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(71) Applicant: **Daikin Industries, Ltd.**

Osaka-shi, Osaka 530-8323 (JP)

(72) Inventors:

- **KATAOKA, H., c/o DAIKIN IND., LTD., Shiga Plant
Kusatsu-shi, Shiga 525-0044 (JP)**

• **NAGAMINE, M.,**

c/o DAIKIN IND., LTD., Shiga Plant

Kusatsu-shi, Shiga 525-0044 (JP)

(74) Representative: **HOFFMANN EITL**

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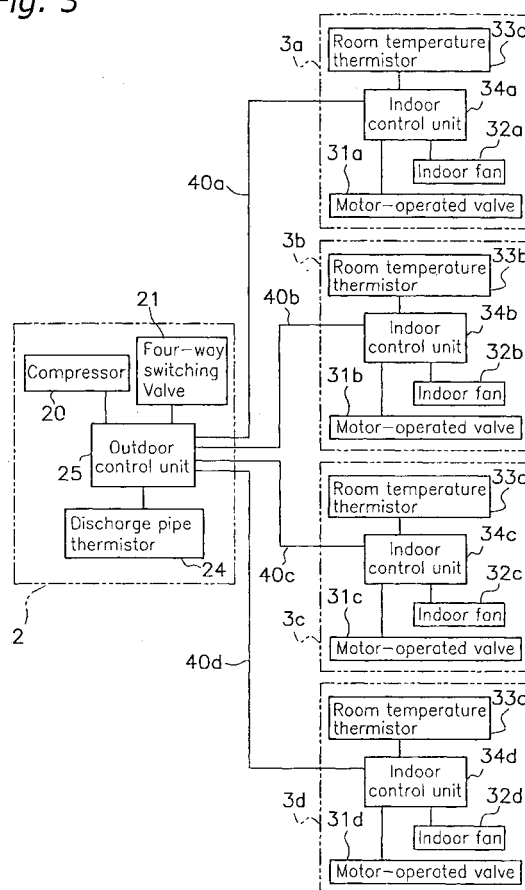
Arabellastrasse 4

81925 München (DE)

(54) **AIR CONDITIONER**

(57) The present invention provides an air conditioner (1) that can accurately detect the indoor temperature, even in an indoor unit in the thermo-off state, while suppressing a precipitous drop in the blow-out temperature in the rooms in operation. The air conditioner (1) comprises a plurality of indoor units (3a - 3d), an outdoor unit (2), and an outdoor control unit (25). The indoor units (3a - 3d) each comprises a room temperature thermistor (33a - 33d), an indoor heat exchanger (30a - 30d), an indoor fan (32a - 32d), and an indoor control unit (34a - 34d). An outdoor unit 2 comprises an outdoor heat exchanger (22), and constitutes a refrigerant circuit with the plurality of indoor units (3a - 3d). Each indoor control unit (34a - 34d) judges, based on the room temperature thermistor (33a - 33d), whether a start condition of room temperature monitoring is satisfied, and makes the indoor fan (32a - 32d) driven if performing room temperature monitoring when heating operation is in the thermo-off state. The outdoor control unit (25) selects a prescribed indoor unit from among a plurality of indoor units (3a - 3d) and sends a room temperature monitoring enable-related signal to the indoor control unit of the selected indoor unit. In addition, each indoor control unit (34a - 34d) determines whether to perform room temperature monitoring based both on the abovementioned signal and on the start condition of room temperature monitoring.

Fig. 3



Description

(FIELD OF THE INVENTION)

[0001] The present invention relates to an air conditioner, and more particularly relates to a multi-room air conditioner wherein a plurality of indoor units is connected to a single outdoor unit.

(RELATED ART)

[0002] A so-called multi-room air conditioner is known wherein, in an air conditioner, a plurality of indoor units is connected to a single outdoor unit. By arranging indoor units in each room of a plurality of rooms, a multi-room air conditioner can air condition a plurality of rooms. In such a multi-room air conditioner, all indoor units are not necessarily operating continuously; some indoor units may be in operation, while the operation of other indoor units may be halted, or in a thermo-off state. In such a case, it is also conceivable that the circulation of refrigerant is unnecessary in indoor units whose operation is halted or is in a thermo-off state. However, to prevent the occurrence of problems due to the pooling of fluid, it is common to flow a minute amount of refrigerant in an indoor unit that is in a thermo-off state or whose heating operation is halted.

[0003] Incidentally, it is also common to provide an air conditioner with a room temperature sensor, and a room temperature monitoring function that detects the indoor temperature. The room interior can thereby be controlled at a comfortable temperature by controlling each of the constituent apparatuses of the air conditioner. Furthermore, to prevent the room temperature sensor of the indoor unit in the thermo-off state from being affected during room temperature monitoring by the heat of an indoor heat exchanger, it is known to detect the room temperature by taking the indoor air into the indoor unit. An indoor fan within the indoor unit in the thermo-off state is therefore driven during room temperature monitoring. The indoor temperature can thereby be detected more accurately. Herein, it is common in the multi-room air conditioner discussed above for each indoor unit to independently judge the start of room temperature monitoring. For example, each indoor unit measures the time with its respective timer, and performs room temperature monitoring at fixed time intervals, e.g., once every five minutes.

[0004] In such a multi-room air conditioner, it is possible for a situation to arise wherein indoor fans are simultaneously driven in a plurality of indoor units in the thermo-off state. In such a case, a problem arises for the following reasons wherein the blow-out temperature in the rooms in operation i.e., the rooms where the indoor units are in operation, falls precipitously. Namely, the refrigerant may condense if the indoor fan is driven because the refrigerant flows in the abovementioned multi-room air conditioner even in the thermo-off state.

If this occurs simultaneously in a plurality of indoor units, then the pressure of the refrigerant drops precipitously in the rooms in operation. Consequently, a phenomenon tends to occur in which the blow-out temperature drops precipitously in the rooms in operation. In addition, in a refrigerant circuit wherein a fixed amount of refrigerant is circulating, the entire amount of radiated heat increases if the drive of the indoor fans in a plurality of indoor units is suddenly started. Consequently, the amount of heat radiated by the rooms in operation decreases, and the blow-out temperature falls.

(DISCLOSURE OF THE INVENTION)

[0005] It is an object of the present invention to provide an air conditioner that can accurately detect the indoor temperature, even in an indoor unit in the thermo-off state, while suppressing a precipitous drop in the blow-out temperature in the rooms in operation.

