so that the dehumidification performance of the dehumidification indoor units that operate in the dehumidification mode in the control cycle is made good.

[0083] In some embodiments, in the step 101, the method for determining the maximum number of the second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further capable of supporting besides the first dehumidification indoor unit includes the following step.

[0084] If the first dehumidification indoor unit is not the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process, the volume of the first dehumidification indoor unit and the volumes of the dehumidification indoor units in the first collection that have not performed the dehumidification in the current time-sharing dehumidification process are accumulated one by one, until the maximum number of the second dehumidification indoor unit(s) that the current heating indoor units are further capable of supporting is determined when the accumulation result is less than or equal to a reference threshold.

[0085] Or, if the accumulation result is still less than the reference threshold when the last dehumidification indoor unit that has not performed the dehumidification in the current time-sharing dehumidification process is accumulated, then the accumulated dehumidification indoor unit(s) other than the first dehumidification indoor unit are set as the second dehumidification indoor unit(s). The reference threshold is a ratio of a total volume of the current heating indoor unit(s) in the multi-split system to the control coefficient K_{DH_CAP} .

[0086] It will be noted that this process may be achieved through the steps 206 to 209 shown in FIG. 3. The reference

threshold is the above $\sum_m^j [\sum \text{Heat_HP}] / K_{DH_CAP}$, i.e., the ratio of the total volume of the current heating indoor unit(s) in the multi-split system to the control coefficient K_{DH_CAP} . Since the specific processes of the steps 206 to 209 have been described in detail in the foregoing embodiments, details will not be repeated here again. In the time-sharing dehumidification method shown in FIG. 3, the first dehumidification indoor unit and the second dehumidification indoor unit(s) are determined through being numbered. Of course, it is also possible that the first dehumidification indoor unit and the second dehumidification indoor unit(s) be determined without the above numbering method. In some embodiments, after the first dehumidification indoor unit is determined, the volume of the first dehumidification indoor unit and the volumes of the dehumidification indoor units in the first collection that have not performed the dehumidification in

the current time-sharing dehumidification process may be accumulated one by one through pointers, so as to determine the second dehumidification indoor unit(s). On the basis of a general idea of the time-sharing dehumidification method provided by the embodiments of the present disclosure, a person skilled in the art may also use other manners to adjust the specific solution for determining the second dehumidification indoor unit(s), which is not limited in the embodiments of the present disclosure.

[0087] In addition, it will be understood by a person of ordinary skill in the art that, all or part of the steps for implementing the above method may be completed through hardware associated with program instructions. The foregoing programs may be stored in a computer readable storage medium, and when executed by a processor, the computer programs implement the time-sharing dehumidification method of the multi-split system described above. When the programs are executed, the steps including the embodiments of the above method are performed. The above storage medium includes a read only memory image (ROM), a random access memory (RAM), a magnetic disk, an optical disk or other media that is able to store program codes.

[0088] On this basis, the dehumidification indoor unit includes a first indoor electronic expansion valve that is not located on a dehumidification loop and a first indoor electronic expansion valve that is located on the dehumidification loop. Taking the multi-split system shown in FIG. 7 as an example, the multi-split system includes an outdoor unit 01, an indoor unit 02 and an indoor unit 03. The indoor unit 02 is the heating indoor unit, and the indoor unit 03 is the dehumidification indoor unit. A first indoor heat exchanger 11 and a first indoor electronic expansion valve 13 of the indoor unit 03 are not located on the dehumidification loop, and a second indoor heat exchanger 12 and a second indoor electronic expansion valve 14 of the indoor unit 03 are located on the dehumidification loop. The multi-split system shown in FIG. 7 is illustrated by it including one dehumidification indoor unit and one heating indoor unit. In a case where the multi-split system includes a plurality of heating indoor units 02 and a plurality of dehumidification indoor units 03, the structure of each indoor unit may be the same as the structure of the above heating indoor unit 02 or the above dehumidification indoor unit 03.

[0089] On this basis, that the operation mode of the dehumidification indoor unit 03 is set to be the dehumidification mode includes the following steps.

[0090] The first indoor electronic expansion valve 13 of the dehumidification indoor unit 03 is in a closed state to make the first indoor heat exchanger 11 not work.

[0091] An initial value $EVR(0)$ of an opening degree of the second indoor electronic expansion valve 14 of the dehumidification indoor unit 03 is a preset value, and in an n -th control cycle of the time-sharing dehumidification process, the opening degree $EVR(n)$ of the second indoor electronic expansion valve 14 of the dehumidification indoor unit 02 meets a condition: $EVR(n) = EVR(n - 1) + 5 \times (SH - SHo)$. Here, SH is used to represent a difference between a temperature of an air pipe 16 and a temperature of a liquid pipe 15 of the dehumidification indoor unit, and SHo is used to represent a target degree of evaporation superheat. In this way, the second indoor heat exchanger 12 of the dehumidification indoor unit 03 may be used as an evaporator for dehumidification.

[0092] It will be noted that the initial value $EVR(0)$ may be set according to actual needs. In some embodiments, the initial value $EVR(0)$ is within a range from 100 puls to 150 puls. The target degree of evaporation superheat SHo may be a preset value, or may be determined according to a relative humidity of return air of the dehumidification indoor unit 02, a humidity set by a user, the temperature of the liquid pipe of the dehumidification indoor unit and a temperature of the return air of the dehumidification indoor unit.

[0093] On this basis, in some embodiments, the target degree of evaporation superheat SHo may be determined according to Table 1.

Table 1

ΔH	SHo
$\Delta H \leq -10\%$	$(Ti - Tlp) + 4$
$-10\% < \Delta H \leq 0$	$(Ti - Tlp)$
$0 < \Delta H \leq 10\%$	$3 \times (Ti - Tlp) + 4$
$10\% < \Delta H \leq 20\%$	$(Ti - Tlp) / 2$
$20\% < \Delta H$	3

[0094] Here, ΔH is a difference between Hs and Hi (i.e., $\Delta H = Hs - Hi$), Hi is used to represent the relative humidity of the return air of the dehumidification indoor unit, Hs is used to represent the humidity set by the user, Ti is used to represent the temperature of the return air of the dehumidification indoor unit, and Tlp is used to represent the temperature of the liquid pipe 15 of the dehumidification indoor unit 02. The relative humidity of the return air refers to a relative

humidity at a position of the dehumidification indoor unit where the air returns.

[0095] On this basis, the embodiments of the present disclosure provide a method for controlling opening degrees of the first indoor electronic expansion valve 13 that is not located on the dehumidification loop and the second indoor electronic expansion valve 14 that is located on the dehumidification loop in the dehumidification indoor unit in each control cycle in the time-sharing dehumidification process, so as to ensure that the dehumidification performance of the dehumidification indoor units in each control cycle is good.

