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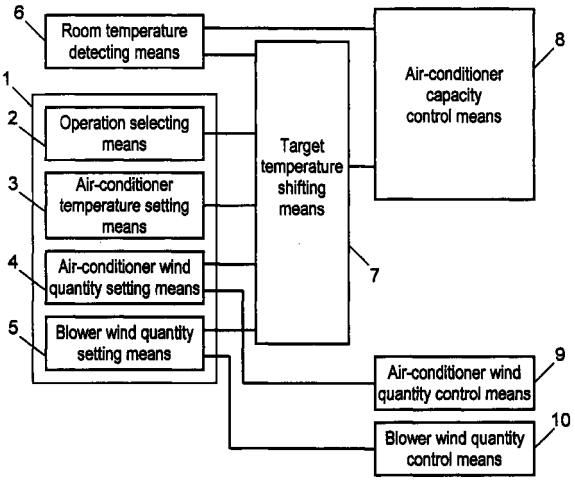
(54) Control device of air contitioning system

(57) In an air conditioning system concurrently using an air conditioner and a blower, coolness feeling is provided by wind from the blower, so that a target temperature for cooling can be shifted to be higher. As a result, energy can be saved. The present invention provides a control device for the air conditioning system using the air conditioner and the blower, which has air-conditioner temperature setting means (3) for setting the target temperature of the air conditioner, blower wind quantity setting means (5) for setting the wind quantity of the blower, and target temperature shifting means (7). The target temperature shifting means (7) determines a shift amount of the target temperature based on the target temperature and the wind quantity of the blower, and shifts the target temperature to be the shift amount higher, when the air conditioner and the blower are concurrently operated in a cooling mode.

FIG. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a control device for an air conditioning system concurrently using an air conditioner and a blower such as an electric fan.

BACKGROUND OF THE INVENTION

[0002] A conventional control device for an air conditioning system concurrently using an air conditioner and a blower is provided with a switch for changing a target temperature of the air conditioner, as shown in Japanese Patent Application Examined Publication No.S60-29855. During cooling, the switch raises the target temperature by a given degree, and simultaneously a driving switch of an electric fan is turned on in synchronization with the switch. Thus, while coolness feeling is kept by wind from the electric fan, energy saving is effected by raising the target temperature.

[0003] In the prior art discussed above, independently of a room temperature and operation-condition-settings for the air conditioner and the blower (e.g. electric fan) such as the target temperature of the air conditioner, wind quantity of the air conditioner, and wind quantity of the blower which are set by a user, the target temperature is shifted to be a given amount higher. Therefore, there is a problem that comfortableness of the air condition may be impaired.

SUMMARY OF THE INVENTION

[0004] The present invention solves such a conventional problem. An object of the present invention is to provide a control device for an air conditioning system that can always and compatibly provide comfortableness and energy saving by shifting a target temperature of an air conditioner by an optimal shift amount responsive to a room temperature and operation-condition-settings for the air conditioner and a blower, during a concurrent operation of the air conditioner and the blower.

[0005] A control device in accordance with a first invention of the present invention comprises the following elements:

an air-conditioner temperature setting means for setting the target temperature thereof,
a blower wind quantity setting means for setting wind quantity thereof, and
a target temperature shifting means.

When the air conditioner and the blower are concurrently used during a cooling operation, the target temperature shifting means determines a shift amount of the target temperature based on the target temperature and the wind quantity of the blower, and shifts the target temperature to be the given amount higher.

[0006] In a second invention of the present invention, the target temperature shifting means determines the shift amount of the target temperature to be smaller with higher target temperature. Thus, even when the target temperature set by a user changes, coolness feeling can be kept constant.

[0007] In a third invention of the present invention, the target temperature shifting means determines the shift amount of the target temperature to be larger with larger wind quantity of the blower. Thus, even when the target temperature set by the user changes, coolness feeling can be kept constant and energy saving is effected.

