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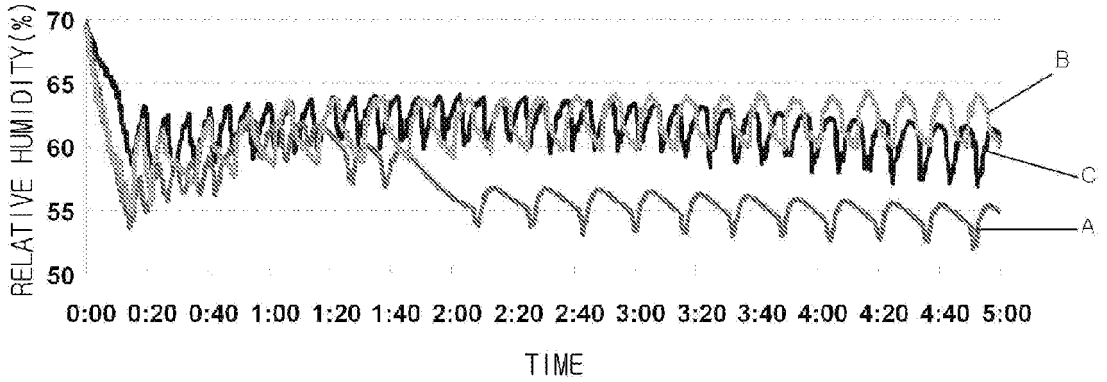
(54) Air conditioner, control method thereof and dehumidifying method thereof

(57) An air conditioner, a control method thereof, and a dehumidifying method thereof are provided. The air conditioner comprises an air-conditioning unit (10) and an input unit (20), and a control unit (50). The air-conditioning unit (10) exchanges heat between a cooling medium flowing therein and the air in the interior and exterior spaces so as to dehumidify the interior space. The input unit (20) receives a signal for selecting a mode for dehumidifying the interior space and an input dehumidifying temperature. The control unit (50) controls the air-conditioning unit (10) to continuously dehumidify, for a preset dehumidifying time, the interior space at a set dehumidifying temperature, which is set to increase by degrees depending upon the input dehumidifying temperature when the input unit receives the selection signal and the input dehumidifying temperature.

Fig. 3



EP 2 354 692 A2

Description

BACKGROUND

[0001] The present disclosure relates to an air conditioner, and more particularly, to an air conditioner having a dehumidifying function, a control method thereof, and a dehumidifying method thereof.

[0002] An air conditioner is a home appliance designed to condition the air in the interior space, i.e. to conduct cooling and/or heating the air in the interior space. Recently, an air conditioner having a dehumidifying function for dehumidifying the interior space has come out. However, the dehumidifying function of the air conditioner is not enough to dehumidify the interior space and excessive power is consumed to dehumidify the interior space.

SUMMARY

[0003] Embodiments provide an air conditioner, a control method thereof, and a dehumidifying method thereof that are designed to dehumidify the interior space more efficiently.

[0004] Embodiments also provide an air conditioner, a control method thereof, and a dehumidifying method thereof that are designed to dehumidify the interior space more economically.

[0005] In one embodiment, an air conditioner includes: an air-conditioning unit exchanging heat between a cooling medium flowing therein and the air in the interior and exterior spaces so as to dehumidify the interior space; an input unit receiving a signal for selecting a mode for dehumidifying the interior space and an input dehumidifying temperature; and a control unit controlling the air-conditioning unit to continuously dehumidify, for a preset dehumidifying time, the interior space at a set dehumidifying temperature, which is set to increase by degrees depending upon the input dehumidifying temperature when the input unit receives the selection signal and the input dehumidifying temperature.

[0006] In another embodiment, in an air conditioner including an air-conditioning unit exchanging heat between a cooling medium flowing therein and the air of the interior and exterior spaces, an input unit receiving an operation signal for the air-conditioning unit, and a control unit controlling the air-conditioning unit according to the operation signal received by the input unit, a control method includes: the input unit receiving a signal for selecting a dehumidifying mode and an input dehumidifying temperature; and the control unit controlling the air-conditioning unit to continuously dehumidify the interior space at a set dehumidifying temperature, which is set to increase by degrees according to the input dehumidifying temperature, for a dehumidifying time, which is set according to a value of the set dehumidifying temperature.