[0006] The air conditioner as recited in Claim 1 comprises a plurality of indoor units, an outdoor unit, and a room temperature monitoring control unit. Each indoor unit comprises a room temperature sensor; an indoor heat exchanger; an indoor fan; and an indoor control unit. The outdoor unit comprises an outdoor heat exchanger and constitutes a refrigerant circuit with the plurality of indoor units. The indoor control unit judges whether a start condition of room temperature monitoring is satisfied based on the room temperature sensor, and makes the indoor fan driven if performing room temperature monitoring when heating operation is in the thermo-off state. The room temperature monitoring control unit selects a prescribed indoor unit from the plurality of indoor units, and sends a room temperature monitoring enable-related signal to the indoor control unit of the selected indoor unit. In addition, the indoor control unit determines whether to perform room temperature monitoring based both on the signal and on the start condition of room temperature monitoring.

[0007] In the present air conditioner, the indoor control unit determines whether to perform room temperature monitoring based both on the signal received from the room temperature monitoring control unit, and the room temperature monitoring start condition. Consequently, the present air conditioner can limit the number of indoor units that simultaneously perform room temperature monitoring from the room temperature monitoring control unit. Accordingly, the number of simultaneously driven indoor fans can be limited. Thereby, the present air conditioner can accurately detect the indoor temperature, even in an indoor unit in the thermo-off state, while suppressing a precipitous drop in the blow-out temperature in the rooms in operation.

[0008] The invention as recited in Claim 2 is the air conditioner as recited in Claim 1, wherein the signal is a room temperature monitoring enable signal that enables the performance of room temperature monitoring. Further, the indoor control unit performs room tempera-

ture monitoring if the room temperature monitoring enable signal is received and the start condition of room temperature monitoring is satisfied.

[0009] In the present air conditioner, room temperature monitoring is performed if the indoor control unit receives a room temperature monitoring enable signal and the room temperature monitoring start condition is satisfied. Consequently, even if a certain indoor control unit judges that the room temperature monitoring start condition is satisfied based on the conditions of the interior of that indoor unit, room temperature monitoring is not performed until the room temperature monitoring control unit enables room temperature monitoring. Accordingly, the number of indoor units that simultaneously perform room temperature monitoring can be limited from the room temperature monitoring control unit. Thereby, the present air conditioner can accurately detect the indoor temperature, even in an indoor unit in the thermo-off state, while suppressing a precipitous drop in the blow-out temperature in the rooms in operation.

[0010] The invention as recited in Claim 3 is the air conditioner as recited in Claim 2, wherein the room temperature monitoring control unit sends the room temperature monitoring enable signal to each of the indoor control units staggered in time.

[0011] In the present air conditioner, room temperature monitoring is not performed simultaneously for two or more indoor units because the room temperature monitoring enable signal is sent to each of the indoor control units staggered in time. Consequently, the present air conditioner can suppress a precipitous drop in the blow-out temperature in the rooms in operation.

[0012] The invention as recited in Claim 4 is the air conditioner as recited in any one claim of Claim 1 through Claim 3, wherein the room temperature monitoring control unit sends the abovementioned signal to each of the indoor control units with equal timing.

[0013] In the present air conditioner, the room temperature monitoring control unit sends the signal to each of the indoor control units with equal timing. Consequently, an opportunity to perform room temperature monitoring is given equally to each of the indoor units. It is thereby possible to suppress biasing the number of times that room temperature monitoring is performed by each of the indoor units.

[0014] The invention as recited in Claim 5 is the air conditioner as recited in any one claim of Claim 1 through Claim 4, wherein the room temperature monitoring control unit sends the abovementioned signal only to the indoor control units of the indoor units among the plurality of indoor control units wherein heating operation is in the thermo-off state.

[0015] In the present air conditioner, the room temperature monitoring control unit sends the signal only to the indoor control units of the indoor units wherein heating operation is in the thermo-off state. Consequently, the probability of an indoor unit losing an opportunity to perform monitoring is small compared with the case where-

in a signal is sent to the indoor control units of all of the indoor units.

[0016] The invention as recited in Claim 6 is the air conditioner as recited in any one claim of Claim 1 through Claim 4, wherein the room temperature monitoring control unit sends the signal to all of the indoor units.

[0017] In the present air conditioner, the room temperature monitoring control unit sends a signal to all of the indoor units. Consequently, the room temperature monitoring control unit does not need to judge whether the indoor unit is in the thermo-off state. The details of control are consequently simplified, lightening the burden placed on the room temperature monitoring control unit.

(BRIEF EXPLANATION OF DRAWINGS)

[0018]

FIG. 1 is an external view of the air conditioner.

FIG. 2 is a schematic of the refrigerant circuit of the air conditioner.

FIG 3 is a control block diagram of the air conditioner.

FIG 4 depicts the relationship among each of the timers.

FIG 5 depicts a concrete example of each of the timers.

FIG 6 depicts the timers for the case wherein one of the indoor units is in the thermo-off state.

(PREFERRED EMBODIMENTS)

<OVERALL CONSTITUTION OF AN AIR CONDITIONER>

[0019] FIG 1 depicts an air conditioner 1 that is used in one embodiment of the present invention.

[0020] The air conditioner 1 is a so-called multi-room air conditioner, wherein a plurality of indoor units is connected to a single outdoor unit.

[0021] In the present air conditioner 1, four indoor units 3a, 3b, 3c, 3d are respectively connected by refrigerant pipes 4a, 4b, 4c, 4d to a single outdoor unit 2.

These four indoor units 3a, 3b, 3c, 3d are respectively disposed in separate rooms.

[0022] FIG 2 depicts a schematic of the refrigerant circuit of the present air conditioner 1.

[0023] The refrigerant circuit comprises a single outdoor unit 2, and four indoor units 3a, 3b, 3c, 3d connected in parallel to the outdoor unit 2.

[0024] The indoor unit 3a comprises an indoor heat exchanger 30a, a motor-operated valve 31a, an indoor fan 32a, a room temperature thermistor 33a, and an indoor control unit 34a (refer to FIG. 3).

[0025] The indoor heat exchanger 30a and the motor-operated valve 31a are connected in series, and constitute a refrigerant circuit with the outdoor unit 2. The mo-

tor-operated valve 31a is provided on the outlet side of the indoor heat exchanger 30a, and controls the amount of the refrigerant flowing to the indoor heat exchanger 30a.

[0026] The indoor fan 32a is provided inside the indoor unit 3a and is made to be driven by the indoor control unit 34a. The indoor fan 32a takes into the interior of the indoor unit 3a the indoor air in which the indoor unit 3a is disposed, and sends indoors the air that has been heat exchanged by the indoor heat exchanger 30a.

[0027] The room temperature thermistor 33a is provided inside the indoor unit 3a, detects the indoor temperature, and sends a detection signal to the indoor control unit 34a.