[0008] In a fourth invention of the present invention, the control device in accordance with the first invention further has a room temperature detecting means. When the room temperature is a predetermined value higher than the target temperature, the target temperature shifting means shifts the target temperature to be higher after the room temperature reaches the proximity of the target temperature. Thus, when the room temperature is considerably higher than the target temperature, for example, in starting of the cooling operation, the target temperature is not shifted to be higher until the room temperature reaches the proximity of the target temperature, and therefore, the user can feel comfortable in a short time.

[0009] In a fifth invention of the present invention, the control device in accordance with the first invention further has an air-conditioner wind quantity setting means for setting wind quantity of the air conditioner, and the target temperature shifting means does not shift the target temperature when the wind quantity of the air conditioner is larger than a given value and the wind quantity of the blower is smaller than a given value. In other words, the target temperature is not shifted to be higher when coolness felt by the user is not improved with the operation of the blower.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig.1 is a block diagram of a control device for an air conditioning system in accordance with an embodiment of the present invention.
Fig.2 is a time-based diagram of a control operation in accordance with the embodiment.
Fig.3 is a diagram for describing a determination method for a shift amount of a target temperature based on wind quantity of a blower and wind quantity of an air conditioner.
Fig.4 is a time-based diagram of another control operation in accordance with the embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0011] An embodiment of the present invention is described hereinafter with reference to the accompanying drawings.

[0012] Fig. 1 shows a block diagram of a control device for an air conditioning system in accordance with the present invention. In the block diagram, operating means 1 comprises the following elements:

operation selecting means 2,
air-conditioner temperature setting means 3,
air-conditioner wind quantity setting means 4, and
blower wind quantity setting means 5.

For example, operating means 1 is formed by providing each operation-condition-setting-switch to an infrared remote control. A user feeds respective operation condition settings for an air conditioner and a blower into the operating means, and transmits respective operation-condition-setting-signals to the air conditioner and the blower from it.

[0013] Operation selecting means 2 has respective switches for turning on or off of the air conditioner and turning on or off of the blower such as an electric fan or a ceiling fan, and is used for selecting a single operation of either the air conditioner or the blower or a concurrent operation of the air conditioner and the blower. Air-conditioner temperature setting means 3 is to feed and set a target temperature of the air conditioner, air-conditioner wind quantity setting means 4 is used by the user to feed and set a wind quantity of the air conditioner, and blower wind quantity setting means 5 is to feed and set a wind quantity of the blower.

[0014] Room temperature detecting means 6 has a room temperature sensor at an air-conditioning inlet and detects a room temperature. Target temperature shifting means 7-installed in the air conditioner-determines a shift amount by which the target temperature is shifted based on each operation condition setting information of operation selecting means 2, air-conditioner temperature setting means 3, air-conditioner wind quantity setting means 4, and blower wind quantity setting means 5. The information discussed above is transmitted from operating means 1. In addition to that information, the room temperature information from the room temperature detecting means 6 is also used for determining the shift amount. Further, the means 7 changes the target temperature set by air-conditioner temperature setting means 3 by shifting it by the determined shift amount.

[0015] Air-conditioner capacity control means 8 is used for controlling capacity of the air conditioner so that the room temperature detected by room temperature detecting means 6 is equal to the target temperature set by air-conditioner temperature setting means 3 and target temperature shifting means 7. Air-conditioner wind quantity control means 9 controls number of revolutions of a fan-motor of the air conditioner to control wind quantity of the air conditioner to be equal to the wind quantity set by air-conditioner wind quantity setting means 4. Blower wind quantity control means 10 controls number of revolutions of a fan-motor of the blower to control wind quantity of the blower to be equal to the wind quantity set by blower wind quantity setting means 5.