[0096] On this basis, that the operation mode of the dehumidification indoor unit 03 is set to be the temporary non-dehumidification mode includes: the first indoor electronic expansion valve 13 and the second indoor electronic expansion valve 14 of the dehumidification indoor unit 03 being in a fully closed state.

[0097] In addition, in the above time-sharing dehumidification process, the operation mode of the heating indoor unit(s) is the heating mode. In some embodiments, as shown in FIG. 7, a second indoor electronic expansion valve 14' of the heating indoor unit is in a fully closed state, so that a second indoor heat exchanger 12' does not work; and a first indoor electronic expansion valve 13' is in a fully open state, so that a first indoor heat exchanger 11' is used as the condenser for heating.

[0098] According to the time-sharing dehumidification method provided by some embodiments of the present disclosure, in the control cycle in the time-sharing dehumidification process, the first dehumidification indoor unit and the maximum number of the second dehumidification indoor unit(s) that the current heating indoor unit(s) are further capable of supporting are determined, and the operation mode of the first dehumidification indoor unit is set to be the dehumidification mode. If there exist the second dehumidification indoor unit(s), the operation modes of the second dehumidification indoor unit(s) are set to be the dehumidification mode, and the dehumidification indoor units that are not set to operate in the dehumidification mode in the current control cycle are set to be in the temporary non-dehumidification mode. If the current control cycle is not the last control cycle in the current time-sharing dehumidification process, the next control cycle in the current time-sharing dehumidification process is started after the current control cycle is finished. In this way, in the time-sharing dehumidification process, it may be ensured that all the current dehumidification indoor units may operate in the dehumidification mode once, and it may also be ensured that the current heating indoor unit(s) are capable of supporting the first dehumidification indoor unit and the second dehumidification indoor unit(s) in each control cycle to operate in the dehumidification mode. As a result, the dehumidification performance of each dehumidification indoor unit that operates in the dehumidification mode in each control cycle is good. Accordingly, in the case where the total volume of the current heating indoor unit(s) is not matched with the total volume of the current dehumidification indoor units, the problem that the dehumidification performance of the dehumidification indoor units is poor or even part of the dehumidification indoor units cannot perform the dehumidification, caused by the fact that all the current dehumidification indoor units simultaneously operate in the dehumidification mode, is avoided.

[0099] Some embodiments of the present disclosure further provide a multi-split system including a memory and a processor. The memory stores computer programs capable of running on the processor, and the processor is configured to execute the computer programs to make the multi-split system implement the following steps. In the control cycle in the time-sharing dehumidification process, at least one of a plurality of dehumidification indoor units operates in the dehumidification mode, so that the sum of the volume of the evaporator of the at least one dehumidification indoor unit is matched with the sum of the volume(s) of the condenser(s) of the current heating indoor unit(s). In the next control cycle in the time-sharing dehumidification process, the at least one dehumidification indoor unit stops operating in the dehumidification mode, and another at least one dehumidification indoor unit operates in the dehumidification mode; and a total volume of the evaporator of the another at least one dehumidification indoor unit is matched with the total volume of the condenser(s) of the current heating indoor unit(s). The steps are cyclically performed in this way, so that in the time-sharing dehumidification process, each of the plurality of dehumidification indoor units operates in the dehumidification mode once.

[0100] The processor of the multi-split system may achieve a plurality of logical functions, and the processor may be divided into different functional modules according to the logical functions realized by the processor. As shown in FIG. 8, after the processor is divided into different functional modules, the processor includes a control module 10 and a determination module 20. The control module 10 is configured to set the operation mode of the first dehumidification indoor unit to be the dehumidification mode in the control cycle of the time-sharing dehumidification process for the dehumidification indoor unit(s) in the first collection that have not performed the dehumidification in the time-sharing dehumidification process. The first collection is composed of the current dehumidification indoor units in the multi-split system. The determination module is used to determine the maximum number of the second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further capable of supporting besides the first dehumidification indoor unit.

[0101] On this basis, the control module 10 is further configured to set the operation mode of each second dehumidification indoor unit to be the dehumidification mode when there exist the second dehumidification unit(s). The control module 10 is further configured to set the operation modes of the remaining dehumidification indoor units in the first collection to be the temporary non-dehumidification mode. The remaining dehumidification indoor units are the dehu-

modification indoor units that are not set to operate in the dehumidification mode in the control cycle.

[0102] On this basis, if the current control cycle is not the last control cycle in the current time-sharing dehumidification process, the control module 10 is further configured to control the next control cycle in the current time-sharing dehumidification process to be started after the current control cycle is finished.

[0103] On this basis, if the dehumidification indoor units in the first collection and/or the current heating indoor unit(s) are adjusted in the time-sharing dehumidification process, the control module 10 is further configured to control the next time-sharing dehumidification process to be started.

[0104] On this basis, the determination module 20 includes an accumulation module and a comparison module. The accumulation module is configured to accumulate the volume of the first dehumidification indoor unit and the volume(s) of the dehumidification indoor unit(s) in the first collection that have not performed the dehumidification in the time-sharing dehumidification process one by one. The comparison module is configured to compare the accumulation result with the reference threshold, until the determination module 20 determines the maximum number of the second dehumidification indoor unit(s) that the current heating indoor units may further capable of supporting when accumulation result is less than or equal to the reference threshold. Or, if the accumulation result is still less than the reference threshold when the last dehumidification indoor unit that has not performed the dehumidification in the time-sharing dehumidification process is accumulated by the accumulation module, then the accumulated dehumidification indoor unit(s) other than the first dehumidification indoor unit is used as the second dehumidification indoor unit(s). The reference threshold is the ratio of the total volume of the current heating indoor units in the multi-split system to the control coefficient.

[0105] On this basis, the multi-split system provided by some embodiments of the present disclosure further includes a numbering module 30 which is configured to number the dehumidification indoor units in the first collection according to the rule of the arithmetic progression.

[0106] In this case, in some embodiments, in the control cycle, for the dehumidification indoor units in the first collection that have not performed the dehumidification in the time-sharing dehumidification process, the control module 10 may be configured to take the dehumidification indoor unit with the smallest serial number or the largest serial number as the first dehumidification indoor unit, and set the operation mode of the first dehumidification indoor unit to be the dehumidification mode. The determination module 20 is configured to determine the maximum number of the second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further capable of supporting besides the first dehumidification indoor unit. The second dehumidification indoor unit(s) and the first dehumidification indoor unit are consecutively numbered.

[0107] On this basis, the dehumidification indoor unit includes the first indoor electronic expansion valve that is not located on the dehumidification loop, and the second indoor electronic expansion valve that is located on the dehumidification loop. The multi-split system further includes an opening degree control module.