[0028] The indoor control unit 34a comprises a microprocessor, ROM, RAM, various interfaces, and the like. As shown in FIG 3, the indoor control unit 34a is connected to the motor-operated valve 31 a, the indoor fan 32a, and the room temperature thermistor 33a; and inputs the detection signal of the room temperature thermistor 33a. In addition, the indoor control unit 34a transmits a control signal to the motor-operated valve 31a to adjust the opening thereof. Furthermore, if performing room temperature monitoring, discussed later, in the thermo-off state, then the indoor control unit 34a makes the indoor fan 32a driven.

[0029] The outdoor unit 2 comprises a compressor 20, a four-way switching valve 21, an outdoor heat exchanger 22, an accumulator 23, a discharge pipe thermistor 24, an outdoor control unit 25, and the like (refer to FIG 3).

[0030] The compressor 20, the four-way switching valve 21, the outdoor heat exchanger 22, and the accumulator 23 constitute a refrigerant circuit with the indoor units 3a-3d, and the four-way switching valve 21 switches the flow of the refrigerant depending on whether cooling or heating.

[0031] The discharge pipe thermistor 24 is attached on the discharge side of the compressor 20, and detects the discharge pipe temperature on the discharge side of the compressor 20.

[0032] The outdoor control unit 25 comprises a microprocessor, ROM, RAM, various interfaces, and the like. As shown in FIG 3, the outdoor control unit 25 is connected to the discharge pipe thermistor 24, and inputs the detection signal of the discharge pipe thermistor 24. In addition, the outdoor control unit 25 controls air conditioning operation by controlling the operation frequency of the compressor 20 in accordance with various conditions during operation. In addition, the outdoor control unit 25 determines the opening of the motor-operated valve of the indoor unit during operation based on the discharge pipe temperature, and determines the opening of the motor-operated valve of the indoor unit whose operation is halted to be a value proportionate to the opening of the motor-operated valve of the indoor unit during operation.

[0033] A transmission line 40a is provided between the outdoor control unit 25 and the indoor control unit 34a, and various signals can be transmitted and received via this transmission line 40a, such as the control signal of the motor-operated valve 31 a and a signal related to enabling of room temperature monitoring, discussed later.

[0034] Other indoor units 3b, 3c, 3d are constituted the same as the indoor unit 3a, and are also connected to the outdoor unit 2. In FIG 2 and FIG 3, identical constituent elements are displayed with substituted symbols. For example, the motor-operated valve 31a of the indoor unit 3a is indicated as the motor-operated valve 31b of the indoor unit 3b.

<ROOM TEMPERATURE MONITORING OPERATION>

[0035] In the present air conditioner 1, room temperature monitoring is performed wherein the room temperature in each of the indoor units 3a, 3b, 3c, 3d is periodically detected by room temperature thermistors 33a, 33b, 33c, 33d. For example, the present air conditioner 1 performs room temperature monitoring in an indoor unit in the thermo-off state, and detects the room temperature of the room wherein that indoor unit is disposed. If any of the indoor control units 34a, 34b, 34c, 34d judge that the respective room temperature has fallen to a fixed value, then it performs control so that it transitions to the thermo-on state.

[0036] In the present air conditioner 1, if room temperature monitoring is performed in an indoor unit in the thermo-off state during heating operation, then the indoor control unit of that indoor unit makes the indoor fan driven, and detects the room temperature. If the indoor fan is thus made to be driven during room temperature monitoring, then room temperature monitoring is performed with respect to the air taken in from inside the room. Consequently, the impact of the heat of the indoor heat exchanger on the room temperature thermistor can be reduced. It is thereby possible to accurately detect the room temperature.

[0037] However, if the drive of indoor fans by indoor units in the thermo-off state is started simultaneously in a plurality of indoor units, then the pressure of the refrigerant can precipitously fall due to condensation, causing a phenomenon wherein the blow-out temperature of the indoor units in the rooms in operation drops precipitously.

[0038] To suppress such a phenomenon in the present air conditioner 1, room temperature monitoring is controlled so that room temperature monitoring by indoor units in the thermo-off state is not started simultaneously in a plurality of indoor units. The following explains the present control.

<ROOM TEMPERATURE MONITORING CONTROL>

[0039] First, room temperature monitoring control will be briefly explained.

[0040] The outdoor control unit 25 selects an indoor unit to perform room temperature monitoring, and transmits a room temperature monitoring enable signal to the indoor control unit of the selected indoor unit. At this time, the outdoor control unit 25 transmits the room temperature monitoring enable signal to each of the indoor control units 34a, 34b, 34c, 34d staggered in time.

[0041] Each of the indoor control units 34a, 34b, 34c, 34d judges whether the room temperature monitoring start condition is satisfied. This room temperature monitoring start condition is judged independently in each of the indoor units 3a, 3b, 3c, 3d. The indoor control units 34a, 34b, 34c, 34d receive room temperature monitoring enable signals from the outdoor control unit 25, and perform room temperature monitoring if the room temperature monitoring start conditions are satisfied.

[0042] The following discusses the details of the room temperature monitoring control on the outdoor control unit 25 side.

[START CONDITION OF CONTROL]

[0043] First, the outdoor control unit 25 judges whether to start room temperature monitoring control on the outdoor unit 2 side.

[0044] The outdoor control unit 25 starts room temperature monitoring control if the following two conditions are both satisfied.

- (1) The air conditioner 1 is in heating operation.
- (2) The air conditioner 1 is not defrosting.

[SETTING AND STARTING OF ROOM TEMPERATURE MONITORING TIMERS FOR EACH INDOOR UNIT]

[0045] Next, as shown in FIG 4, various room temperature monitoring timers are set and started for each of the indoor units 3a, 3b, 3c, 3d. Herein, Tm2(A) indicates a room temperature monitoring enabled timer that measures the time in which room temperature monitoring of the indoor unit 3a is enabled. In addition, this is shown for the other indoor units 3b, 3c, 3d by the substitution of the parenthesized symbol. For example, the monitoring enabled timer of the indoor unit 3b is indicated by Tm2(B). The same notation is used for other timers below.

[0046] Tm01(B) indicates an initially disabled timer of the indoor unit 3b. The initially disabled timer measures the time in which room temperature monitoring is initially disabled in each indoor unit from the time when the outdoor control unit 25 starts room temperature monitoring control. Furthermore, as discussed later, the initially disabled timer Tm01(A) of the indoor unit 3a is not depicted

in FIG. 4 because it is set to zero.

[0047] The outdoor control unit 25 sets the value of each timer as below.