[0016] Fig.2 is a time-based diagram showing a control operation during cooling in accordance with the embodiment. When the user turns on only the air conditioner with operation selecting means 2 at time t0, air-conditioner capacity control means 8 controls the capacity of the air conditioner so that the room temperature detected by room temperature detecting means 6 equals to target temperature Ts1 fed by air-conditioner temperature setting means 3. The wind quantity of the air conditioner is controlled by air-conditioner wind quantity control means 9 so as to equal to wind quantity setting Va2 fed by air-conditioner wind quantity setting means 4. Thus, the room temperature before an operation of the air conditioner drops time-dependently and stabilizes at target temperature Ts1.

[0017] At time t1, in addition to the air conditioner, the blower is turned on with operation selecting means 2, and thereby the air conditioner and the blower are concurrently operated. The wind quantity of the blower is controlled by blower wind quantity control means 10 so as to equal to wind quantity Vf3 fed by blower wind quantity setting means 5. Just at the time when operation of the blower is started, target temperature Ts1 during the single operation of the air conditioner is shifted to be + Δ T2°C higher, i.e. the target temperature is changed to Ts1+ Δ T2 for the concurrent operation with the blower, by target temperature shifting means 7.

[0018] At time t2, the user is assumed to change the blower wind quantity setting from Vf3 to Vf2. At this time, the shift amount of the target temperature is lowered from +ΔT2°C to +ΔT1°C by target temperature shifting means 7. Target temperature shifting means 7 determines the shift amount of the target temperature, based on a prerecorded relation of optimal shift amount of the target temperature to the blower wind quantity setting, in which the shift amount of the target temperature increases at the greater blower wind quantity setting. In other words, wind speed for the user becomes higher with larger wind quantity of the blower, and this increases coolness feeling. Therefor, the user feels the same coolness even when the target temperature is set higher. Thus, regardless of a level of the blower wind quantity setting during the concurrent operation with the blower, comfortable coolness feeling equivalent to that during the single operation of the air conditioner can be always maintained.

[0019] At time t3, the user is assumed to lower the blower wind quantity setting from Vf2 to Vf1, and increases the air-conditioner wind quantity setting from Va2 to Va3. At this time, the shift amount of the target

temperature is set at 0°C by target temperature shifting means 7, in other words, the target temperature setting is returned to target temperature Ts1 during the single operation of the air conditioner and is prevented from being shifted. This is based on a rule that the shift amount of the target temperature is set at 0°C when the air-conditioner wind quantity setting is larger than a preset value Va3 and the blower wind quantity setting is smaller than a preset value Vf1.

[0020] This rule is described in details. As shown in Fig.3, in a dotted region, the target temperature is shifted higher, and in a shaded region, the shift amount of the target temperature is null. In the shaded region, even when the blower is concurrently operated, the wind speed for the user does not become higher comparing with the operation of only air conditioner, the coolness feeling thus does not improve, and therefore the shift amount should be null. At this time, if the target temperature is shifted higher than target temperature Ts1 during the single operation of the air conditioner though the wind speed does not rise, the room temperature becomes higher. As a result, a problem that the coolness feeling is impaired occurs.

[0021] Fig.4 is a time-based diagram showing another example of control operations during cooling in accordance with the embodiment. When the user turns on both the air conditioner and the blower with operation selecting means 2 at time t0, air-conditioner capacity control means 8 controls the capacity of the air conditioner so that the room temperature detected by room temperature detecting means 6 equals to target temperature Ts3 fed by air-conditioner temperature setting means 3. The wind quantity of the air conditioner is controlled by air-conditioner wind quantity control means 9 so as to equal to wind quantity setting Va2 fed by air-conditioner wind quantity setting means 4. The wind quantity of the blower is controlled by blower wind quantity control means 10 so as to equal to wind quantity setting Vf3 fed by blower wind quantity setting means 5.

[0022] In this case, a condition that difference (T0-Ts3) between room temperature T0 and target temperature setting Ts3 is higher than a predetermined Δ Ta is met at time t0. Therefore, even when the blower is concurrently operated, target temperature shifting means 7 sets the shift amount of the target temperature at null i.e. not to shift target temperature setting Ts3 during the single operation of the air conditioner and keep the setting until the room temperature reaches target temperature setting Ts3 and stabilizes. At time t1, target temperature Ts3 is shifted to be + Δ T3°C higher, i.e. the target temperature is changed to Ts3+ Δ T3, by target temperature shifting means 7.