[0007] According to preferred embodiments, the set dehumidifying temperature increases by degrees according to the input dehumidifying temperature so as to enable the interior space to be dehumidified efficiently, providing a user with a more comfortable environment.

[0008] Further, power consumption for dehumidifying the interior space may be reduced, enabling the interior space to be dehumidified more economically.

[0009] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a schematic view illustrative of an embodiment of an air conditioner.

Fig. 2 is a flow diagram illustrative of a procedure of a control method of the air conditioner according to an embodiment.

Fig. 3 is a graphic chart illustrative of a comparison result of a dehumidifying efficiency between an embodiment and the related art.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0011] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0012] Fig. 1 is a schematic view illustrative of an embodiment of an air conditioner.

[0013] Referring to Fig. 1, the air conditioner carries out the operation of conditioning the air in the interior space, i.e. cooling and/or heating the air in the interior space. In the present embodiment, the air conditioner also carries out the operation of dehumidifying the interior space. The air conditioner includes an air-conditioning unit 10, an input unit 20, an internal thermometer 30, an external thermometer 40, and a control unit 50.

[0014] Particularly, the air-conditioning unit 10 is used for air-conditioning and dehumidifying the interior space. The air-conditioning unit 10 may include heat-exchange parts, e.g. a compressor, an external heat-exchanger, an expansion valve, an internal heat-exchanger and the like. Air conditioning and dehumidification of the interior space is conducted by heat exchange between the cooling medium circulating through the air-conditioning unit 10 and the air of the interior and exterior spaces. The construction of the air-conditioning unit 10 has already been known in the art and a detailed explanation thereof will be omitted.

[0015] The input unit 20 receives a signal for air conditioning and dehumidification of the interior space. Particularly the input unit 20 receives a signal for selecting a mode for dehumidifying the interior space and an input dehumidifying temperature T0. Here, the input dehumidifying temperature T0 indicates a dehumidifying temperature of the interior space that a user expects.

[0016] The internal thermometer 30 detects the temperature of the interior space. The external thermometer 40 detects the temperature of the exterior space.

[0017] The control unit 50 controls the air-conditioning unit 10 to air-condition or dehumidify the interior space according to the input signal received by the input unit 20. Particularly, when the input unit 20 receives the selection signal for the dehumidifying mode and the input dehumidifying temperature T0, the control unit 50 controls the air-conditioning unit 10 to dehumidify the interior space at a set dehumidifying temperature T, which is set according to the input dehumidifying temperature T0, for a preset dehumidifying time t.

[0018] Here, the set dehumidifying temperature T is set to increase step by step. For example, the set dehumidifying temperature T is set in such manner that, if the input dehumidifying temperature T0 is below 22°C, it is set to increase by one degrees within the range from 22°C to 28°C. Further, if the input dehumidifying temperature T0 ranges from 22°C to 27°C, the set dehumidifying temperature T is set to increase by one degrees within the range from a value, which is obtained by raising a vale below the decimal of the input dehumidifying temperature T0, to 28°C. If the input dehumidifying temperature T0 exceeds 27°C, the set dehumidifying temperature T is set to 28°C. Exemplary setting of the set dehumidifying temperature T according to the input dehumidifying temperature T, which is done by the control unit 50, is shown in table 1 below.

Table 1

Input Temp.	≤22°C	22°C< ≤23°C	23°C< ≤24°C	24°C< ≤25°C	25°C< ≤26°C	26°C< ≤27°C	27°C< ≤28°C
Set Temp.	22°C						
	23°C	23°C					
	24°C	24°C	24°C				
	25°C	25°C	25°C	25°C			
	26°C	26°C	26°C	26°C	26°C		
	27°C	27°C	27°C	27°C	27°C	27°C	
	28°C	28°C	28°C	28°C	28°C	28°C	28°C

[0019] Thus, for example, if the input dehumidifying temperature T0 is 22°C, the set dehumidifying temperature°C T is set to increase by one degrees within the range from 22°C to 28°C. Thus, if the input dehumidifying temperature T0 is 22°C, the set dehumidifying temperature T is set to 22°C, 23°C, 24°C, 25°C, 26°C, 27°C, and 28°C, which increases by one degrees. If the input dehumidifying temperature T0 is 25°C, the set dehumidifying temperature T is set to 25°C, 26°C, 27°C, and 28°C, which increases by one degrees. For convenience of explanation, the set dehumidifying temperatures, which are set to the range from 22°C to 28°C, will be hereinafter referred to as first to seventh set dehumidifying temperatures T1, T2, T3, T4, T5, T6 and T7.