[0048] First, a room temperature monitoring disabled time T1 is set to a time when room temperature monitoring of each of the indoor units 3a, 3b, 3c, 3d is disabled, and a room temperature monitoring enabled time T2 is set to a time when room temperature monitoring of each of the indoor units 3a, 3b, 3c, 3d is enabled. The room temperature monitoring disabled time T1 and the room temperature monitoring enabled time T2 are equal for each of the indoor units 3a, 3b, 3c, 3d. Accordingly, the timer values of the monitoring enabled timers Tm2(A), Tm2(B), Tm2(C), Tm2(D) of each of the indoor units 3a, 3b, 3c, 3d are all equal to T2. In addition, the monitoring disabled timers Tm1(A), Tm1(B), Tm1(C), Tm1(D) of each of the indoor units 3a, 3b, 3c, 3d are all equal to T1. Herein, the monitoring disabled timers measure the time when room temperature monitoring of each of the indoor units 3a, 3b, 3c, 3d is disabled, and measure the monitoring disabled time starting from the second time that room temperature monitoring control is started.

[0049] The value of the initially disabled timer for each of the indoor units 3a, 3b, 3c, 3d is set as below.

[0050] First, if we let N be the number of indoor units that performs room temperature monitoring, then the monitoring interval ΔT for each of the indoor units 3a, 3b, 3c, 3d can be derived by the following formula.

$$\Delta T = (T1 + T2) \div N - T2$$

[0051] Furthermore, the monitoring interval for each indoor unit means the time from the end of room temperature monitoring enabled of a certain indoor unit until the start of room temperature monitoring enabled of the next indoor unit.

[0052] If room temperature monitoring is performed in the order of the indoor unit 3a, the indoor unit 3b, the indoor unit 3c, and the indoor unit 3d, then the timer value of the initially disabled timer for each indoor unit is assigned by the following formulas.

$$Tm01(A) = (\Delta T + T2) \times 0$$

$$Tm01(B) = (\Delta T + T2) \times 1$$

$$Tm01(C) = (\Delta T + T2) \times 2$$

$$Tm01(D) = (\Delta T + T2) \times 3$$

[0053] When room temperature monitoring control starts, the outdoor control unit 25 sets and starts the initially disabled timer of each of the indoor units 3a, 3b,

3c, 3d.

[0054] Subsequently, if the initially disabled timer of each of the indoor units 3a, 3b, 3c, 3d exceeds its count, then the outdoor control unit 25 sets and starts the monitoring enabled timer of each of the indoor units 3a, 3b, 3c, 3d. Subsequently, the process of setting and starting the monitoring disabled timers and the monitoring enabled timers is cyclically performed for each of the indoor units 3a, 3b, 3c, 3d while the start condition of the room temperature monitoring is satisfied.

[0055] The following describes a concrete example of the count for each of the timers.

[0056] Let room temperature monitoring disabled time $T1 = 270$ s, room temperature monitoring enabled time $T2 = 90$ s, and $N = 4$.

[0057] Under these conditions, the monitoring interval $\Delta T = 0$. This means that, if the count of a monitoring enabled timer of a certain indoor unit is exceeded, then the monitoring enabled timer of another indoor unit is set and started immediately without any time delay.

[0058] The initially disabled timer of each of the indoor units 3a, 3b, 3c, 3d is as follows.

$Tm01(A) = 0$ s
 $Tm01(B) = 90$ s
 $Tm01(C) = 180$ s
 $Tm01(D) = 270$ s

[0059] For each of the indoor units 3a, 3b, 3c, 3d, let monitoring enabled timers $Tm2(A)$, $Tm2(B)$, $Tm2(C)$, $Tm2(D) = 90$ s, and monitoring disabled timers $Tm1(A)$, $Tm1(B)$, $Tm1(C)$, $Tm1(D) = 270$ s.

[0060] FIG. 5 shows the relationship among the timers.

[0061] When room temperature monitoring control starts, the outdoor control unit 25 sets and starts the initially disabled timers $Tm01(A) = 0$ s, $Tm01(B) = 90$ s, $Tm01(C) = 180$ s, $Tm01(D) = 270$ s of the indoor units 3a, 3b, 3c, 3d.

[0062] The monitoring enabled timer $Tm2(A) = 90$ s is set and started immediately for the indoor unit 3a because the initially disabled timer $Tm01(A) = 0$ s for the indoor unit 3a.

[0063] The monitoring enabled timer $Tm2(A)$ of the indoor unit 3a and the initially disabled timer $Tm01(B)$ of the indoor unit 3b both exceed their count simultaneously because the initially disabled timer of the indoor unit 3b is $Tm01(B) = 90$ s. Further, the monitoring enabled timer $Tm2(B)$ of the indoor unit 3b is then set and started. In addition, simultaneous with the count of $Tm2(A)$ being exceeded, the monitoring disabled timer $Tm1(A) = 270$ s (not shown) is set and started for the indoor unit 3a.

[0064] Simultaneous with the monitoring enabled timer $Tm2(B)$ of the indoor unit 3b exceeding its count, the count of the initially disabled timer $Tm01(C)$ of the indoor unit 3c is exceeded. Further, the monitoring enabled timer $Tm2(C)$ of the indoor unit 3c is simultaneously set and started. The following is the same for the indoor unit 3d.

[0065] When the count of the monitoring enabled timer $Tm2(D)$ of the indoor unit 3d is exceeded, the count of the monitoring disabled timer $Tm1(A)$ (not shown) of the indoor unit 3a is exceeded, and the monitoring enabled timer $Tm2(A)$ of the indoor unit 3a is once again set and started. Subsequently, the present control is repeated.

[0066] Regardless of whether the indoor units 3a, 3b, 3c, 3d are in the thermo-off state, if the outdoor control unit 25 sends a monitoring enable signal to all of the indoor units 3a, 3b, 3c, 3d, then the outdoor control unit 25 sends a monitoring enable signal to the target indoor units while the above monitoring enabled timers are measuring. Thereby, a monitoring enable signal can be sent to each of the indoor units 3a, 3b, 3c, 3d, staggered in time, under a simple control.

[CONTROL FOR CASE WHEREIN MONITORING ENABLE SIGNAL IS SENT ONLY TO INDOOR UNITS IN THE THERMO-OFF STATE]

[0067] If a monitoring enable signal is sent only to indoor units in the thermo-off state in heating operation, then the following type of control is performed in addition to the abovementioned control.

[0068] If the certain indoor unit previously in the thermo-on state transitions to the thermo-off state, then a thermo-off initially disabled timer of that indoor unit is set and started. The timer value of the thermo-off initially disabled timer is the room temperature monitoring disabled time $T1$. The following explains, as shown in FIG. 6, that the indoor unit 3d is taken to be in the thermo-off state during the count of the monitoring enabled timer $Tm2(A)$ of the indoor unit 3a.

[0069] In the present control process, a monitoring enabled flag $f(D)$ is judged as described below. The monitoring enabled flag $f(D) = 1$ if the conditions (3) and (4) below are both satisfied.

