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(54) OIL RETURN CONTROL METHOD FOR AIR CONDITIONER, AIR CONDITIONER AND COMPUTER-READABLE STORAGE MEDIUM

(57) Disclosed is an air conditioner oil return control method, which comprises the steps of: detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting the start-stop times as an initial value; after completing the oil return operation, detecting whether a start-stop operation occurs in the outdoor unit; updating the start-stop times when the start-stop operation occurs in the outdoor unit; and when updated start-stop times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation. Also disclosed are an air conditioner and a computer readable storage medium. The present disclosure implements the oil return of the outdoor unit according to the start-stop times occurring in the outdoor unit, thereby effectively solving the problem of insufficient lubricating oil of the compressor and prolonging the service life of the outdoor unit.

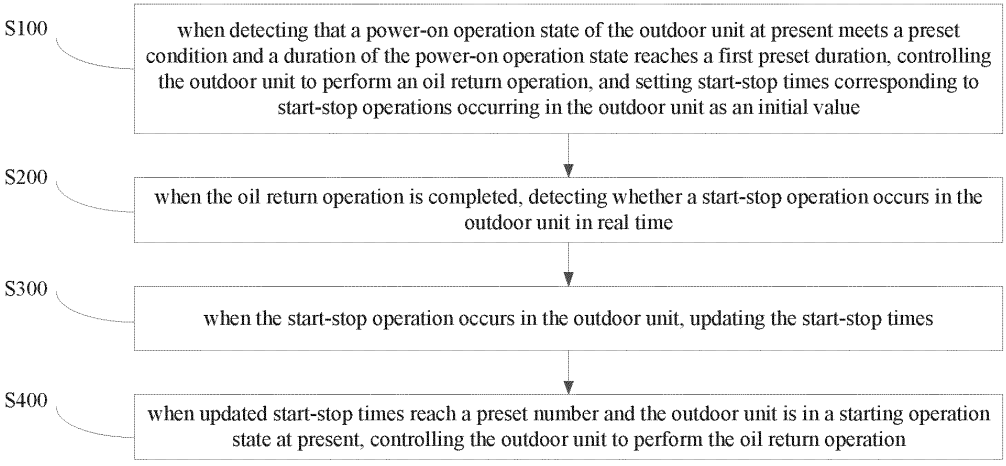

Fig. 2

EP 3 637 021 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Chinese Patent Application No. 201810927936.7 entitled "Air Conditioner Oil Return Control Method, Air Conditioner and Computer Readable Storage Medium" filed on August 15, 2018 by Guangdong Midea Heating & Ventilating Equipment Co., Ltd. and Midea Group Co., Ltd.

FIELD

[0002] The present disclosure relates to the technical field of air conditioners, in particular to an air conditioner oil return control method, an air conditioner and a computer readable storage medium.

BACKGROUND

[0003] With the improvement of people's living standard, the demand for heating/cooling performance of an air conditioner is also higher and higher. In general, a compressor in the air conditioner is an important factor for affecting the heating/cooling performance of the air condi ti oner.

[0004] Now, oil-free lubrication cannot be realized in the compressor of the air conditioner. Lubricating oil is a substance which plays a lubricating role between moving parts in the compressor. If the compressor lacks the lubricating oil, a motor bearing and a compression cavity of the compressor cannot be effectively lubricated, so that the compressor is damaged due to increased friction. Therefore, the recovery of lubricating oil for the air conditioner plays an important role in the reliable operation of air conditioners.

[0005] However, the existing air conditioner basically uses the accumulated operation time of the current operation as an oil return triggering condition, and the control mode has certain disadvantages. For example, when only one indoor unit is started for 24 hours in a security room, a small machine room and the like, the corresponding outdoor unit may be started and stopped frequently at a low frequency by the control mode, or the outdoor unit is started and stopped frequently when the three-pipeline air conditioner is switched around 20 degrees in the mode. Therefore, the accumulated operation time of the outdoor unit cannot reach the oil return triggering condition, so that the lubrication of the compressor is insufficient, and the compressor is burnt out due to oil shortage.

[0006] The foregoing is provided merely to aid in the understanding of the present disclosure and is not an admission that the foregoing is prior art.

SUMMARY

[0007] The present disclosure has a main purpose of providing an air conditioner oil return control method, an air conditioner and a computer readable storage medium, and is directed to solve the technical problem of insufficient lubrication of a compressor caused by insufficient lubricating oil return of the existing air conditioner.

[0008] To achieve the above purpose, the present disclosure provides in embodiments an air conditioner oil return control method, wherein the air conditioner comprises an outdoor unit, and the air conditioner oil return control method comprises the steps of:

when detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to number of on-off operations occurring in the outdoor unit as an initial value;

when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit;

when the on-off operation occurs in the outdoor unit, updating the number of on-off times; and

when the updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation.

[0009] In one embodiment, the steps of when the updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation comprise:

when the updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present, determining the first on-off moment and the last on-off moment correspondingly after the number of on-off times is updated;

calculating a time interval between the first on-off moment and the last on-off moment; and

when the time interval is less than or equal to a second preset duration, controlling the outdoor unit to perform the oil return operation.

[0010] In one embodiment, after the steps of when the updated number of on-off times reach a preset number and the outdoor unit is in a switch-on operation state at present, controlling the outdoor unit to perform the oil return operation, the air conditioner oil return control method further comprises:

when completing the oil return operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether a on-off operation occurs in the outdoor unit in real time.

[0011] In one embodiment, the steps of when the on-off operation occurs in the outdoor unit, updating the

number of on-off times comprise:

when the on-off operation occurs in the outdoor unit, determining whether the on-off operation occurring in the outdoor unit is a power-off on-off operation; and when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, updating the number of on-off times.

[0012] In one embodiment, after the step of determining whether the current on-off operation occurring in the outdoor unit is a power-off on-off operation, the method further comprises:
when the on-off operation occurring in the outdoor unit at present is a power-off on-off operation, setting the number of on-off times as an initial value, and continuously executing the steps of detecting that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, controlling the outdoor unit to perform an oil return operation.

[0013] In one embodiment, the steps of when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, updating the on-off times comprise:

when the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation; and
when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, updating the number of on-off times.