[0108] In this case, that the control module 10 set the operation mode of the dehumidification indoor unit to be the dehumidification mode includes the following step. The control module 10 is configured to control the first indoor electronic expansion valve of the dehumidification indoor unit to be in the closed state. The initial value $EVR(0)$ of the opening degree of the second indoor electronic expansion valve is the preset value. In the n -th control cycle in the time-sharing dehumidification process, the opening degree control module is configured to control the opening degree of the second indoor electronic expansion valve of the dehumidification indoor unit, so that the opening degree of the second indoor electronic expansion valve meets the condition: $EVR(n) = EVR(n - 1) + 5 \times (SH - SHo)$. Here, SH is used to represent the difference value between the temperature of the air pipe and the temperature of the liquid pipe of the dehumidification indoor unit, and SHo is used to represent the target degree of evaporation superheat. In some embodiments, the target degree of evaporation superheat SHo may be determined according to the Table 1 described above, and details will not be repeated again in the embodiments of the present disclosure.

[0109] It will be noted that each module in the embodiments may be a processor provided independently, or may be integrated in a certain processor of the multi-split system, or may be stored in the memory of the multi-split system in a form of program code and called by a certain processor of the multi-split system to perform the function of each unit described above. The processor described herein may be a central processing unit (CPU), a graphics processing unit (GPU), or an application specific integrated circuit (ASIC), or one or more integrated circuits configured to implement the embodiments of the present disclosure.

[0110] In some embodiments, the multi-split system may include a control board in the multi-split system. The control board may include an indoor unit control board and a general control board communicatively connected to the indoor unit control board. The indoor unit control board may be disposed in each indoor unit, and the general control board may be disposed in the outdoor unit of the multi-split system. In some embodiments, with reference to the above method, the general control board may determine the first dehumidification indoor unit and the second dehumidification indoor unit(s) that may be set to operate in the dehumidification mode in a control cycle in the time-sharing dehumidification process, and notify the indoor unit control boards to control the first dehumidification indoor unit and the second dehumidification indoor unit(s) to operate in the dehumidification mode, and to control the operation modes of the remaining dehumidification indoor unit(s) to be the temporary non-dehumidification mode.

[0111] On this basis, some embodiments of the present disclosure provide a multi-split system to which the time-sharing dehumidification method of the multi-split system described above is applied, and the multi-split system has same beneficial effects as the time-sharing dehumidification method for the multi-split system.

[0112] Some embodiments of the present disclosure provide a computer storage medium storing computer instructions that, when executed by a time-sharing dehumidification device of the multi-split system, cause the time-sharing dehumidification device to perform the time-sharing dehumidification method for the multi-split system. The computer storage medium has the same beneficial effects as the time-sharing dehumidification method for the multi-split system provided by the foregoing embodiments. Since the beneficial effects of the time-sharing dehumidification method for the multi-split system have been described in detail in the foregoing embodiments, details will not be repeated again herein.

[0113] It will be noted that the computer storage medium may include the ROM, the RAM, the magnetic disk, the optical disk or other media that is capable of storing program codes.

[0114] The foregoing descriptions are merely some implementations of the present disclosure, but the protection scope of the present disclosure is not limited thereto. Changes or replacements that any person skilled in the art can easily think of within the technical scope of the present disclosure shall be included in the protection scope of the present disclosure. Therefore, the protection scope of the present disclosure shall be subject to the protection scope of the claims.

Claims

1. A time-sharing dehumidification method for a multi-split system, comprising:
in a control cycle of a time-sharing dehumidification process, controlling at least one dehumidification indoor unit of a plurality of dehumidification indoor units that have not operate in a dehumidification mode in the time-sharing dehumidification process to operate in the dehumidification mode; and setting an operation mode of each remaining dehumidification indoor unit to be a temporary non-dehumidification mode, a total volume of an evaporator of the at least one dehumidification indoor unit being not greater than a total volume of condensers of current heating indoor unit(s), wherein the time-sharing dehumidification process includes at least two control cycles, and the time-sharing dehumidification process includes sequentially performing the at least two control cycles until each dehumidification indoor unit in the plurality of dehumidification indoor units operates in the dehumidification mode once.
2. The time-sharing dehumidification method according to claim 1, wherein in the control cycle of the time-sharing dehumidification process, controlling a first dehumidification indoor unit of the plurality of dehumidification indoor units to operate in the dehumidification mode includes:

in the control cycle of the time-sharing dehumidification process, for dehumidification indoor units in a first collection that have not performed dehumidification in the time-sharing dehumidification process: setting an operation mode of the first dehumidification indoor unit to be the dehumidification mode; determining a maximum number of second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further capable of supporting besides the first dehumidification indoor unit; and if there exist the second dehumidification indoor unit(s), setting operation modes of the second dehumidification indoor unit(s) to be the dehumidification mode, wherein the first collection is composed of current dehumidification indoor units in the multi-split system; and
setting the operation mode of each remaining dehumidification indoor unit in the first collection to be the temporary non-dehumidification mode, each remaining dehumidification indoor unit being a dehumidification indoor unit that is not set to operate in the dehumidification mode in the control cycle.
3. The time-sharing dehumidification method according to claim 2, further comprising:
if the control cycle is not a last control cycle in the time-sharing dehumidification process, after the control cycle is finished, starting a next control cycle in the time-sharing dehumidification process.
4. The time-sharing dehumidification method according to claim 3, further comprising:
if the control cycle is the last control cycle in the current time-sharing dehumidification process, after the control cycle is finished, starting a first control cycle of a next time-sharing dehumidification process.
5. The time-sharing dehumidification method according to claim 2, further comprising:
if an adjustment instruction is received in the time-sharing dehumidification process, starting a next time-sharing dehumidification process, wherein the adjustment instruction is configured to cause at least one of following operations to be performed:

increasing or reducing a number of the dehumidification indoor units in the first collection; or
 increasing or reducing a number of the current heating indoor unit(s); or
 changing a distribution of the dehumidification indoor units in the first collection in a case where the number of
 the dehumidification indoor units is not changed; or
 changing a distribution of the heating indoor unit(s) in a case where the number of the current heating indoor
 unit(s) is not changed.

6. The time-sharing dehumidification method according to claim 2, wherein determining a maximum number of the
 second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further
 capable of supporting besides the first dehumidification indoor unit includes:

if the first dehumidification indoor unit is not a last dehumidification indoor unit that has not performed the
 dehumidification in the time-sharing dehumidification process, accumulating a volume of the first dehumidifica-
 tion indoor unit and volumes of the dehumidification indoor units in the first collection that have not performed
 the dehumidification in the current time-sharing dehumidification process one by one, until the maximum number
 of the second dehumidification indoor unit(s) that the current heating indoor unit(s) are further capable of sup-
 porting is determined when an accumulation result is less than or equal to a reference threshold; or if the
 accumulation result is still less than the reference threshold when the last dehumidification indoor unit that has
 not performed the dehumidification in the current time-sharing dehumidification process is accumulated, setting
 accumulated dehumidification indoor unit(s) other than the first dehumidification indoor unit as the second
 dehumidification indoor unit(s), wherein
 the reference threshold is a ratio of the total volume of the current heating indoor unit(s) in the multi-split system
 to a control coefficient.