[0023] In other words, when the room temperature is considerably higher than the target temperature as in starting of the cooling operation, even in the concurrent operation with the blower, the target temperature is not shifted higher until the room temperature approaches the target temperature and stabilizes, and comfortableness can be prevented from being impaired in starting the operation, because a high priority is given to more rapidly providing the user with sufficient coolness feeling.

[0024] At time t2, the user is assumed to turn off the blower with operation selecting means 2, and simultaneously increase the target temperature setting from Ts3 to Ts4 with air-conditioner temperature setting means 3. At this time, since only the air conditioner is operating, the shift amount of the target temperature setting is set at null by target temperature shifting means 7, and target temperature is changed from Ts3+ΔT3 to Ts4.

[0025] At time t3, the user is assumed to turn on the blower again with operation selecting means 2. At this time, the shift amount of the target temperature is set at +Δ T4 by target temperature shifting means 7, and target temperature is changed from Ts4 during the single operation of the air conditioner to Ts4+Δ T4 during the concurrent operation with the blower. Comparing the present target temperature Ts4 during the single operation of the air conditioner with the previous target temperature Ts3, Ts3 is lower than Ts4, and therefore the shift amount of the target temperature is set so that + Δ T3 is larger than + Δ T4. In other words, target temperature shifting means 7 determines the shift amount of the target temperature based on a prerecorded relation of the shift amount of the target temperature during the concurrent operation with the blower to the target temperature during the single operation of the air conditioner, in which the shift amount of the target temperature during the concurrent operation with the blower is smaller with larger target temperature during the single operation of the air conditioner.

[0026] This relation is based on human's sensing characteristic for temperature that effect for increasing the coolness feeling is smaller with higher room temperature even for same wind speed increment. Therefore, during the concurrent operation with the blower, an optimal shift amount of the target temperature according to levels of the target temperature is set, and comfortable coolness feeling can be always maintained.

[0027] As is clear from the above description, a control device of the present invention for an air conditioning system can always and compatibly provide comfortableness and energy saving by shifting the target temperature of the air conditioner by the optimal shift amount responsive to a room temperature and operation condition settings for the air conditioner and the blower, during the concurrent operation of the air conditioner and the blower.

Claims

1. A control device for an air conditioning system concurrently using an air conditioner and a blower, said control device comprising:

air-conditioner temperature setting means (3) for setting a target temperature of the air conditioner;

blower wind quantity setting means (5) for setting wind quantity of the blower; and

target temperature shifting means (7),

said target temperature shifting means (7) being characterized by determining a shift amount of the target temperature based on the target temperature and the wind quantity of the blower, and by shifting the target temperature to be the shift amount higher, when the air conditioner and the blower are concurrently operated in a cooling mode.

2. The control device for the air conditioning system according to claim 1, wherein

said target temperature shifting means (7) determines the shift amount of the target temperature to be smaller at a higher target temperature.

3. The control device for the air conditioning system according to claim 1, wherein

said target temperature shifting means (7) determines the shift amount of the target temperature to be larger at a greater wind quantity of the blower.

4. The control device for the air conditioning system according to claim 1 further comprising room temperature detecting means (6), wherein

said target temperature shifting means (7) shifts the target temperature to be higher after a room temperature reaches the target temperature, in the case that the room temperature is a given value higher than the target temperature.

5. The control device for the air conditioning system according to claim 1 further comprising air-conditioner wind quantity setting means (4) for setting the wind quantity of the air conditioner, wherein

said target temperature shifting means (7) keeps the target temperature without shifting, in the case that the wind quantity of the air conditioner is larger than a given value and the wind quantity of the blower is smaller than a given value.