[0014] In one embodiment, after the steps of determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation, the method further comprises:
when the on-off operation occurring in the outdoor unit at present is the forced refrigeration operation or the defrosting operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0015] In one embodiment, after the steps of when detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value, the air conditioner oil return control method further comprises:

updating an operation duration of the outdoor unit in real time;
when the operation duration reaches a third preset duration, controlling the outdoor unit to perform an oil return operation, wherein the third preset duration is longer than the first preset duration; and
setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0016] In addition, to achieve the above object, the present disclosure also provides in embodiments an air conditioner comprising: a memory, a processor, and an air conditioner oil return control program stored on the memory and operable by the processor, wherein the air conditioner oil return control program, when executed by the processor, implements the steps of the air conditioner oil return control method described in any one of the above.

[0017] In addition, in order to achieve the above object, the present disclosure also provides in embodiments a computer readable storage medium having stored thereon an air conditioner oil return control program, and the air conditioner oil return control program, when executed by a processor, implements the steps of the air conditioner oil return control method described in any one of the above.

[0018] When detecting that the power-on operation state of the outdoor unit at present meets a preset condition and the duration of the initial power-on operation state reaches a first preset duration, the present method includes controlling the outdoor unit to perform an oil return operation, setting the number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value; then when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit in real time; when the on-off operation occurs in the outdoor unit, updating the number of on-off times; when the updated number of on-off times reach preset times and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation, so that the oil return of the outdoor unit is realized according to the on-off times occurring in the outdoor unit; the problem that oil cannot be returned in time due to the fact that the operation time of the outdoor unit cannot reach the triggering condition of oil return in the existing oil return mode, lubrication of the compressor is insufficient, even oil shortage and burning of the compressor are caused is avoided, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is a structurally schematic diagram of an air conditioner in a hardware operating environment according to an embodiment of the present disclosure;
Fig. 2 is a flow diagram of a first embodiment of an air conditioner oil return control method of the

present disclosure;

Fig. 3 is a detailed flow diagram illustrating the steps of controlling the outdoor unit to perform oil return operation when the updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present in a second embodiment of the air conditioner oil return control method of the present disclosure;

Fig. 4 is a detailed flow diagram illustrating the steps of updating the number of on-off times when an on-off operation occurs in the outdoor unit in a third embodiment of the air conditioner oil return control method of the present disclosure;

Fig. 5 is a detailed flow diagram illustrating the steps of updating the number of on-off times when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation in a fourth embodiment of the air conditioner oil return control method of the present disclosure; and

Fig. 6 is a flow diagram of a fifth embodiment of the air conditioner oil return control method of the present disclosure.

[0020] The object implementation, functional features and advantages of the present disclosure will be further described with reference to the accompanying drawings according to the embodiments.

DETAILED DESCRIPTION

[0021] It should be understood that the specific embodiments described herein are merely illustrative of the present disclosure and are not intended to be limiting thereof.

[0022] As shown in Fig. 1, an embodiment of the present disclosure relates to a structurally schematic diagram of an air conditioner in a hardware operating environment.

[0023] As shown in Fig. 1, the air conditioner may include a processor 1001, such as a CPU, a network interface 1004, a user interface 1003, a memory 1005, and a communication bus 1002; wherein the bus system 1002 is configured to enable connection communication between these components. The user interface 1003 may include a display, an input unit, such as a keyboard, and the optional user interface 1003 may also include a standard wired interface or a wireless interface. The network interface 1004 may optionally include a standard wired interface, or a wireless interface (e.g., a WI-FI interface). The memory 1005 may be a highspeed RAM memory or a non-volatile memory, such as a disk memory. The memory 1005 may optionally be a storing device independent of the aforementioned processor 1001.

[0024] Optionally, the air conditioner may also include a camera, RF (Radio Frequency) circuitry, sensors, audio circuitry, WiFi modules, etc.; wherein, the sensors include such as a light sensor, a motion sensor, and other sensors. Of course, the air conditioner may also be provided with other sensors such as gyroscopes, barometers, hygrometers, thermometers, infrared sensors, etc., which will not be described in detail herein.

[0025] It will be understood by those skilled in the art that the air conditioner structure shown in Fig. 1 is not intended to limit the air conditioner, and may include more or fewer components than shown, or some combination of components, or different arrangements of components.

[0026] As shown in Fig. 1, a memory 1005, which is a computer storage medium, may include an operating system, a network communication module, a user interface module, and an air conditioner oil return control program.

[0027] In the air conditioner shown in Fig. 1, the network interface 1004 is mainly used for connecting and communicating data with a background server; the user interface 1003 is mainly used for connecting and carrying out data communication with a client (user side); the processor 1001 may be used to call an air conditioner oil return control program stored in the memory 1005.

[0028] In this embodiment, the air conditioner includes a memory 1005, a processor 1001 and an air conditioner oil return control program stored on the memory 1005 and operable on the processor 1001, wherein when the processor 1001 calls the air conditioner oil return control program stored in the memory 1005, the processor 1001 executes the operations of:

when detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value;

when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit;

when the on-off operation occurs in the outdoor unit, updating the number of on-off times; and

when updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation.

[0029] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:

when the updated number of on-off times reach a preset number and the outdoor unit is in the starting operation state at present, determining the first on-off moment and the last on-off moment corresponding to the updated number of on-off times;

calculating a time interval between the first on-off moment and the last on-off moment; and

when the time interval is less than or equal to a second preset duration, controlling the outdoor unit to perform the oil return operation.

[0030] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:
when completing the oil return operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0031] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:

when the on-off operation occurs in the outdoor unit, determining whether the on-off operation occurring in the outdoor unit is a power-off on-off operation; and
when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, updating the number of on-off times.

[0032] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:
when the on-off operation occurring in the outdoor unit at present is a power-off on-off operation, setting the number of on-off times as an initial value, and continuously executing the steps of detecting that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, controlling the outdoor unit to perform an oil return operation.

[0033] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:

when the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation; and
when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, updating the number of on-off times.

[0034] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:
when the on-off operation occurring in the outdoor unit at present is the forced refrigeration operation or the defrosting operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether a on-off operation occurs in the outdoor unit in real time.