7. The time-sharing dehumidification method according to claim 2, wherein the time-sharing dehumidification method
 further comprises: numbering the dehumidification indoor units in the first collection according to a rule of an arithmetic
 progression; and

in the control cycle of the time-sharing dehumidification process, for the dehumidification indoor units in the first
 collection that have not performed the dehumidification in the current time-sharing dehumidification process: setting
 the operation mode of the first dehumidification indoor unit to be the dehumidification mode; determining the maximum
 number of the second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system
 are further capable of supporting besides the first dehumidification indoor unit includes:

in the control cycle, for the dehumidification indoor units in the first collection that have not performed the dehumid-
 ification in the time-sharing dehumidification process: setting a dehumidification indoor unit with a smallest serial
 number or a dehumidification indoor unit with a largest serial number as the first dehumidification indoor unit; setting
 the operation mode of the first dehumidification indoor unit to be the dehumidification mode; and determining the
 second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further
 capable of supporting besides the first dehumidification indoor unit, the second dehumidification indoor unit(s) and
 the first dehumidification indoor unit being consecutively numbered.

8. The time-sharing dehumidification method according to claim 2, wherein each dehumidification indoor unit includes
 a first indoor electronic expansion valve that is not located on a dehumidification loop and a second indoor electronic
 expansion valve that is located on the dehumidification loop; and setting an operation mode of the dehumidification
 indoor unit to be the dehumidification mode includes:

the first indoor electronic expansion valve of the dehumidification indoor unit being in a closed state; and
 an initial value $EVR(0)$ of an opening degree of the second indoor electronic expansion valve of the dehumid-
 ification indoor unit being a preset value; and in an n th control cycle of the time-sharing dehumidification process,
 the opening degree $EVR(n)$ of the second indoor electronic expansion valve of the dehumidification indoor unit
 meeting: $EVR(n) = EVR(n - 1) + 5 \times (SH - SHo)$, wherein SH is used to represent a difference between a
 temperature of an air pipe and a temperature of a liquid pipe of the dehumidification indoor unit, and SHo is
 used to represent a target degree of evaporation superheat.

9. The time-sharing dehumidification method according to claim 8, wherein the dehumidification indoor unit further
 includes a first heat exchanger and a second heat exchanger as an evaporator, and the first indoor electronic
 expansion valve is located on a pipe between the dehumidification loop and the first heat exchanger, and the second
 indoor electronic expansion valve and the second heat exchanger are sequentially located on the dehumidification
 loop.

10. The time-sharing dehumidification method according to claim 8, wherein the target degree of evaporation superheat

$$SHo = \begin{cases} (Ti - Tlp) + 4 & \Delta H \leq -10\% \\ (Ti - Tlp) & -10\% \leq \Delta H \leq 0\% \\ 3 \times (Ti - Tlp) / 4 & 0\% \leq \Delta H \leq 10\% \\ (Ti - Tlp) / 2 & 10\% \leq \Delta H \leq 20\% \\ 3 & 20\% < \Delta H \end{cases},$$

SHo meets:

and Hi; and

Hi is used to represent a relative humidity of return air of the dehumidification indoor unit, Hs is used to represent a humidity set by a user, Ti is used to represent a temperature of the return air of the dehumidification indoor unit, and Tlp is used to represent the temperature of the liquid pipe of the dehumidification indoor unit.

wherein ΔH is a difference between Hs

11. A multi-split system, comprising a memory and a processor, wherein the memory stores computer programs capable of running on the processor, and the processor is configured to run the computer programs to cause the multi-split system to:

in a control cycle in a time-sharing dehumidification process, control at least one dehumidification indoor unit of dehumidification indoor units that have not operate in a dehumidification mode in a plurality of dehumidification indoor units in the time-sharing dehumidification process to operate in the dehumidification mode, set an operation mode of each remaining dehumidification indoor unit to be a temporary non-dehumidification mode, a total volume of evaporator of the at least one dehumidification indoor unit being not greater than a total volume of condensers of current heating indoor unit(s), wherein the time-sharing dehumidification process includes at least two control cycles, and the time-sharing dehumidification process includes sequentially performing the at least two control cycles until each dehumidification indoor unit in the plurality of dehumidification indoor units operates in the dehumidification mode once.

12. The multi-split system according to claim 11, wherein the processor is further configured to:

in the control cycle in the time-sharing dehumidification process, for dehumidification indoor units in a first collection that have not performed the dehumidification in the time-sharing dehumidification process, set an operation mode of a first dehumidification indoor unit to be the dehumidification mode; determine a maximum number of second dehumidification indoor unit(s) that the current heating indoor unit(s) in the multi-split system are further capable of supporting besides the first dehumidification indoor unit; and if there exist the second dehumidification indoor unit(s), set operation modes of the second dehumidification indoor unit(s) to be the dehumidification mode, wherein the first collection is composed of current dehumidification indoor units in the multi-split system; and

set the operation mode of each remaining dehumidification indoor unit in the first collection to be the temporary non-dehumidification mode, each remaining dehumidification indoor unit being a dehumidification indoor unit that is not set to operate in the dehumidification mode in the control cycle.

13. The multi-split system according to claim 12, wherein the dehumidification indoor unit includes a first indoor electronic expansion valve that is not located on a dehumidification loop, a first heat exchanger, a second heat exchanger as an evaporator, and a second indoor electronic expansion valve that is disposed on the dehumidification loop; and the first indoor electronic expansion valve is disposed on a pipe between the dehumidification loop and the first heat exchanger, the second indoor electronic expansion valve and the second heat exchanger are sequentially disposed on the dehumidification loop, and the processor is further configured to:

set a first indoor electronic expansion valve of the dehumidification indoor unit to be in a closed state, an initial value EVR(0) of an opening degree of the second indoor electronic expansion valve of the dehumidification indoor unit being a preset value; and in an n-th control cycle of the time-sharing dehumidification process, control the opening degree EVR(n) of the second indoor electronic expansion valve of the dehumidification indoor unit to meet: $EVR(n) = EVR(n - 1) + 5 \times (SH - SHo)$, wherein SH is used to represent a difference value between a temperature of an air pipe and a temperature of a liquid pipe, and SHo is used to represent a target degree of evaporation superheat.