FIG. 1

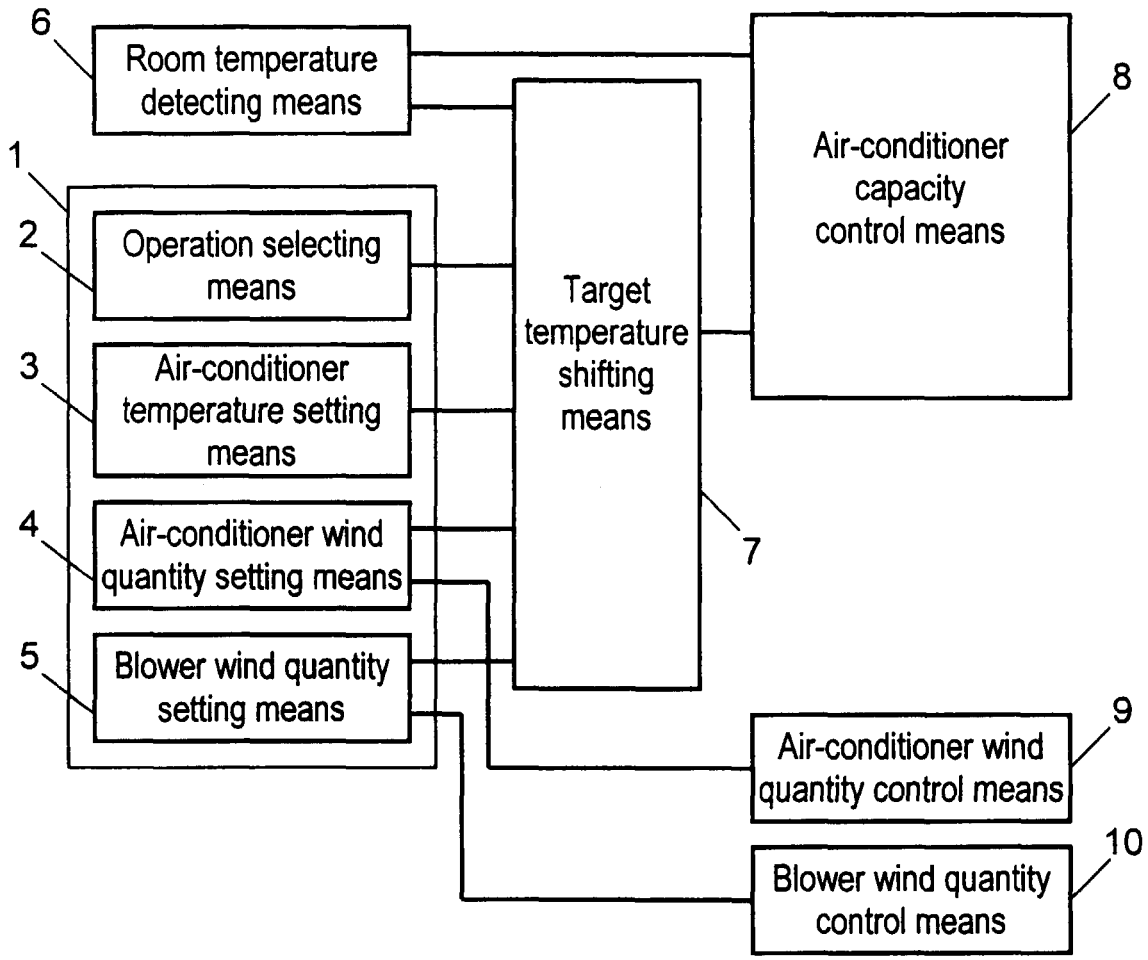

6
Room temperature detecting means
1
2
Operation selecting means
3
Air-conditioner temperature setting means
4
Air-conditioner wind quantity setting means
5
Blower wind quantity setting means
Target temperature shifting means
7
8
Air-conditioner capacity control means
9
Air-conditioner wind quantity control means
10
Blower wind quantity control means