[0035] Further, the processor 1001 may call an air conditioner oil return control program stored in the memory 1005 and also perform the operations of:

updating an operation duration of the outdoor unit in real time;
when the operation duration reaches a third preset duration, controlling the outdoor unit to perform an oil return operation, wherein the third preset duration is longer than the first preset duration; and
setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0036] The present disclosure also provides in embodiments an air conditioner oil return control method, referring to Fig. 2, which is a flow diagram of a first embodiment of an air conditioner oil return control method of the present disclosure.

[0037] In the embodiment, the air conditioner oil return control method comprises the following steps:

S100, when detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value;
The outdoor unit in this embodiment may be any one of one or more outdoor units in a multi-on-line system. The initial value can be reasonably set, for example, the initial value can be set to 0, and the number of on-off times are set to the initial value, namely the number of on-off times reset. The first preset duration may also be reasonably set, for example, the first preset duration may be set to 10 minutes, 30 minutes, etc., and is not limited in this embodiment.

[0038] It can be determined whether the power-on operation state of the outdoor unit at present meets a preset condition according to the operation data of the outdoor unit. In particular, the power-on operation state of the outdoor unit at present meets a preset condition when the previous shutdown operation occurring in the outdoor unit is a normal stopping operation before the power-on operation at present is determined according to the operation data of the outdoor unit. For example, when the previous stopping operation occurring in the outdoor unit controls the stopping of the outdoor unit as a control command for increasing such as a remote controller, the stopping operation is a normal stopping operation; and the stopping operation when the outdoor unit is frequently started and stopped and the stopping operation when the outdoor unit is stopped due to power failure are both abnormal stopping operations, that is, if the previous stopping operation occurring in the outdoor unit is the stopping operation when the outdoor unit is frequently started and stopped or the stopping operation when the

outdoor unit is stopped due to power failure, the current power-on operation state of the outdoor unit does not meet the preset condition.

[0039] In the embodiment, if the power-on operation occurring in the outdoor unit of the air conditioner is detected, and the power-on operation state meets the preset condition at present, the duration of the power-on operation occurring in the outdoor unit is accumulated in real time; and when the duration of the power-on operation occurring in the outdoor unit reaches the first preset duration, the outdoor unit is controlled to perform an oil return operation, and the on-off times corresponding to the on-off operation occurring in the outdoor unit are set as an initial value.

[0040] The on-off operation refers to the operation performed by the outdoor unit in the process that the outdoor unit goes from the operation state to the stop operation state, and from the stop operation state to the operation state again; and as the outdoor unit goes through the process from the operation state to the stop operation state and from the stop operation state to the operation state again once, it is recorded as one on-off, i.e. the number of on-off times are increased by one.

[0041] It's necessary to note that the outdoor unit includes a compressor and an oil separator communicated with the compressor. The compressor is disconnected from the oil separator during normal operation occurring in the outdoor unit, and the compressor is communicated with the oil separator during the oil return operation occurring in the outdoor unit so that lubricating oil in the oil separator flows to the compressor. Preferably, a control switch may be provided in the communication pipeline between the compressor and the oil separator; when the outdoor unit performs the oil return operation, the compressor is communicated with the oil separator by controlling the control switch; and when the oil return operation is completed, the compressor is disconnected from the oil separator by controlling the control switch Preferably, the outdoor unit further includes an electronic expansion valve, one end of the electronic expansion valve is communicated with the oil separator, the other end of the electronic expansion valve is communicated with the compressor. When the outdoor unit performs oil return operation, the compressor is communicated with the oil separator by adjusting the opening degree of the electronic expansion valve; and when the oil return operation is completed, the compressor is disconnected from the oil separator by adjusting the opening degree of the electronic expansion valve.

[0042] S200, when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit;

In the embodiment, when the oil return operation is completed, the operation data of the outdoor unit at present are monitored in real time, and it has been determined whether the outdoor unit has an on-off operation according to the operation data of the outdoor unit at present, wherein the on-off operation includes a frequent on-off of the outdoor unit, an on-off of the outdoor unit triggered by power failure, and an on-off of the outdoor unit caused by a forced refrigeration operation or a defrosting operation occurring in the outdoor unit.

[0043] S300, when the on-off operation occurs in the outdoor unit, updating the number of on-off times; and

S400, when updated number of on-off times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation.

[0044] The preset times can be reasonably set, for example, the preset times can be set to 15, 20, 30 and the like.

[0045] In the embodiment, when it is determined that the outdoor unit has an on-off operation at present, the on-off times corresponding to the on-off operation are updated. Specifically, the on-off times at present are increased by one to serve as new on-off times; if the updated number of on-off times reach a preset number, the outdoor unit is controlled to perform oil return operation when the outdoor unit has a starting operation state at present, so that lubricating oil in the oil separator flows back to the compressor of the outdoor unit, and oil return of the compressor is realized according to the on-off times occurring in the outdoor unit; the problem that oil cannot be returned in time due to the fact that the operation time of the outdoor unit cannot reach the triggering condition of oil return in the existing oil return mode, lubrication of the compressor is insufficient, even oil shortage and burning of the compressor are caused is avoided, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0046] Further, in an embodiment, after the step S400, the air conditioner oil return control method further includes: when completing the oil return operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0047] In the embodiment, when oil return of the outdoor unit is completed, the number of on-off times is set as an initial value, and it is detected in real time whether an on-off operations occurs in the outdoor unit; the number of on-off times occurring in the outdoor unit is continuously accumulated, it is judged whether the new number of on-off times meets triggering conditions of oil return for the outdoor unit, that is, whether the new on-off times reach a preset number, and then the oil return operation can be continuously performed according to the on-off times occurring in the outdoor unit, so as to avoid the problem of insufficient lubricating oil of the compressor and further prolong the service life of the outdoor unit.