14. A multi-split system, comprising an outdoor unit, heating indoor units and dehumidification indoor units, wherein the outdoor unit is provided with a first end, a second end and a third end which are used for refrigerant flow, and each

heating indoor unit includes a first heat exchanger and a second heat exchanger, and each dehumidification indoor unit include a third heat exchanger and a fourth heat exchanger;

the first end of the outdoor unit is connected to an end of the first heat exchanger via a first indoor electronic expansion valve, to an end of the second heat exchanger via a second indoor electronic expansion valve, to an end of the third heat exchanger via a third indoor electronic expansion valve, and to an end of the fourth heat exchanger via a fourth indoor electronic expansion valve; another end of the first heat exchanger is connected to the third end of the outdoor unit, another end of the third heat exchanger is connected to the third end of the outdoor unit; another end of the second heat exchanger is connected to the second end of the outdoor unit, and another end of the fourth heat exchanger is connected to the second end of the outdoor unit;

the first indoor electronic expansion valve in the heating indoor unit are closed, and the second indoor electronic expansion valve in the heating indoor unit is opened, so that a refrigerant flows into the second end of the outdoor unit from the second indoor heat exchanger via the second indoor electronic expansion valve;

the fourth indoor electronic expansion valve in the dehumidification indoor unit is closed; and

the third indoor electronic expansion valve in the dehumidification indoor unit is configured to be opened when the indoor unit operates in a dehumidification mode, so that the refrigerant flows into the third end of the outdoor unit from the third indoor heat exchanger via the third indoor electronic expansion valve.

15. The multi-split system according to claim 14, wherein the dehumidification indoor unit includes a first dehumidification indoor unit and a second dehumidification indoor unit, the first dehumidification indoor unit and the second dehumidification indoor unit both include two heat exchangers, in a cycle, in response to the first dehumidification indoor unit operating in the dehumidification mode, a third indoor electronic expansion valve in the first dehumidification indoor unit is opened and a fourth indoor electronic expansion valve in the first dehumidification indoor unit is closed, and in response to the second dehumidification indoor unit operating in a temporary non-dehumidification mode, the third indoor electronic expansion valve and the fourth indoor electronic expansion valve in the second dehumidification indoor unit are both closed.

16. The multi-split system according to claim 15, wherein in another cycle, in response to the first dehumidification indoor unit operating in the temporary non-dehumidification mode, the third indoor electronic expansion valve and the fourth indoor electronic expansion valve in the first dehumidification indoor unit are both closed, and in response to the second dehumidification indoor unit being in the dehumidification mode, the third indoor electronic expansion valve in the second dehumidification indoor unit is opened, and the fourth indoor electronic expansion valve in the second dehumidification indoor unit is closed.