[0020] The set dehumidifying temperature T is compensated according to the temperature difference between internal temperature detected by the internal thermometer 30 and external temperature detected by the external thermometer 40. In the present embodiment, at the time when the set dehumidifying temperature T increases from 26°C to 27°C by one degree, if the temperature difference between the interior and the exterior is above 5°C, the set dehumidifying temperature T is set to 28°C that increases from 26°C not by one degree, but by two degrees. In other words, if the set dehumidifying temperature T is 26°C, the interior space is dehumidified at the set dehumidifying temperature T such that, if the temperature difference between the interior and the exterior is above 5°C at the time when the dehumidifying time t (fifth dehumidifying time t5 to be described later) passed, which is set according to the set dehumidifying temperature T, the set dehumidifying temperature T is set not to 27°C, but to 28°C. This is done for the purpose of, in case of the

temperature range, which substantially has a little influence on the dehumidification of the interior space, increasing the set dehumidifying temperature T thereby to reduce the power for the dehumidification and the temperature difference between the interior and the exterior, which can increase the user's adaptability when the user goes out of doors.

[0021] The dehumidifying time t is set differently according to the set dehumidifying temperature T, i.e. first to seventh dehumidifying temperatures T1 to T7. Here, the dehumidifying time t is set to increase according to the set dehumidifying temperature T. For example, if the set dehumidifying temperature T is set to the values described in table 1, the dehumidifying time t can be set to the values described in table 2.

Table 2

Set Temp.	22°C	23°C	24°C	25°C	26°C	27°C	28°C
Dehumidifying Time	19min	23min	30min	35min	40min	54min	70min

[0022] That is, at the first dehumidifying temperature T1, the dehumidifying time t is set to the time less than 21 minutes, preferably 19 minutes. At the second dehumidifying temperature T2, the dehumidifying time t is set to the time ranging between 21 minutes and 26 minutes, e.g. 23 minutes. At the third dehumidifying temperature T3, the dehumidifying time t is set to the time ranging between 26 minutes and 33 minutes, e.g. 30 minutes. At the fourth dehumidifying temperature T4, the dehumidifying time t is set to the time ranging between 33 minutes and 38 minutes, e.g. 35 minutes. At the fifth dehumidifying temperature T5, the dehumidifying time t is set to the time ranging between 38 minutes and 47 minutes, e.g. 40 minutes. At the sixth dehumidifying temperature T6, the dehumidifying time t is set to the time ranging between 47 minutes and 62 minutes, e.g. 54 minutes. Finally, at the seventh dehumidifying temperature T7, the dehumidifying time t is set to the time ranging above 62 minutes, e.g. 70 minutes. For convenience of explanation, the dehumidifying time t will be hereinafter referred to as first to seventh dehumidifying times t1 to t7 at the first to seventh dehumidifying temperatures T1 to T7, respectively.

[0023] A control method of the air conditioner according to an embodiment will now be described in detail with reference to the accompanied drawings.

[0024] Fig. 2 is a flow diagram illustrative of a procedure of the control method of the air conditioner according to an embodiment, and Fig. 3 is a graphic chart illustrative of a comparison result of a dehumidifying efficiency between an embodiment and the related art.

[0025] Referring to Fig. 2, the input unit 20 receives an input dehumidifying temperature T0 (S11). Here, the input unit 20 may receive the input dehumidifying temperature T0 by the unit of 1°C, 0.5°C or 0.1°C.