[0048] According to the air conditioner oil return control method provided by the embodiment, when detecting that the power-on operation state of the outdoor unit at present meets a preset condition and the duration of the initial power-on operation state reaches a first preset du-

ration, the method includes controlling the outdoor unit to perform an oil return operation, setting the number of on-off times corresponding to the on-off operations occurring in the outdoor unit as an initial value; then when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit in real time; when the on-off operation occurs in the outdoor unit, updating the number of on-off times; when updated number of on-off times reaches preset times and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation, so that the oil return of the outdoor unit is realized according to the on-off times occurring in the outdoor unit; the problem that oil cannot be returned in time due to the fact that the operation time of the outdoor unit cannot reach the triggering condition of oil return in the existing oil return mode, lubrication of the compressor is insufficient, even oil shortage and burning of the compressor are caused is avoided, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0049] Based on the first embodiment, a second embodiment of the air conditioner oil return control method of the present disclosure is provided. Referring to Fig. 3, in the present embodiment, the step S400 includes:

S410, when the updated number of on-off times reaches a preset number and the outdoor unit is in the starting operation state at present, determining the first on-off moment and the last on-off moment corresponding to the updated on-off times;

S420, calculating a time interval between the first on-off moment and the last on-off moment; and

S430, when the time interval is less than or equal to a second preset duration, controlling the outdoor unit to perform the oil return operation.

[0050] Herein, the second preset duration can be reasonably set, and the second preset duration is longer than the first preset duration; for example, the second preset duration may be set to 2 hours, 3 hours, etc., and is not limited in this embodiment.

[0051] In the embodiment, when the updated number of on-off times reaches a preset number, if the outdoor unit is in a starting operation state at present, the first on-off moment and the last on-off moment corresponding to the updated on-off times are acquired, namely, the on-off moment of the first outdoor unit on-off and the on-off moment of the last outdoor unit on-off in the on-off times at present; and the time interval between the first on-off moment and the last on-off moment is calculated.

[0052] If the calculated time interval is less than or equal to the second preset time, the outdoor unit is controlled to perform an oil return operation, so that when the outdoor unit is started and stopped frequently in a short time, the outdoor unit can return oil in time, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0053] It should be noted that if the time interval is greater than the second preset duration, the duration between each on-off moment and the last on-off moment in the updated on-off times is calculated; the on-off time corresponding to the duration less than the second preset duration is determined according to the acquired plurality of durations; the remaining on-off times after the on-off moment are determined according to the updated on-off times, and the remaining on-off times are used as new on-off times, and the step of detecting whether the outdoor unit has an on-off operation in real time is continuously executed.

[0054] According to the air conditioner oil return control method provided by the embodiment, the method includes when the updated number of on-off times reach a preset number and the outdoor unit at present is in a starting operation state, determining the first on-off moment and the last on-off moment corresponding to the updated on-off times; calculating a time interval between the first on-off moment and the last on-off moment; and then when the time interval is less than or equal to the second preset time duration, the outdoor unit is controlled to perform an oil return operation, so that the oil return of the outdoor unit is realized when the outdoor unit is frequently started and stopped within the second preset duration, and the outdoor unit can return oil in time, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0055] Based on the first embodiment, a third embodiment of the air conditioner oil return control method of the present disclosure is provided. Referring to Fig. 4, in the present embodiment, the step S300 includes:

S310, when the on-off operation occurs in the outdoor unit, determining whether the on-off operation occurring in the outdoor unit is a power-off on-off operation; and

S320, when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, updating the on-off times.

[0056] In the embodiment, when a on-off operation occurs in the outdoor unit, it is determined whether the on-off operation occurring in the current outdoor unit is a power-off on-off operation. Specifically, the operation data for the outdoor unit can be acquired, and it is determined whether the on-off operation occurring in the outdoor unit at present is the power-off on-off operation according to the input power information of the outdoor unit in the operation data. For example, it is determined that the on-off operation occurring in the outdoor unit is a power-off on-off operation when the operation data includes the interruption information of the input power before the outdoor unit is started, or the interruption information of the input power of the air conditioner system corresponding to the outdoor unit.

[0057] If the on-off operation occurring in the outdoor unit is the non-power-off on-off operation, the on-off times are updated, and the on-off operation can be a frequent on-off operation occurring in the outdoor unit.

[0058] Further, in an embodiment, after the step S310, it further includes: when the on-off operation occurring in the outdoor unit at present is the power-off on-off operation, setting the on-off times as an initial value, and continuously executing the steps of detecting that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, controlling the outdoor unit to perform an oil return operation.

[0059] In the embodiment, if the on-off operation occurring in the outdoor unit at present is the power-off on-off operation and the outdoor unit is powered on again after power-off, the on-off times are set as an initial value; and when it is detected that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, the outdoor unit is controlled to perform an oil return operation, so that the outdoor unit can return oil in time after a power-off start, and the outdoor unit can return oil in time, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0060] According to the air conditioner oil return control method provided by the embodiment, when the on-off operation occurs in the outdoor unit, it is determined whether the on-off operation occurring in the outdoor unit is a power-off on-off operation; and when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, the on-off times are updated, so that the power-off on-off operation can be eliminated, the accuracy of the on-off times is improved, then the accuracy of oil return for the outdoor unit according to the on-off times is improved, and the service life of the outdoor unit is further prolonged.

[0061] Based on the third embodiment, a fourth embodiment of the air conditioner oil return control method of the present disclosure is provided. Referring to Fig. 5, in the present embodiment, the step S320 includes:

> S321, when the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation; and
> S322, when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, updating the on-off times.

[0062] In the embodiment, if the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, it is determined whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation, that is, whether the on-off operation at present is caused by receiving a forced refrigeration instruction or a defrosting instruction; and the on-off times are updated when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, so that the forced refrigeration operation and defrosting operation can be eliminated, the accuracy of on-off times is improved, then the accuracy of oil return for the outdoor unit according to the on-off times is improved, and the service life of the outdoor unit is further prolonged.

[0063] Further, in an embodiment, after the step S321, it further includes: when the on-off operation occurring in the outdoor unit at present is the forced refrigeration operation or the defrosting operation, setting the on-off times as an initial value, and continuously executing the step of detecting whether a on-off operation occurs in the outdoor unit in real time.