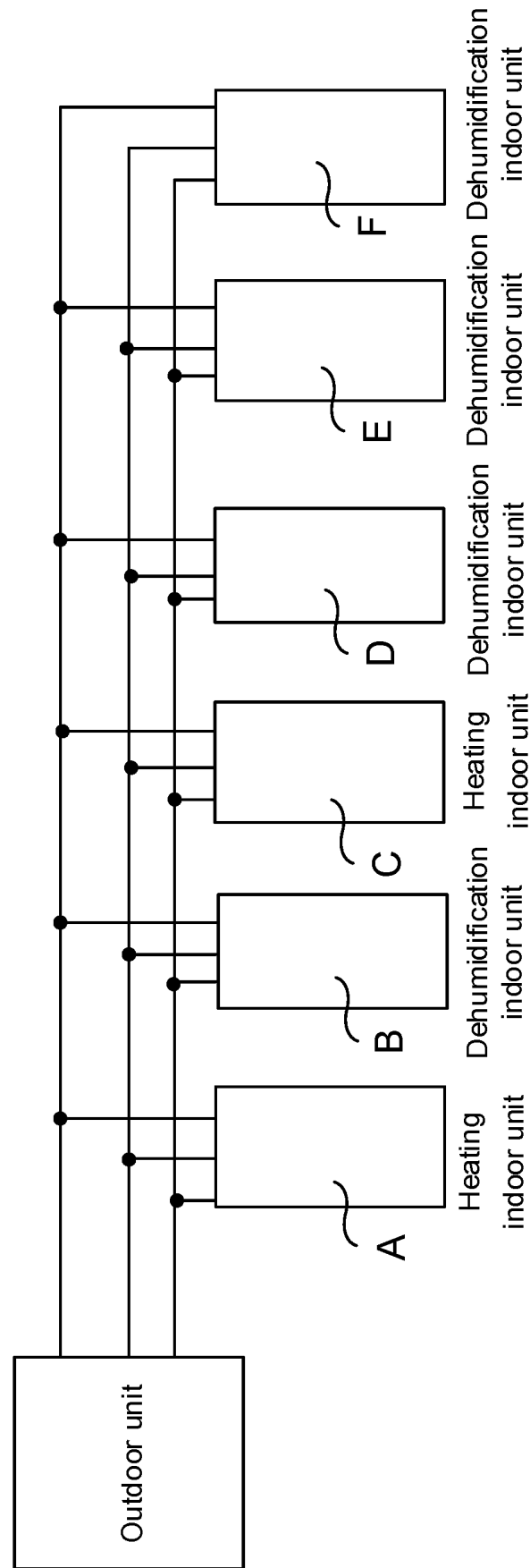


FIG. 1

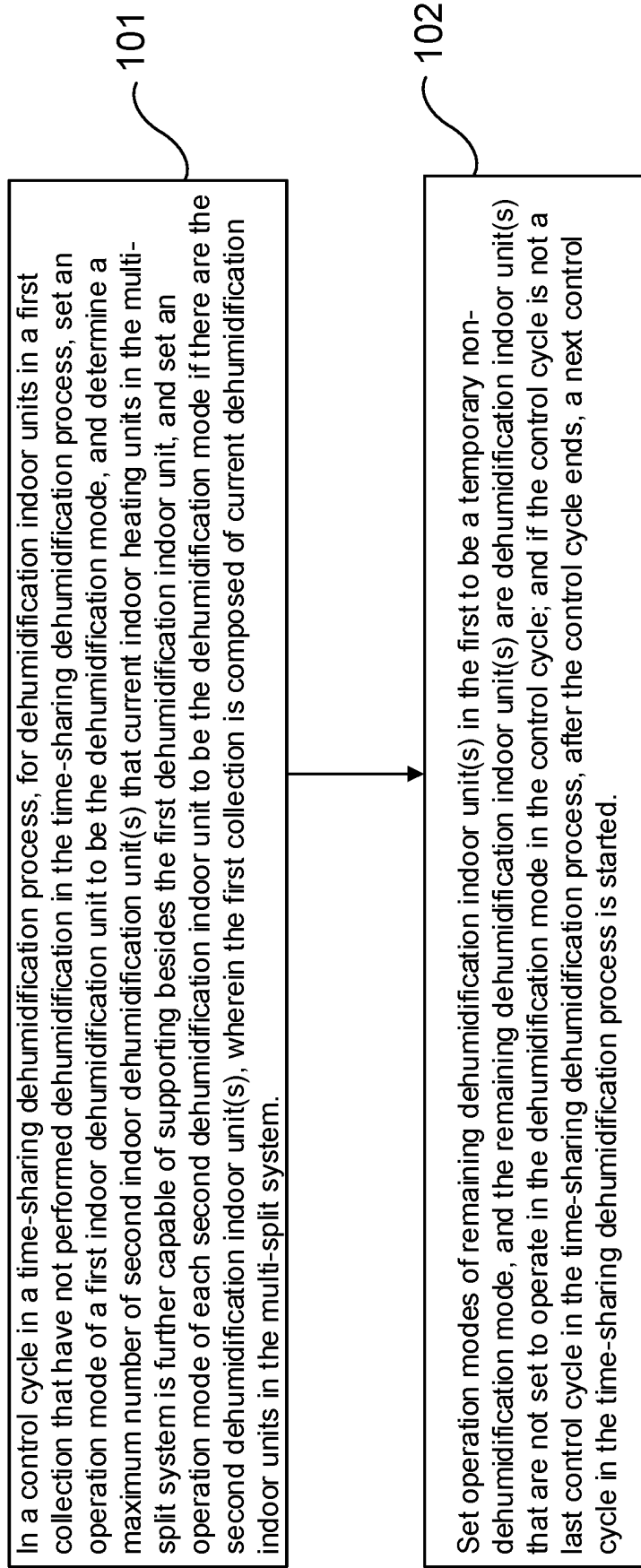


FIG. 2

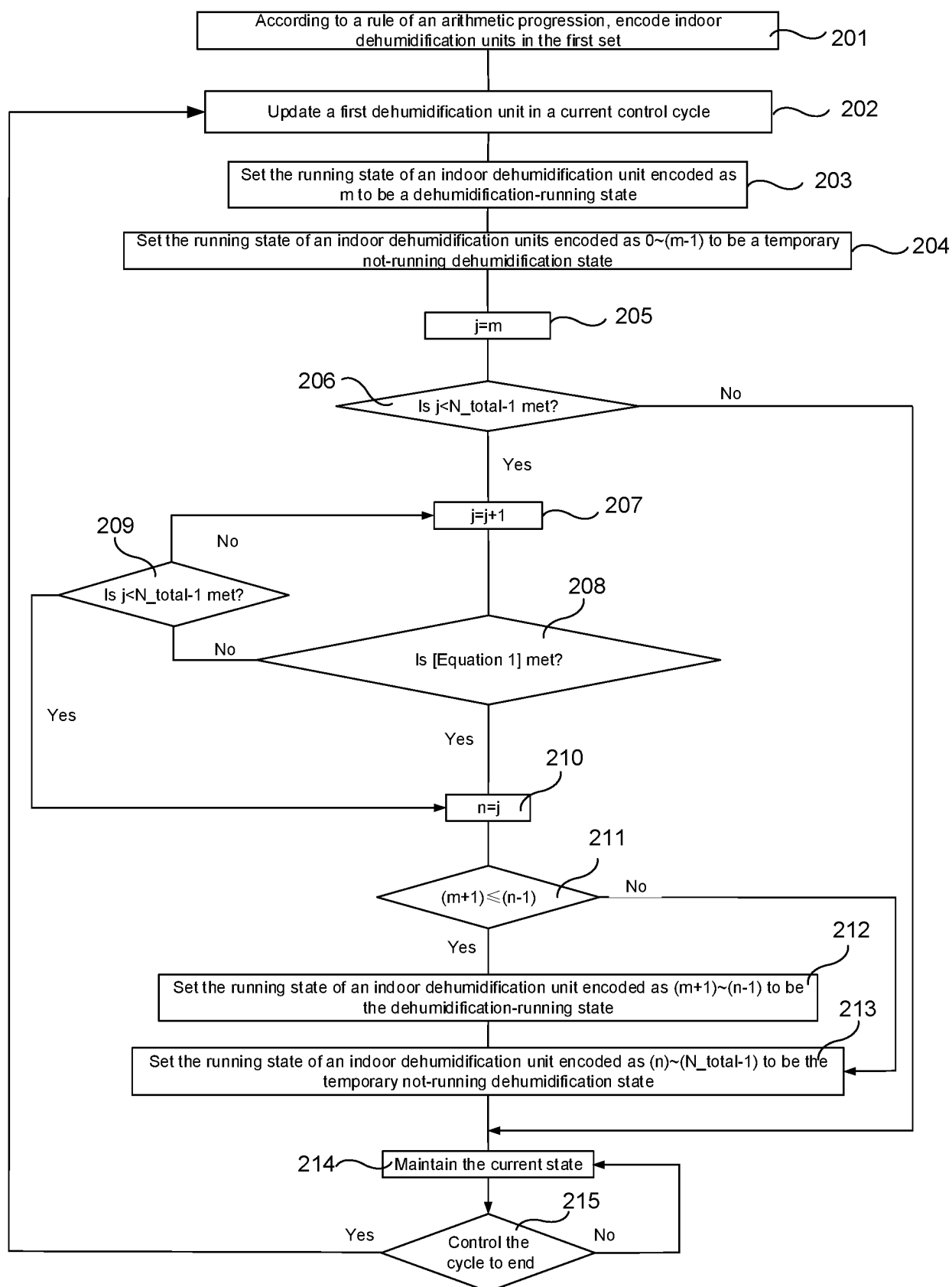


FIG. 3

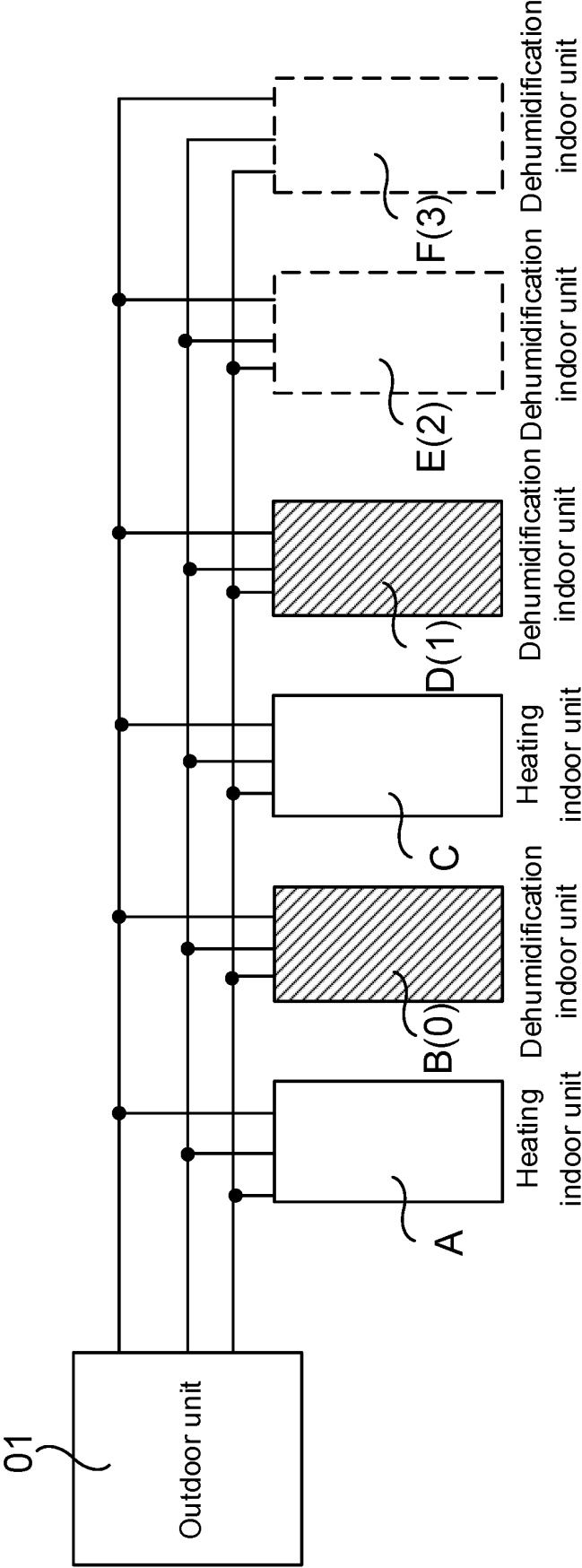


FIG. 4

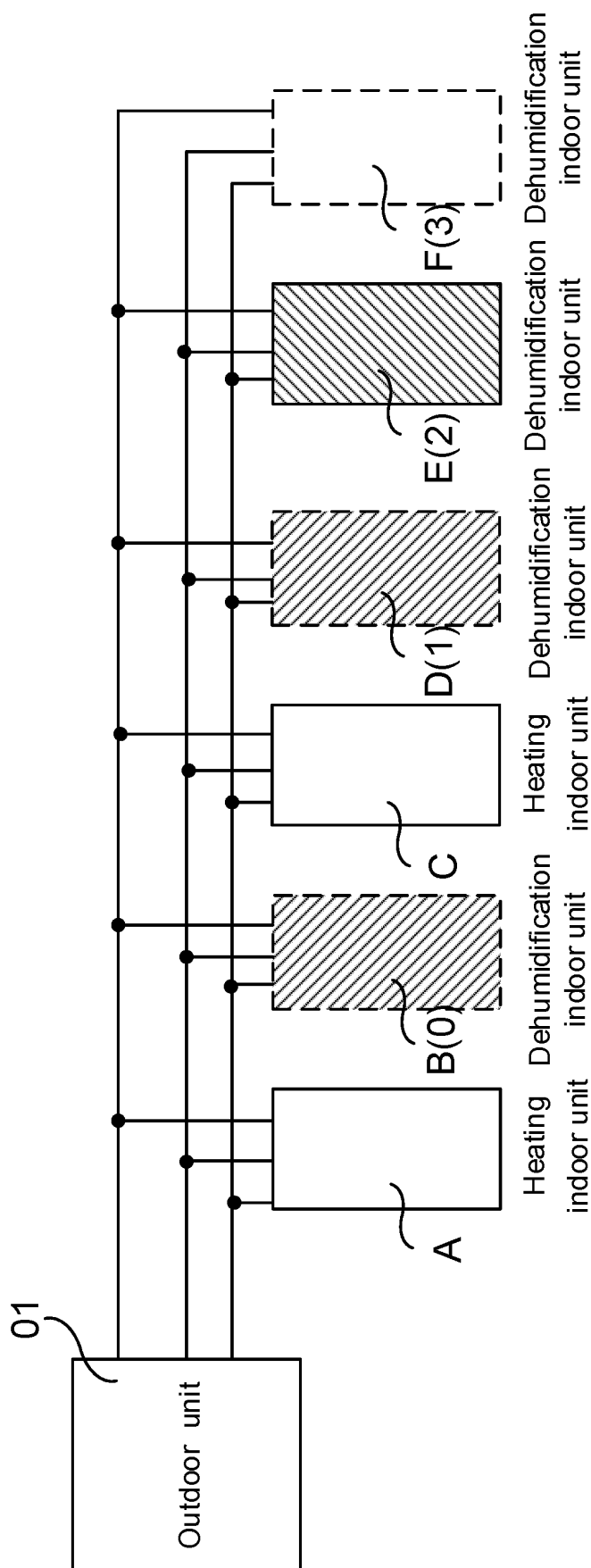


FIG. 5

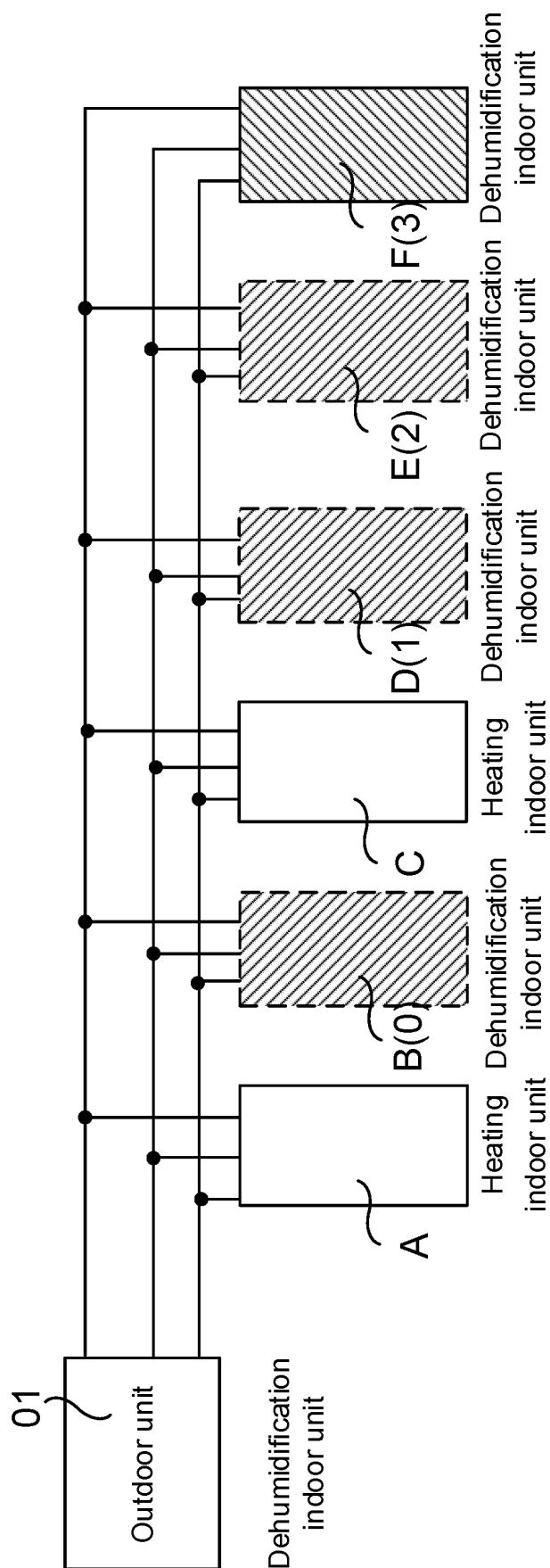


FIG. 6

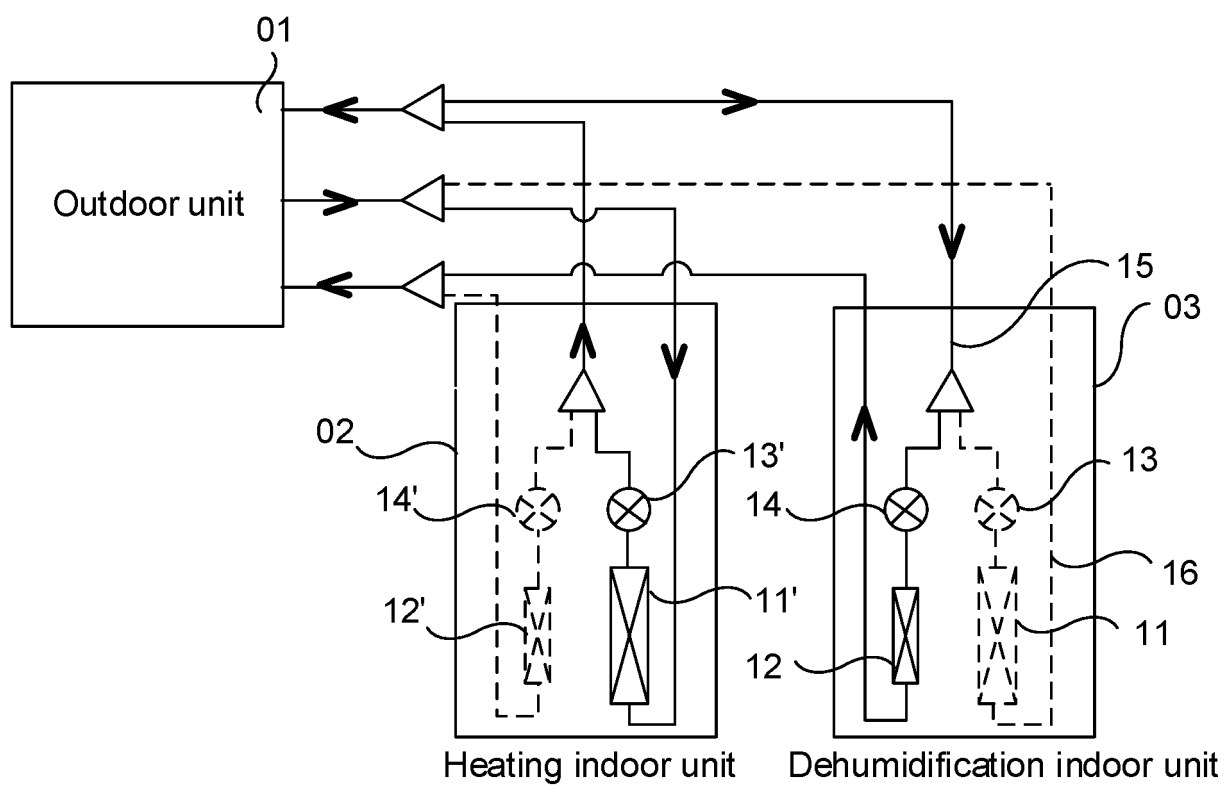


FIG. 7

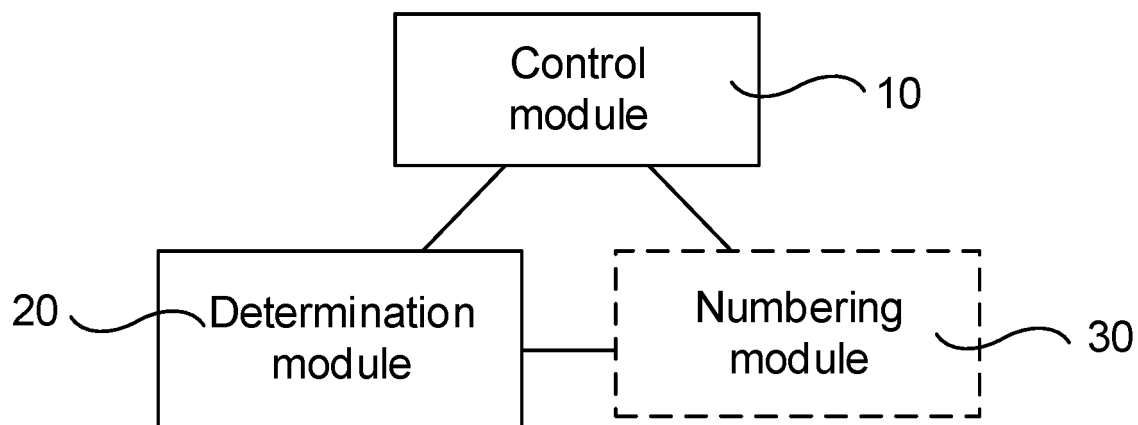


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/078914

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/30(2018.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F,F25B

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

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

CNABS, CNTXT, CNKI, VEN, USTXT, WOTXT, EPTXT, DWPI, SIPOABS, JPTXT: 海信, 日立, 空调, 空气调节, 一拖多, 多联机, 除湿, 制冷, 制热, 运行模式, 分时, 周期, 容积, 和, 