FIG. 2

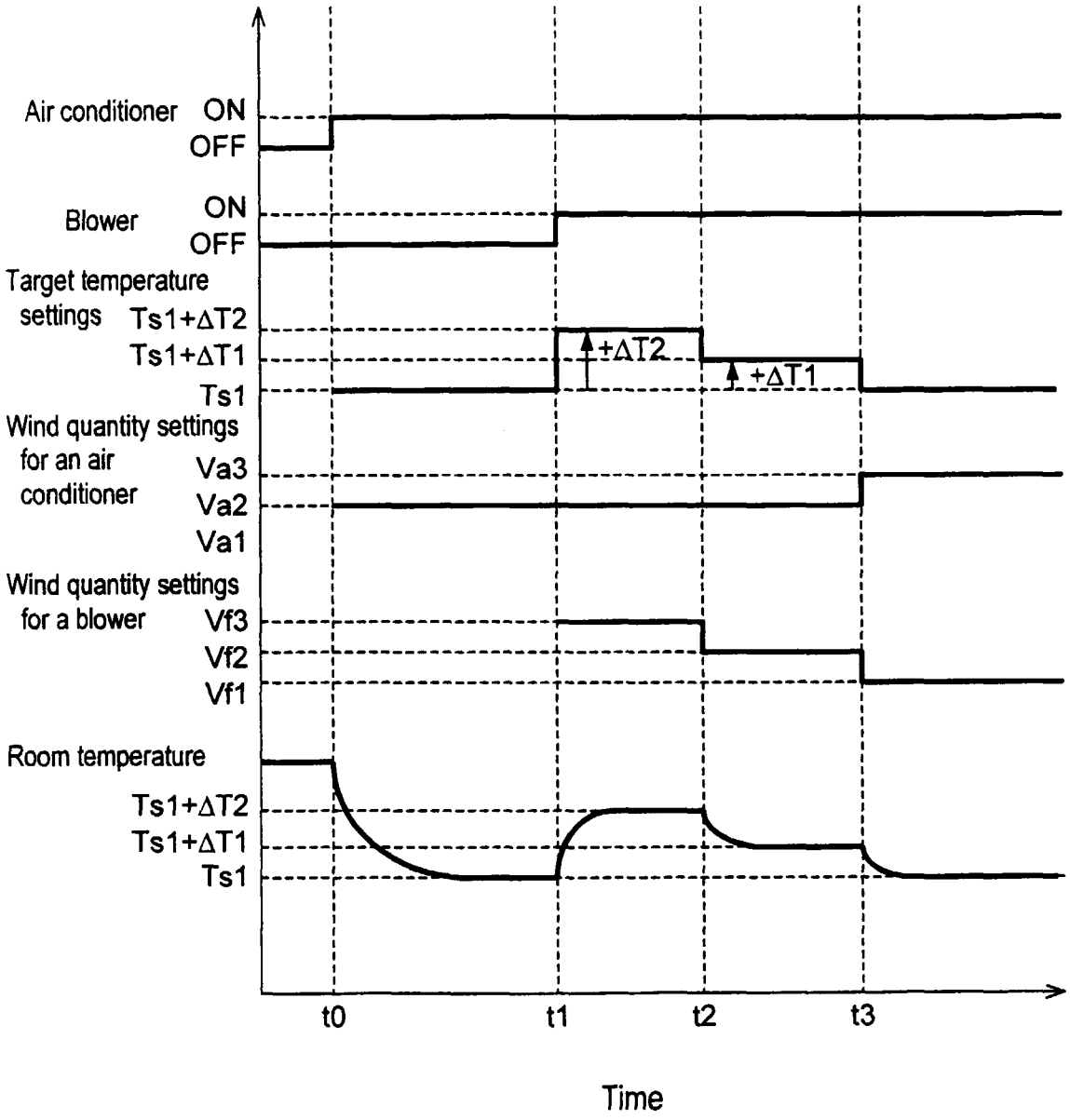

Air conditioner
ON
OFF
Blower
ON
OFF
Target temperature settings
Ts1+ΔT2
Ts1+ΔT1
Ts1
+ΔT2
+ΔT1
Wind quantity settings for an air conditioner
Va3
Va2
Va1
Wind quantity settings for a blower
Vf3
Vf2
Vf1
Room temperature
Ts1+ΔT2
Ts1+ΔT1
Ts1
t0
t1
t2
t3
Time