[0064] In the embodiment, if the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation, that is, the on-off operation at present is caused by receiving a forced refrigeration instruction or a defrosting instruction, and the on-off times are set as an initial value; it is detected in real time whether the on-off operation occurs in the outdoor unit, then the on-off times occurring in the outdoor unit are continuously accumulated after the forced refrigeration operation or the defrosting operation; and it is judged whether the new on-off times meet triggering conditions of oil return for the outdoor unit, that is, whether the new on-off times reach a preset number, and then the oil return operation can be continuously performed according to the on-off times occurring in the outdoor unit, so as to avoid the problem of insufficient lubricating oil of the compressor and further prolong the service life of the outdoor unit.

[0065] According to the air conditioner oil return control method provided by the embodiment, when the on-off operation occurring in the outdoor unit at present is a non-power-off on-off operation, it is determined whether the on-off operation occurring in the outdoor unit is a forced refrigeration operation or a defrosting operation; and then the on-off times are updated when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, so that the forced refrigeration operation and defrosting operation can be eliminated, the accuracy of on-off times is improved, then the accuracy of oil return for the outdoor unit according to the on-off times is improved, and the service life of the outdoor unit is further prolonged. Meanwhile, since the outdoor unit has completed oil return after performing the forced refrigeration operation or the defrosting operation, the oil return does not need to be performed according to the on-off times again, and oil return efficiency of the outdoor unit is improved.

[0066] Based on the above embodiment, a fifth embodiment of the air conditioner oil return control method of the present disclosure is provided. Referring to Fig. 6, in the present embodiment, the step S400 includes:

S500, updating an operation duration of the outdoor unit in real time;

S600, when the operation duration reaches a third preset duration, controlling the outdoor unit to perform an oil return operation, wherein the third preset duration is longer than the first preset duration; and

S700, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0067] The third preset duration can be appropriately set, for example, the third preset duration can be set to be 5 hours, 8 hours and the like; the third preset duration is longer than the first preset duration, preferably, the third preset duration is longer than the second preset duration.

[0068] In the embodiment, after the outdoor unit is controlled to perform the oil return operation, the operation duration of the outdoor unit is accumulated in real time. Specifically, when an on-off operation occurs in the outdoor unit, the duration accumulation continues according to the operation duration accumulated before the outdoor unit is stopped; and when the operation duration reaches a third preset duration, the outdoor unit is controlled to perform an oil return operation, and the number of on-off times is set as an initial value, so that when the accumulated operation duration of the outdoor unit reaches the third preset time, the outdoor unit can return oil in time, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0069] By detecting in real time whether an on-off operation occurs in the outdoor unit, it is judged whether the new on-off times meet triggering conditions of oil return for the outdoor unit, that is, whether the new number of on-off times reaches a preset number, and then the oil return operation can be continuously performed according to the number of on-off times occurring in the outdoor unit, so as to avoid the problem of insufficient lubricating oil of the compressor and further prolong the service life of the outdoor unit.

[0070] According to the air conditioner oil return control method provided by the embodiment, when the operation duration of the outdoor unit is updated in real time and the operation duration reaches a third preset duration, the outdoor unit is controlled to perform an oil return operation, and then the number of on-off times is set as an initial value; and the step of detecting whether an on-off operation occurs in the outdoor unit in real time is continued, so that the outdoor unit can be controlled to perform the oil return operation according to the operation duration of the outdoor unit, and then the outdoor unit can return oil in time, so as to effectively solve the problem of insufficient lubricating oil of the compressor and prolong the service life of the outdoor unit.

[0071] In addition, the embodiment of the present disclosure also provides a computer readable storage medium, wherein an air conditioner oil return control program is stored on the computer readable storage medium, and the air conditioner oil return control program, when executed by a processor, implements the operations of:

detecting that a power-on operation state of an outdoor unit at present meets a preset condition and a duration of a power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value;

when completing the oil return operation, detecting whether an on-off operation occurs in the outdoor unit;

when the on-off operation occurs in the outdoor unit, updating the number of on-off times; and

when updated number of on-off times reaches a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation.

[0072] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:

when the updated number of on-off times reaches a preset number and the outdoor unit is in the starting operation state at present, determining the first on-off moment and the last on-off moment corresponding to the updated on-off times;

calculating a time interval between the first on-off moment and the last on-off moment; and

when the time interval is less than or equal to a second preset duration, controlling the outdoor unit to perform the oil return operation.

[0073] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:

when completing the oil return operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0074] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:

when the on-off operation occurs in the outdoor unit, determining whether the on-off operation occurring in the outdoor unit is a power-off on-off operation; and when the on-off operation occurring in the outdoor unit is a non-power-off on-off operation, updating the on-off times.

[0075] Further, when the air conditioner oil return control program, when executed by the processor, imple-

ments the operations of:
when the on-off operation occurring the outdoor unit at present is a power-off on-off operation, setting the on-off times as an initial value, and continuously executing the steps of detecting that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, controlling the outdoor unit to perform an oil return operation.

[0076] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:

when the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation; and
when the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, updating the number of on-off times.

[0077] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:
when the on-off operation occurring in the outdoor unit at present is the forced refrigeration operation or the defrosting operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0078] Further, when the air conditioner oil return control program, when executed by the processor, implements the operations of:

updating an operation duration of the outdoor unit in real time;
when the operation duration reaches a third preset duration, controlling the outdoor unit to perform an oil return operation, wherein the third preset duration is longer than the first preset duration; and
setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit in real time.

[0079] It should be noted that the terms "comprise", "include", or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, a method, an article, or a system that comprises a list of elements include not only those elements but may include other elements not expressly listed or elements inherent to such process, method, article, or system. An element defined by the phrase "comprises a ..." does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or system that includes the element.

[0080] The above-described embodiments of the present disclosure are only for description and do not represent advantages or disadvantages of the embodiments.

From the above description of the embodiments, it will be obvious to a person skilled in the art that the above-described embodiment method can be implemented by means of software plus a necessary general-purpose hardware platform, and it can also be implemented by means of hardware, but in many cases the former is a better embodiment. Based on this understanding, the present disclosure, in essence or in the part contributing to the prior art, may be embodied in the form of a software product stored in a storage medium (e.g., ROM/RAM, diskette, optical disk) as described above including instructions for causing a terminal device (which may be a cell phone, a computer, a server, an air conditioner, or a network device, etc.) to perform the methods described in the various embodiments of the present disclosure.