[0026] The control unit 50 determines whether or not the input dehumidifying temperature T0 received by the input unit 20 is below 22°C (S13). If it is determined to be below 22°C, the set dehumidifying temperature T is set to 22°C, i.e. the first dehumidifying temperature T1 (S15). Then, the control unit 50 controls the air-conditioning unit 10 to dehumidify the interior space at the first dehumidifying temperature T1.

[0027] Next, the control unit 50 determines whether the first dehumidifying time t1 passes or not after the dehumidification of the interior space starts at the first dehumidifying temperature T1 (S17). Then, if the first dehumidifying time t1 is determined to pass, the set dehumidifying temperature T is set to the second dehumidifying temperature T2, i.e. 23°C that increases by one degree from the first dehumidifying temperature T1 (S19). Then, the control unit 50 controls the air-conditioning unit 10 to dehumidify the interior space at the second dehumidifying temperature T2.

[0028] Similar to the step of S19, the set dehumidifying temperature T increases by one degrees from the second dehumidifying temperature T2 of 23°C to the fifth dehumidifying temperature T5 of 26°C, (S23), (S27), and (S31). That is, the set dehumidifying temperature T is set in series to the third to fifth dehumidifying temperatures T3, T4, and T5.

[0029] The control unit 50 controls the air-conditioning unit 10 to dehumidify the interior space at the third to fifth dehumidifying temperatures T3, T4, and T5. Similar to the step of S21, the control unit 50 determines whether the respective third to fifth dehumidifying times t3 to t5 pass or not after starting dehumidification of the interior space at the respective third to fifth dehumidifying temperatures T3 to T5 (S25), (S29), and (S33). If it is determined that the respective third to fifth have passed, S27, S31, and S35 are performed.

[0030] However, if S33 determines the fifth dehumidifying time t5 has passed, the control unit 50 determines whether the temperature difference ΔT between the interior and exterior temperatures, which are respectively detected by the internal thermometer 30 and the external thermometer 40, is above 5°C or not (S35). If S35 determines the temperature difference ΔT is below 5°C, the set dehumidifying temperature T is set to the sixth dehumidifying temperature T6 of 26°C that increases by one degree from the fifth dehumidifying temperature T5 (S37). Next, the control unit 50 controls the air-conditioning unit 10 to dehumidify the interior space at the sixth dehumidifying temperature T6, and determines whether the sixth dehumidifying time t6 has passed or not after starting of the dehumidification of the interior space at the sixth dehumidifying temperature T6 (S39) .

[0031] If S39 determines the sixth dehumidifying time t6 has passed, the set dehumidifying temperature T is set to the seventh dehumidifying temperature T7 (S41). Thus, the control unit 50 controls the air-conditioning unit 10 to dehumidify the interior at the seventh dehumidifying temperature T7. The control unit 50 determines whether the seventh dehumidifying time t7 has passed or not after starting of the dehumidification of the interior at the seventh dehumidifying temperature T7 (S43). If S43 determines the seventh dehumidifying time t7 has passed, the dehumidification of the interior is terminated.

[0032] Meanwhile, S35 determines the temperature difference ΔT is above 5°C, S41 and S43 are carried out. That is, the set dehumidifying temperature T is set to the seventh dehumidifying temperature T7 of 27°C that increases by two degrees from the fifth dehumidifying temperature T5, and the dehumidification of the interior is conducted at the seventh dehumidifying temperature T7 for the seventh dehumidifying time t7. That is, the temperature difference ΔT is above 5°C, S37 in which the set dehumidifying temperature T is set to the sixth dehumidifying temperature T6, and S39 in which the dehumidification of the interior is conducted at the sixth dehumidifying temperature T6 for the sixth dehumidifying time t6 are omitted.

[0033] Meanwhile, S13 determines that the input dehumidifying temperature T0 is not below 22°C, the control unit 50 determines whether the input dehumidifying temperature T0 is below 23°C, i.e. between 22°C and 23°C (S45). If S45 determines that the input dehumidifying temperature T0 ranges between 22°C and 23°C, S19 to S43 are carried out. Similarly, if S45 determines that the input dehumidifying temperature T0 ranges below 22°C, the control unit 50 determines whether the input dehumidifying temperature T0 ranges between 23°C and 24°C, between 24°C and 25°C, between 25°C and 26°C, or between 26°C and 27°C or not (S47), (S49), (S51), and (S53). Then, the control unit 50 controls the air-conditioning unit to carry out S23 to S43, S27 to S43, S31 to S43, or S35 to S43, respectively, according to the input dehumidifying temperature T0 that is determined at S47, S49, S51, and S53.