蒸发, 冷凝, air condition+, dehumidif+, time shar+, multi-split, heat, refrigeration, mode, period, volume, summation, evaporator, condenser

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 108758960 A (QINGDAO HISENSE HITACHI AIR-CONDITIONING SYSTEMS CO., LTD.) 06 November 2018 (2018-11-06) description, paragraphs 25-118, and figures 1-8	1-16
A	CN 104633771 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 20 May 2015 (2015-05-20) claims 1-9, and figures 1-5	1-16
A	CN 103062851 A (QINGDAO HISENSE HITACHI AIR-CONDITIONING SYSTEMS CO., LTD.) 24 April 2013 (2013-04-24) entire document	1-16
A	CN 202902496 U (QINGDAO HISENSE HITACHI AIR-CONDITIONING SYSTEMS CO., LTD.) 24 April 2013 (2013-04-24) entire document	1-16
A	JP 2005016782 A (PANASONIC CORPORATION) 20 January 2005 (2005-01-20) entire document	1-16

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

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

13 May 2019

Date of mailing of the international search report

24 May 2019

Name and mailing address of the ISA/CN

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100088
China

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Facsimile No. (86-10)62019451

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/078914

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 108758960 A	06 November 2018	None	
CN 104633771 A	20 May 2015	CN 104633771 B	03 July 2018
CN 103062851 A	24 April 2013	CN 103062851 B	09 December 2015
CN 202902496 U	24 April 2013	None	
JP 2005016782 A	20 January 2005	None	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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