The foregoing is merely preferred embodiments of the present disclosure and is not intended to limit the scope of the present disclosure. The equivalent structure or equivalent flow transformations made by the present specification and the contents of the drawings, or direct or indirect application to other related technical fields, are all included in the scope of patent protection of the present disclosure.

Claims

1. An air conditioner oil return control method, **characterized in that** an air conditioner comprises an outdoor unit, and the air conditioner oil return control method comprises the steps of:

   detecting that a power-on operation state of the outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to number of on-off operations occurring in the outdoor unit as an initial value;
   completing the oil return operation, and detecting whether an on-off operation occurs in the outdoor unit;
   acquiring that the on-off operation occurs in the outdoor unit, and updating the number of on-off times; and
   detecting that the updated number of on-off times reaches a preset number and the outdoor unit is in a switch-on operation state at present, and controlling the outdoor unit to perform the oil return operation.

2. The air conditioner oil return control method of claim 1, **characterized in that** the steps of detecting that the updated number of on-off times reaches a preset

number and the outdoor unit is in a switch-on operation state at present, and controlling the outdoor unit to perform the oil return operation comprise:

detecting that the updated number of on-off times reaches a preset number and the outdoor unit is in the switch-on operation state at present, and determining a first on-off moment and a last on-off moment correspondingly after the number of on-off times is updated
calculating a time interval between the first on-off moment and the last on-off moment; and
determining that the time interval is less than or equal to a second preset duration, and controlling the outdoor unit to perform the oil return operation.

3. The air conditioner oil return control method of claim 1, **characterized in that**, after the steps of detecting that the updated number of on-off times reaches a preset number and the outdoor unit is in a switch-on operation state at present, and controlling the outdoor unit to perform the oil return operation, the air conditioner oil return control method further comprises:
completing the oil return operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit.

4. The air conditioner oil return control method of any one of claims 1 to 3, **characterized in that** the steps of acquiring that the on-off operation occurs in the outdoor unit, and updating the number of on-off times comprise:

acquiring that the on-off operation occurs in the outdoor unit, and determining whether the on-off operation occurring in the outdoor unit at present is a power-off on-off operation; and
determining that the on-off operation occurring in the outdoor unit at present is a non-power-off on-off operation, and updating the number of on-off times .

5. The air conditioner oil return control method of claim 4, **characterized by**, after the step of determining whether the on-off operation occurring in the outdoor unit at present is a power-off on-off operation, further comprising:
determining that the on-off operation occurring in the outdoor unit at present is a power-off on-off operation, setting the number of on-off times as an initial value, and continuously executing the steps of detecting that the duration of the power-on operation state of the outdoor unit of the air conditioner reaches a first preset duration, and controlling the outdoor unit to perform an oil return operation.

6. The air conditioner oil return control method of claim 4, **characterized in that** the steps of determining that the on-off operation occurring in the outdoor unit at present is a non-power-off on-off operation, and updating the number of on-off times comprise:

determining that the on-off operation occurring in the outdoor unit at present is the non-power-off on-off operation, and determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation; and
determining that the on-off operation occurring in the outdoor unit at present is neither the forced refrigeration operation nor the defrosting operation, and updating the number of on-off times.

7. The air conditioner oil return control method of claim 6, **characterized by**, after the steps of determining whether the on-off operation occurring in the outdoor unit at present is a forced refrigeration operation or a defrosting operation, further comprising:
determining that the on-off operation occurring in the outdoor unit at present is the forced refrigeration operation or the defrosting operation, setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit.

8. The air conditioner oil return control method of any one of claims 1 to 7, **characterized in that** after the steps of detecting that a power-on operation state of the outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting number of on-off times corresponding to on-off operations occurring in the outdoor unit as an initial value, the air conditioner oil return control method further comprises the steps of:

updating an operation duration of the outdoor unit;
determining that the operation duration reaches a third preset duration, and controlling the outdoor unit to perform an oil return operation, wherein the third preset duration is longer than the first preset duration; and
setting the number of on-off times as an initial value, and continuously executing the step of detecting whether an on-off operation occurs in the outdoor unit.

9. An air conditioner, **characterized by** comprising a memory, a processor, and an air conditioner oil return control program stored on the memory and operable by the processor, wherein the air conditioner oil return control program, when executed by the

processor, implements the steps of the air conditioner oil return control method of any one of claims 1 to 8.

10. A computer readable storage medium, **characterized in that** the computer readable storage medium stores an air conditioner oil return control program thereon, and the air conditioner oil return control program, when executed by a processor, implements the steps of the air conditioner oil return control method of any one of claims 1 to 8.