[0034] Referring now to Fig. 3, the dehumidifying efficiencies of the present embodiment and the related art can be compared. In the drawing, A denotes relative humidity of the interior when the interior is dehumidified according to the embodiment as time passes. B and C are also the relative humidity when the interior is dehumidified according to the related art as time passes. It can be seen that the relative humidity of the case A is considerably reduced relative to those of the cases B and C. According to the present embodiment, the relative humidity is considerably reduced as compared to the related art, a more pleasant environment may be provided.

[0035] Further, according to the related art, the power of about 190W is consumed for dehumidifying the interior. However, according to the present embodiment, only the power of about 900W, which corresponds to about 60% of the power consumption for the related art, is consumed for the dehumidification. Thus, according to the present embodiment, the dehumidification of the interior may be conducted more economically.

[0036] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art that fall within the scope of the claims.

Claims

1. An air conditioner comprising:

an air-conditioning unit exchanging heat between a cooling medium flowing therein and the air in the interior and exterior spaces so as to dehumidify the interior space;
an input unit receiving a signal for selecting a mode for dehumidifying the interior space and an input dehumidifying temperature; and
a control unit controlling the air-conditioning unit to continuously dehumidify, for a preset dehumidifying time, the interior space at a set dehumidifying temperature, which is set to increase by degrees depending upon the input dehumidifying temperature when the input unit receives the selection signal and the input dehumidifying temperature.

2. The air conditioner according to claim 1, wherein the control unit sets the set dehumidifying temperature to any one temperature value allocated for a plurality of reference temperature ranges, which are the preset continuous temperature ranges and to which the input dehumidifying temperature belongs, and controls the air-conditioning unit to continuously dehumidify the interior space according to the set dehumidifying temperature allocated to any one of the reference temperature ranges, to which the input dehumidifying temperature belongs, and the set dehumidifying temperature allocated to other reference temperature range exceeding the former allocated range, to which the

input dehumidifying temperature belongs.

3. The air conditioner according to claim 1, wherein the input unit sets, if the input dehumidifying temperature is below 22°C, the set dehumidifying temperature to increase by one degrees within the range from 22°C to 28°C; if the input dehumidifying temperature ranges from 22°C to 27°C, the set dehumidifying temperature to increase by one degrees within the range from a value, which is obtained by raising a vale below the decimal of the input dehumidifying temperature, to 28°C; and if the input dehumidifying temperature exceeds 27°C, the set dehumidifying temperature to 28°C.

4. The air conditioner according to claim 3, wherein the air conditioner comprises internal and external thermometers for detecting internal and external temperatures,
wherein the control unit compares a temperature difference between the interior and the exterior and a preset reference temperature difference at the time when the set dehumidifying temperature increases step by step to the preset reference temperature; if the temperature difference is below the reference temperature difference, sets the set dehumidifying temperature to a value that increase step by step by one degrees; and if the temperature difference exceeds the reference temperature difference, sets the set dehumidifying temperature to a value that increases step by step by two degrees.

5. The air conditioner according to claim 4, wherein the reference temperature is 27°C.

6. The air conditioner according to claim 4, wherein the reference temperature difference is 5°C.

7. The air conditioner according to claim 1, wherein the dehumidifying time is set differently according to the value of the set dehumidifying temperature.

8. The air conditioner according to claim 1, wherein at the respective dehumidifying temperatures of 22°C, 23°C, 24°C, 25°C, 26°C, 27°C, the dehumidifying time is set to the range below 21 minutes, between 21 minutes and 26 minutes, between 26 minutes and 33 minutes, between 33 minutes and 38 minutes, between 38 minutes and 47 minutes, between 47 minutes and 62 minutes, and above 62 minutes, respectively.