(3) The count of the thermo-off initially disabled timer $Tm3(D)$ is exceeded.

(4) The monitoring enabled timer $Tm2(D)$ is not measuring.

In addition, the monitoring enabled flag $f(D) = 0$ if the conditions (5) and (6) below are both satisfied.

(5) The thermo-off initially disabled timer $Tm3(D)$ is measuring.

(6) The monitoring enabled timer $Tm2(D)$ is not measuring.

[0070] Furthermore, the monitoring enabled flag of each indoor unit is zero when monitoring control starts.

[0071] Next, a monitoring enable signal is sent to the indoor unit 3d if all of the following conditions (7) through (10) are satisfied.

(7) The thermo-off initially disabled timer $Tm3(D)$ of the indoor unit 3d is not measuring.

(8) The indoor unit 3d is in the heating thermo-off state.

(9) The monitoring enabled timer Tm2(D) of the indoor unit 3d is measuring.

(10) The monitoring enabled flag f(D) = 1 for the indoor unit 3d.

[0072] Furthermore, the thermo-off initially disabled timers Tm3(A), Tm3(B), Tm3(C), Tm3(D), of each of the indoor units 3a, 3b, 3c, 3d are reset when room temperature monitoring control starts.

[0073] Based on the above control, the number of indoor units that simultaneously perform room temperature monitoring can be limited to just the indoor units in the thermo-off state. Consequently, the number of indoor units subject to limitations is fewer compared with the case wherein a room temperature monitoring enable signal is sent to all of the indoor units 3a, 3b, 3c, 3d. In other words, it is possible to lengthen the time in which the monitoring enable signal is sent per indoor unit. This consequently reduces the probability of an indoor unit losing an opportunity to perform monitoring in the present air conditioner 1.

<FEATURES OF THIS AIR CONDITIONER>

[0074] In the present air conditioner 1, room temperature monitoring is performed if the indoor control units 34a, 34b, 34c, 34d receive a room temperature monitoring enable signal and the start condition of room temperature monitoring is satisfied. Consequently, even if a certain indoor control unit judges that the start condition for room temperature monitoring is satisfied based on the conditions inside that indoor unit, then room temperature monitoring is not performed until the outdoor control unit 25 enables room temperature monitoring. Further, the outdoor control unit 25 does not send a monitoring enable signal simultaneously to two or more indoor units, but rather sends a monitoring enable signal to each of the indoor control units 34a, 34b, 34c, 34d, staggered in time. Accordingly, room temperature monitoring is not performed simultaneously for two or more indoor units. Consequently, the indoor fans of two or more indoor units are not made to be driven simultaneously, and the refrigerant is not precipitously affected. Thereby, in the present air conditioner 1, a precipitous drop in the blow-out temperature in the rooms in operation can be suppressed. Further, the indoor fans 32a, 32b, 32c, 32d are made to be driven during room temperature monitoring, and the indoor air is taken into the interior of the indoor units 3a, 3b, 3c, 3d; consequently, the indoor temperature can be accurately detected in the present air conditioner even if the indoor unit is in the thermo-off state.

[0075] Furthermore, the timer values for the monitoring enabled timer and the monitoring disabled timer are the same for each of the indoor units 3a, 3b, 3c, 3d. In other words, the outdoor control unit 25 sends a moni-

toring enable signal to the indoor control units 34a, 34b, 34c, 34d with equal timing. Consequently, a room temperature monitoring enable signal is sent to each of the indoor units 3a, 3b, 3c, 3d with the same cycle, staggered in time. Consequently, an opportunity to perform room temperature monitoring is given equally to each of the indoor units 3a, 3b, 3c, 3d. It is thereby possible to suppress biasing the number of times that room temperature monitoring is performed by each of the indoor units 3a, 3b, 3c, 3d.

<OTHER EMBODIMENTS>

[0076] The number of indoor units connected to the outdoor unit 2 is not limited to the number recited in the abovementioned embodiment, and may number two, three, five, or more units.

[0077] In addition, although the monitoring enabled timers for two or more indoor units do not simultaneously measure in the abovementioned embodiment, the monitoring enabled timers may simultaneously measure for two or more indoor units if the impact on the refrigerant is low.

[0078] In the abovementioned embodiment, room temperature monitoring is performed if all of the following are met: the outdoor control unit 25 sends monitoring enable signals, the monitoring start conditions of the indoor units 3a, 3b, 3c, 3d are satisfied, and monitoring enable signals are received. However, the signal sent by the outdoor control unit 25 is not limited to the monitoring enable signal, and a monitoring disable signal may also be sent. In this case, room temperature monitoring is performed if both the monitoring start conditions of the indoor units 3a, 3b, 3c, 3d are satisfied and monitoring disable signals are not received.

(INDUSTRIAL FIELD OF APPLICATION)

[0079] Using the air conditioner according to the present invention enables accurate detection of the indoor temperature, even in an indoor unit in the thermo-off state, while suppressing a precipitous drop in the blow-out temperature in the rooms in operation.

Claims

1. An air conditioner, comprising:

a plurality of indoor units (3a, 3b, 3c, 3d), each comprising a room temperature sensor (33a, 33b, 33c, 33d); an indoor heat exchanger (30a, 30b, 30c, 30d); an indoor fan (32a, 32b, 32c, 32d); and an indoor control unit (34a, 34b, 34c, 34d) that judges whether a start condition of room temperature monitoring is satisfied based on said room temperature sensor (33a, 33b, 33c, 33d), and that makes said indoor fan (32a,

32b, 32c, 32d) driven if performing room temperature monitoring when heating operation is in the thermo-off state;

an outdoor unit (2) comprising an outdoor heat exchanger (22) and constituting a refrigerant circuit with said plurality of indoor units (3a, 3b, 3c, 3d); and

a room temperature monitoring control unit (25) that selects a prescribed indoor unit from said plurality of indoor units (3a, 3b, 3c, 3d), and sends a room temperature monitoring enable-related signal to the indoor control unit of the selected said indoor unit,

wherein,

said indoor control unit (34a, 34b, 34c, 34d) determines whether to perform room temperature monitoring based both on said signal and on the start condition of said room temperature monitoring.