FIG. 3

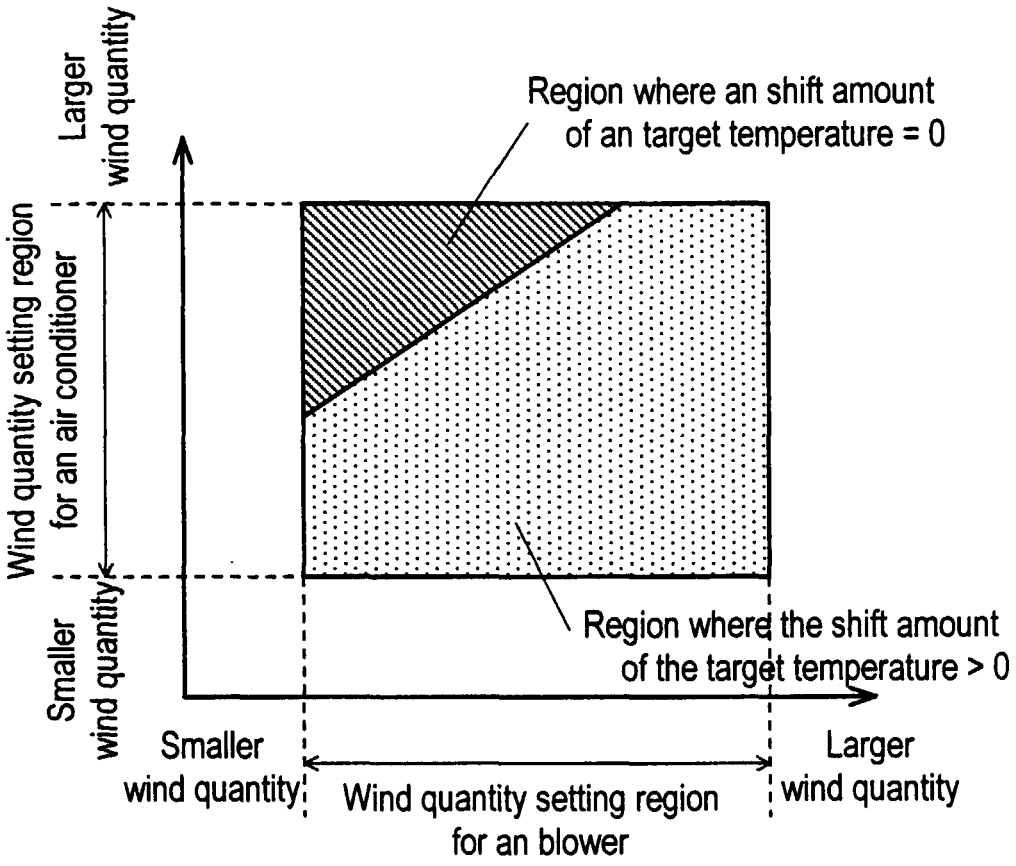
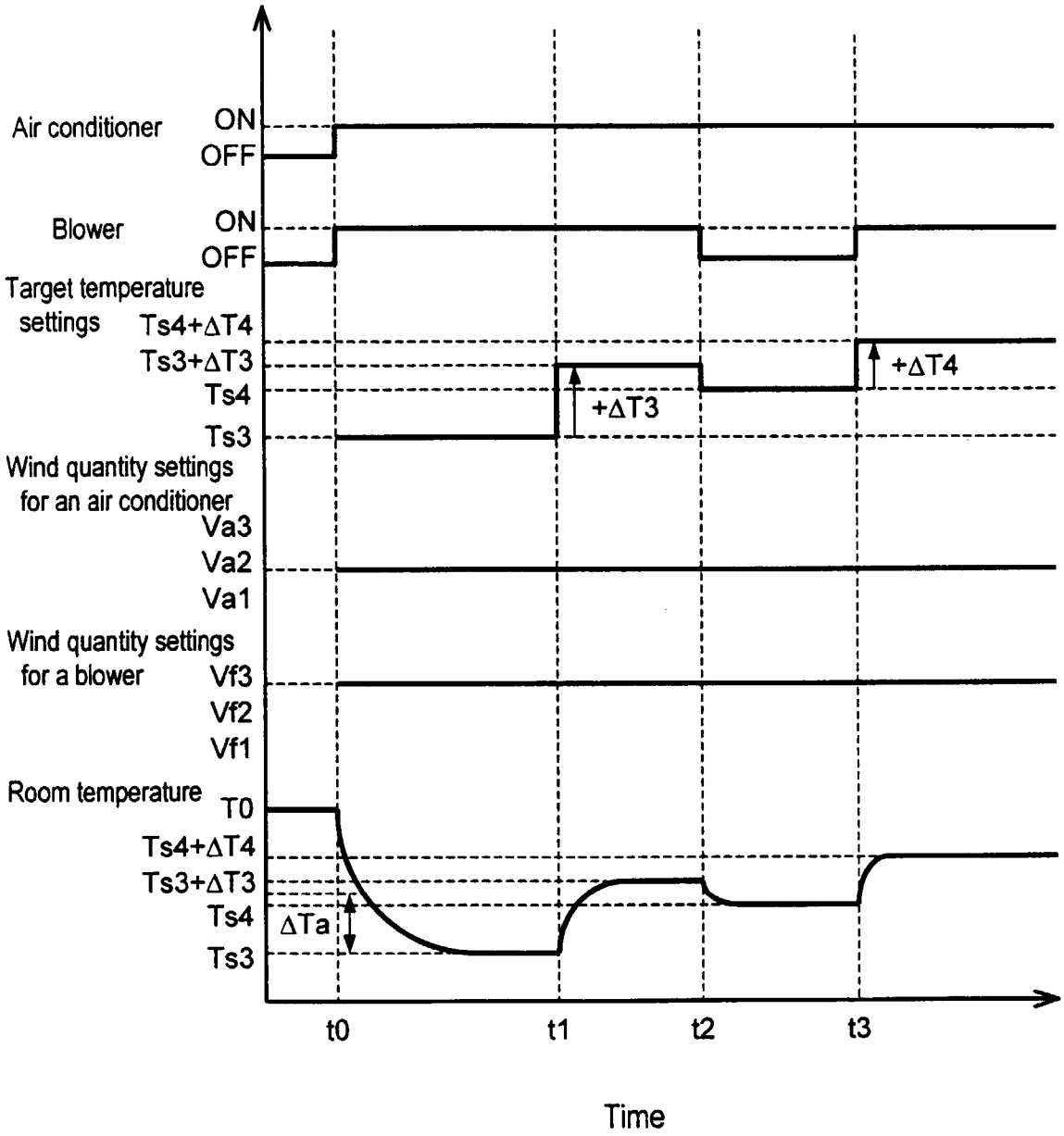

Larger wind quantity
Region where an shift amount of an target temperature = 0
Wind quantity setting region for an air conditioner
Smaller wind quantity
Region where the shift amount of the target temperature > 0
Smaller wind quantity
Wind quantity setting region for an blower
Larger wind quantity

FIG. 4


Air conditioner
ON
OFF
Blower
ON
OFF
Target temperature settings
Ts4+ΔT4
Ts3+ΔT3
Ts4
Ts3
+ΔT4
+ΔT3
Wind quantity settings for an air conditioner
Va3
Va2
Va1
Wind quantity settings for a blower
Vf3
Vf2
Vf1
Room temperature
T0
Ts4+ΔT4
Ts3+ΔT3
Ts4
Ts3
ΔTa
t0
t1
t2
t3
Time