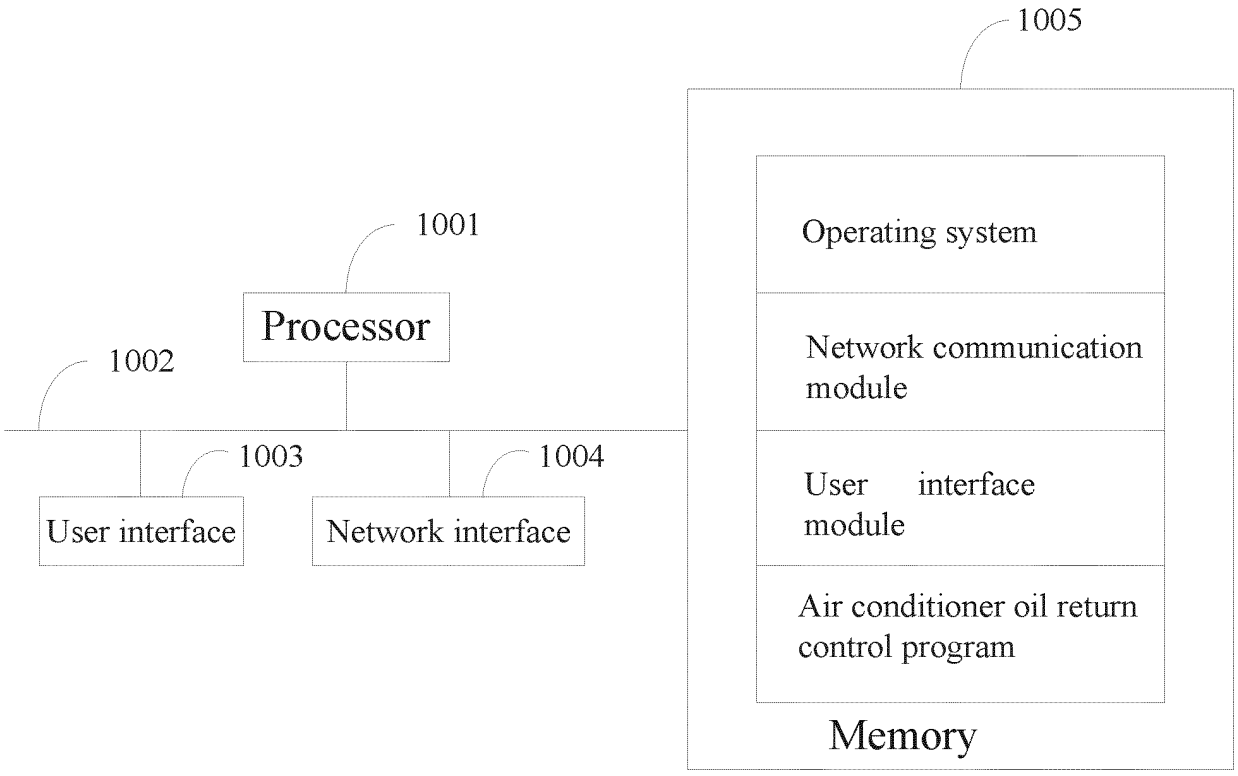
1005
Operating system
Network communication module
User interface module
Air conditioner oil return control program
Memory
1001
Processor
1002
1003
1004
User interface
Network interface

Fig. 1

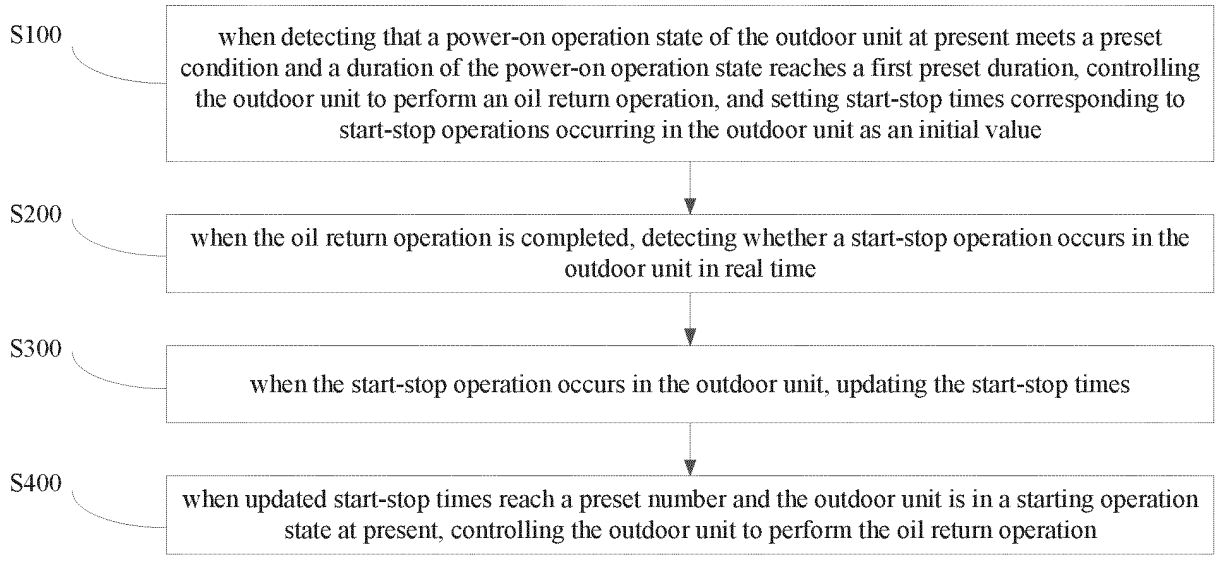
S100
when detecting that a power-on operation state of the outdoor unit at present meets a preset condition and a duration of the power-on operation state reaches a first preset duration, controlling the outdoor unit to perform an oil return operation, and setting start-stop times corresponding to start-stop operations occurring in the outdoor unit as an initial value
S200
when the oil return operation is completed, detecting whether a start-stop operation occurs in the outdoor unit in real time
S300
when the start-stop operation occurs in the outdoor unit, updating the start-stop times
S400
when updated start-stop times reach a preset number and the outdoor unit is in a starting operation state at present, controlling the outdoor unit to perform the oil return operation