2. The air conditioner as recited in Claim 1, wherein said signal is a room temperature monitoring enable signal that enables the performance of room temperature monitoring; and said indoor control unit (34a, 34b, 34c, 34d) performs room temperature monitoring if said room temperature monitoring enable signal is received and the start condition of said room temperature monitoring is satisfied.
3. The air conditioner as recited in Claim 2, wherein said room temperature monitoring control unit (25) sends said room temperature monitoring enable signal to each of said indoor control units (34a, 34b, 34c, 34d) staggered in time.
4. The air conditioner as recited in any one claim of Claim 1 through Claim 3, wherein said room temperature monitoring control unit (25) sends said signal to each of said indoor control units (34a, 34b, 34c, 34d) with equal timing.
5. The air conditioner as recited in any one claim of Claim 1 through Claim 4, wherein said room temperature monitoring control unit sends said signal only to the indoor control units of the indoor units among said plurality of indoor control units (34a, 34b, 34c, 34d) wherein heating operation is in the thermo-off state.
6. The air conditioner as recited in any one claim of Claim 1 through Claim 4, wherein said room temperature monitoring control unit sends said signal to all of said indoor units (34a, 34b, 34c, 34d).

Fig. 1

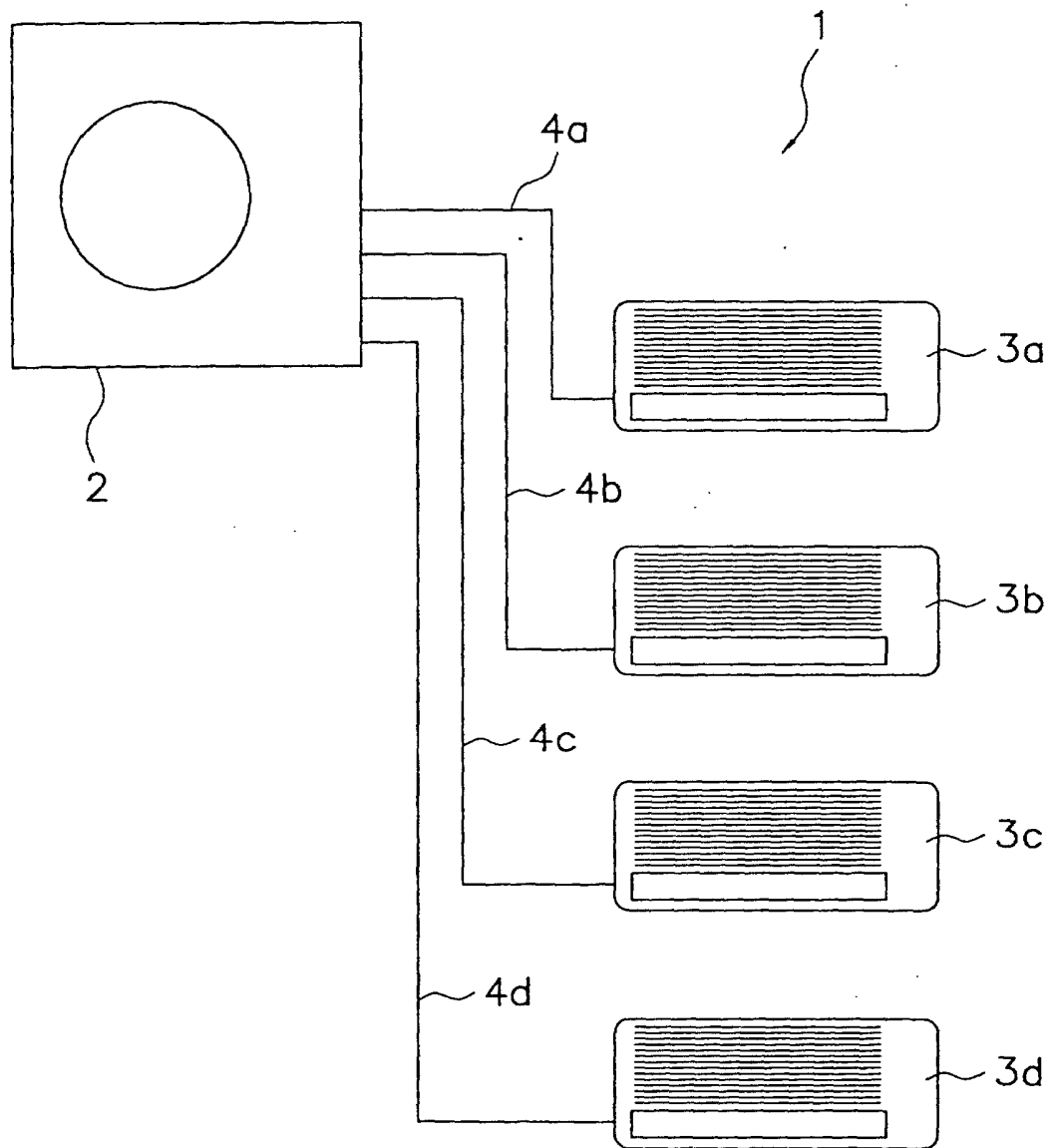


Fig. 2

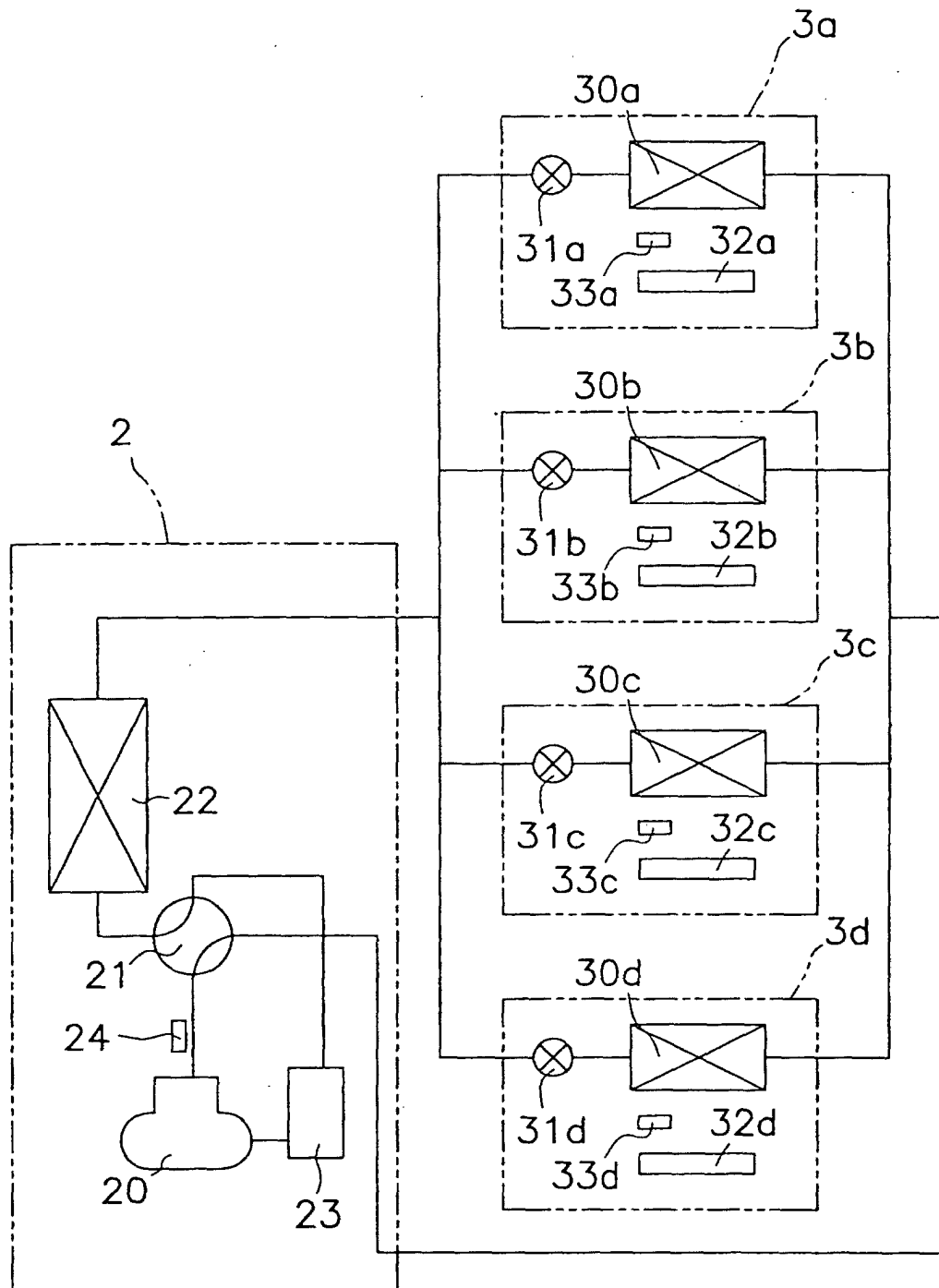


Fig. 3

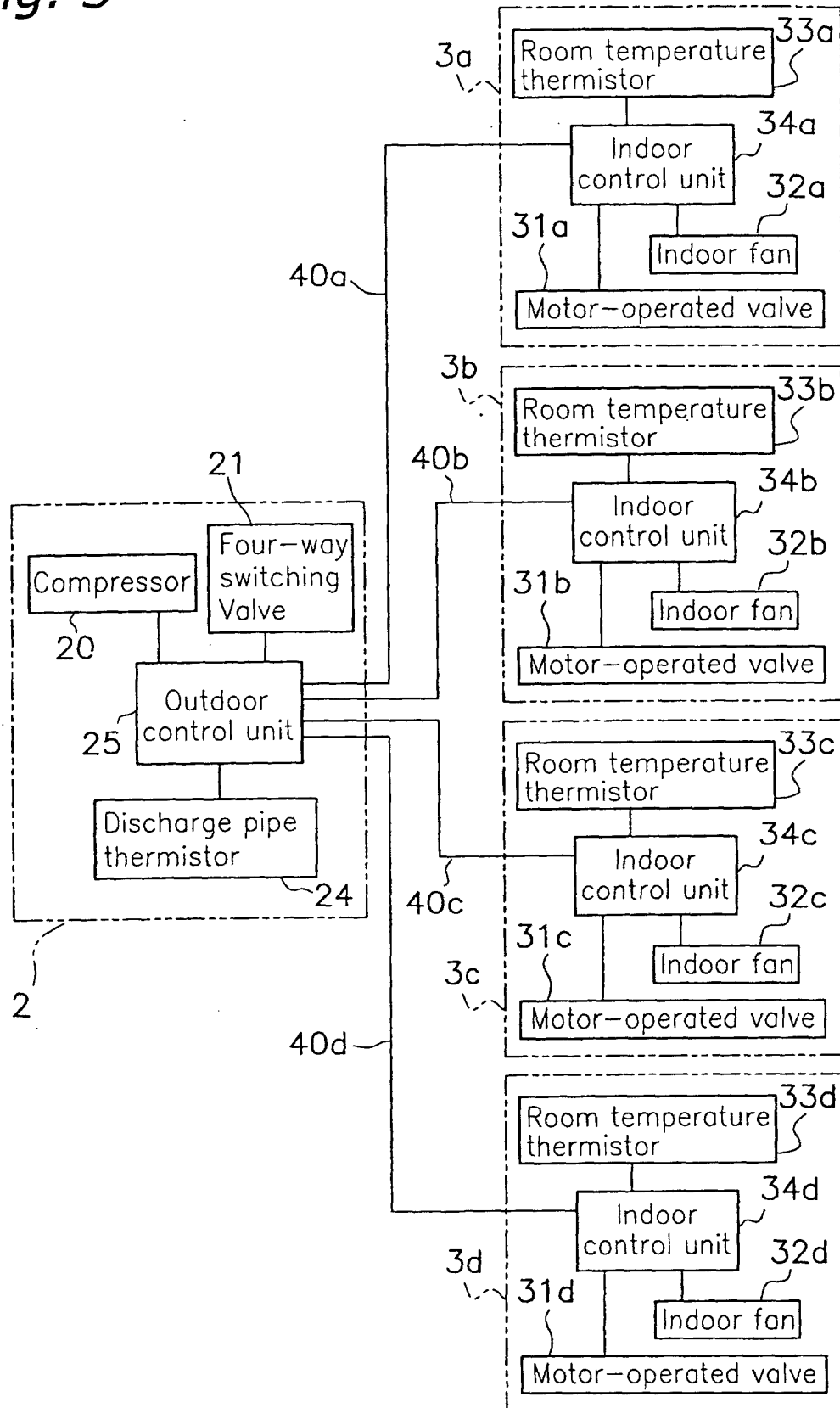


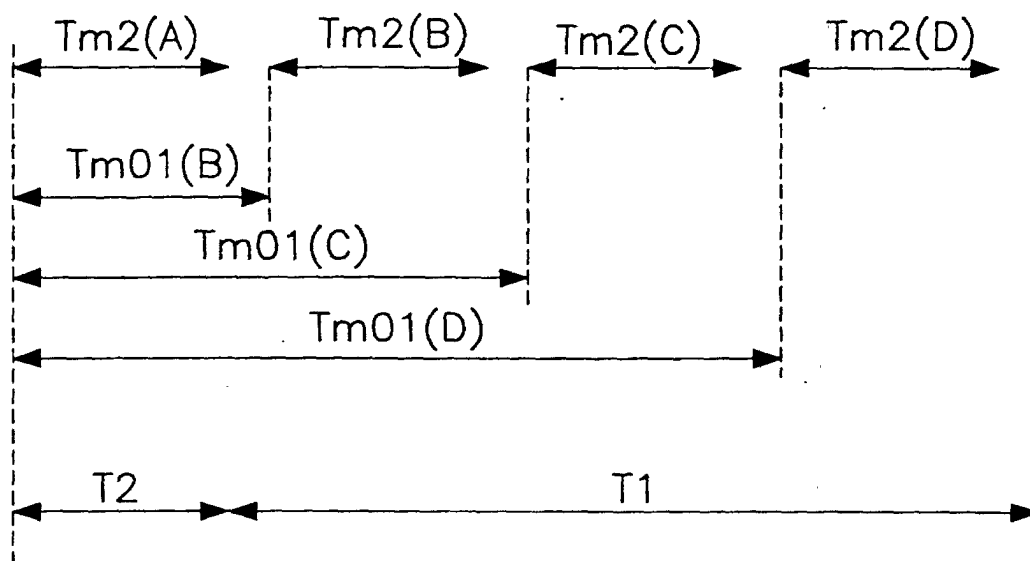
Fig. 4

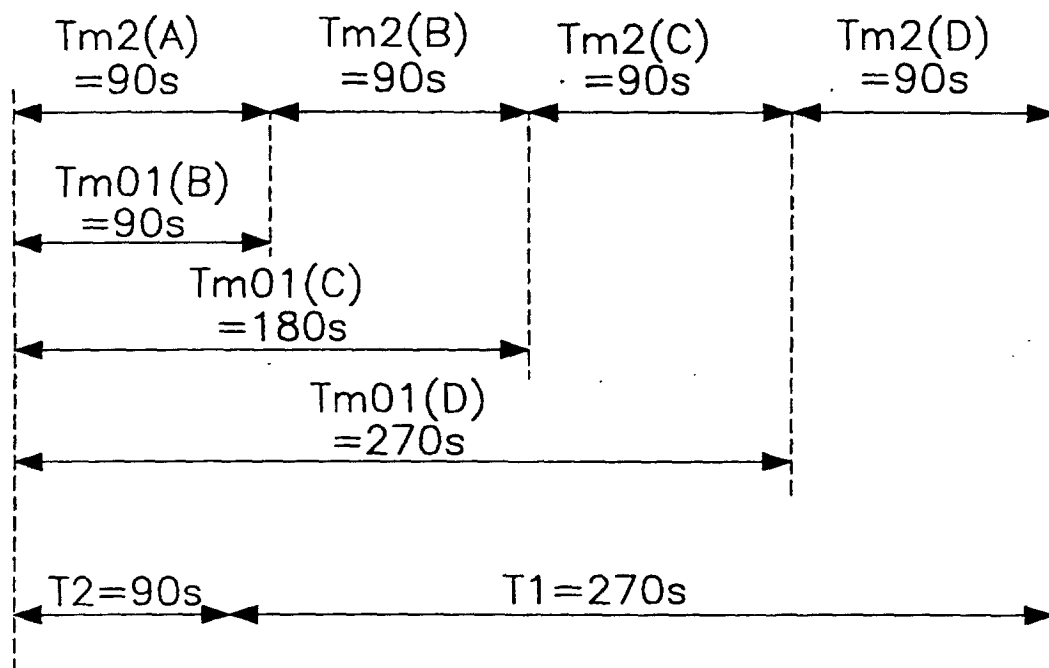
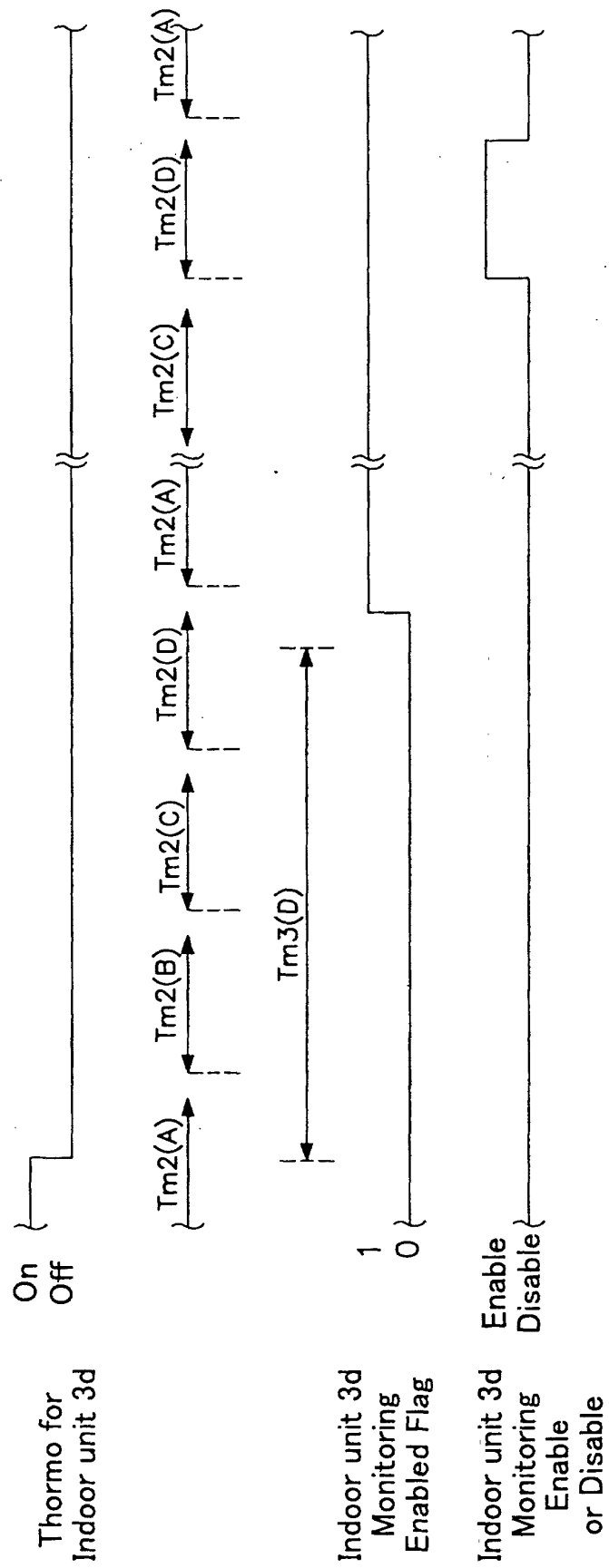
Fig. 5

Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/02609

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ F24F11/02		
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) Int.Cl ⁷ F24F11/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-173628 A (Mitsubishi Heavy Industries, Ltd.), 02 July, 1999 (02.07.99), Full text (Family: none)	1-6
Y	JP 2002-13784 A (Sanyo Electric Co., Ltd.), 18 January, 2002 (18.01.02), Full text (Family: none)	1-6
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier document but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&" 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 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 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 04 April, 2003 (04.04.03)		Date of mailing of the international search report 15 April, 2003 (15.04.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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