Fig. 2

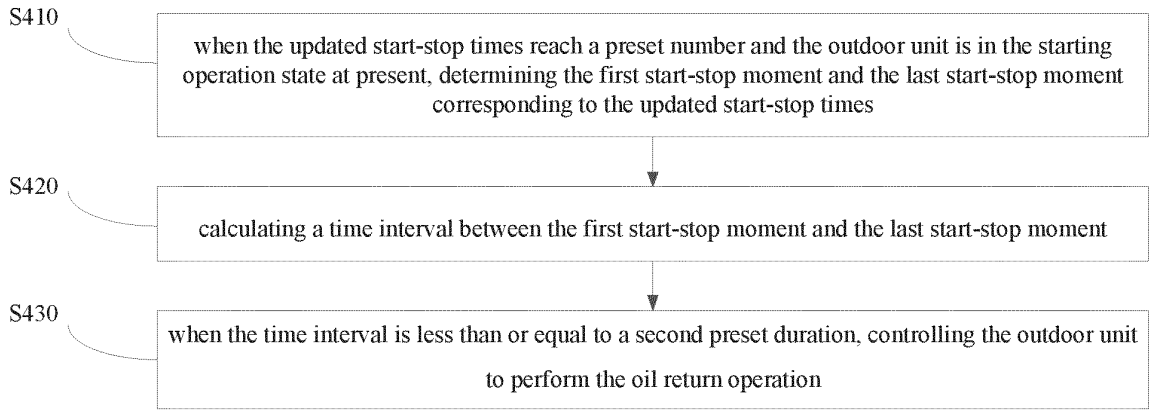

Fig. 3

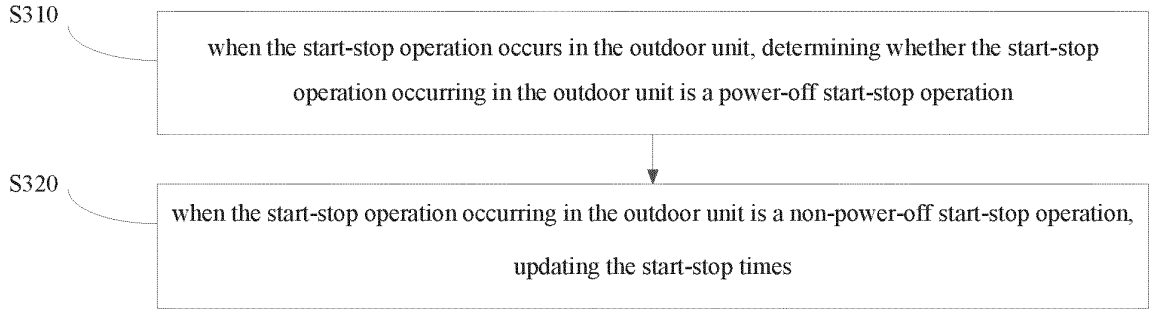

Fig. 4

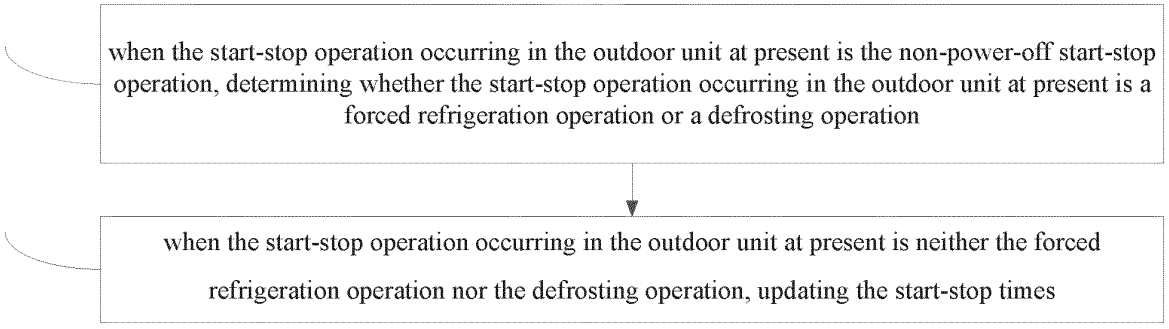

Fig. 5

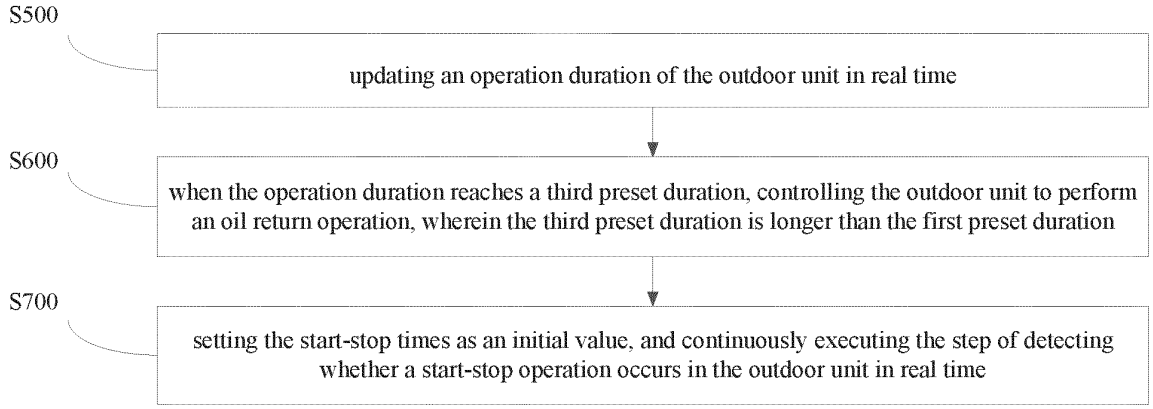

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/089847

A. CLASSIFICATION OF SUBJECT MATTER

F25B 31/00(2006.01)i; F24F 11/32(2018.01)i; F24F 11/61(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)

F25B 31, F24F 11

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)

CNTXT; DWPI; VEN; CNKI; CNABS: 空调, 室外机, 压缩机, 回油, 启, 停, 时间, 时长, 时段, 计时, 判断, air, condition, outdoor, compressor, oil, return, control, detect, start, stop, time, preset

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 109084499 A (GUANGDONG MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD. ET AL.) 25 December 2018 (2018-12-25) description, paragraphs [0043]-[0150], and figures 1-6	1-10
Y	CN 106642771 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 10 May 2017 (2017-05-10) description, paragraphs [0024]-[0038], and figures 1-4	1-10
Y	CN 103335376 A (GUANGDONG MIDEA ELECTRIC APPLIANCES CO., LTD.) 02 October 2013 (2013-10-02) description, paragraphs [0036]-[0040]	1-10
Y	CN 104913556 A (GUANGDONG MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD.) 16 September 2015 (2015-09-16) description, paragraphs [0093]-[0097]	8
A	CN 1392383 A (GUANGDONG KELON ELECTRICAL HOLDINGS CO., LTD.) 22 January 2003 (2003-01-22) entire document	1-10
A	JP 4835515 B2 (TOYOTA JIDOSHA K. K.) 14 December 2011 (2011-12-14) entire document	1-10

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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	Date of mailing of the international search report
08 July 2019	**05 August 2019**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/089847

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 109084499 A	25 December 2018	None	
CN 106642771 A	10 May 2017	None	
CN 103335376 A	02 October 2013	CN 103335376 B	18 May 2016
CN 104913556 A	16 September 2015	CN 104913556 B	30 June 2017
CN 1392383 A	22 January 2003	CN 1183366 C	05 January 2005
JP 4835515 B2	14 December 2011	JP 2008291766 A	04 December 2008

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201810927936 **[0001]**