9. The air conditioner according to claim 1, wherein at the respective dehumidifying temperatures of 22°C, 23°C, 24°C, 25°C, 26°C, 27°C, the dehumidifying time is set to the value of 19 minutes, 23 minutes, 30 minutes, 35 minutes, 40 minutes, 54 minutes, and 70 minutes, respectively.

10. A control method of an air conditioner comprising an air-conditioning unit exchanging heat between a cooling medium flowing therein and the air of the interior and exterior spaces, an input unit receiving an operation signal for the air-conditioning unit, and a control unit controlling the air-conditioning unit according to the operation signal received by the input unit, the method comprises:

    receiving, at the input unit, a signal for selecting a dehumidifying mode and an input dehumidifying temperature; and
    controlling, at the control unit, the air-conditioning unit to continuously dehumidify the interior space at a set dehumidifying temperature, which is set to increase by degrees according to the input dehumidifying temperature, for a dehumidifying time, which is set according to a value of the set dehumidifying temperature.

11. The control method according to claim 10, wherein the control unit sets the set dehumidifying temperature to any one temperature value allocated for a plurality of reference temperature ranges, which are the preset continuous temperature ranges and to which the input dehumidifying temperature belongs, and controls the air-conditioning unit to continuously dehumidify the interior space according to the set dehumidifying temperature allocated to any one of the reference temperature ranges that the input dehumidifying temperature belongs to and the set dehumidifying temperature allocated to other reference temperature range exceeding the former allocated range that the input dehumidifying temperature belongs to.

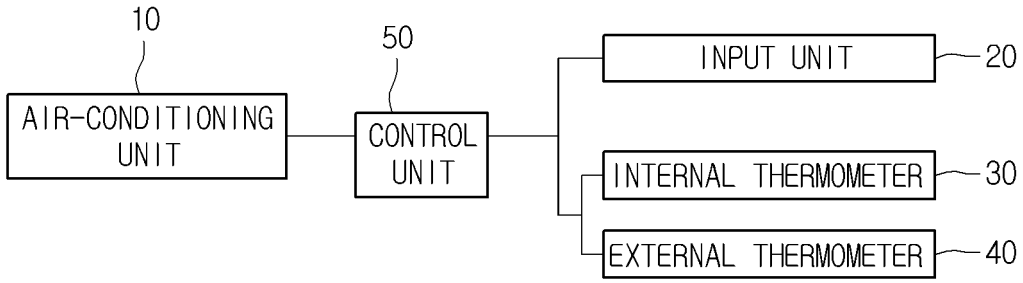
12. The control method according to claim 10, wherein the control unit sets, if the input dehumidifying temperature is below 22°C, the set dehumidifying temperature to increase by one degrees within the range from 22°C to 28°C; if the input dehumidifying temperature ranges from 22°C to 27°C, the set dehumidifying temperature to increase by one degrees within the range from a value, which is obtained by raising the input dehumidifying temperature, to 28°C; and if the input dehumidifying temperature exceeds 27°C, the set dehumidifying temperature to 28°C.

13. The control method according to claim 12, wherein the method comprises detecting, at internal and external thermometers, internal and external temperatures,
wherein if a temperature difference between the interior and the exterior exceeds 5°C at a time when the set dehumidifying temperature increases step by step from 26°C to 27°C, the control unit compensates the set dehumidifying temperature to 28°C.

14. The control method according to claim 10, wherein the control unit sets the dehumidifying temperature by setting the dehumidifying time to the range below 21 minutes, between 21 minutes and 26 minutes, between 26 minutes and 33 minutes, between 33 minutes and 38 minutes, between 38 minutes and 47 minutes, between 47 minutes and 62 minutes, and above 62 minutes, respectively, at the respective dehumidifying temperatures of 22°C, 23°C, 24°C, 25°C, 26°C, 27°C, and 28°C.

15. The control method according to claim 10, wherein the control unit sets the dehumidifying temperature (t) by setting the dehumidifying time (t) to the value of 19 minutes, 23 minutes, 30 minutes, 35 minutes, 40 minutes, 54 minutes, and 70 minutes, respectively, at the respective dehumidifying temperatures of 22°C, 23°C, 24°C, 25°C, 26°C, 27°C, and 28°C.

Fig.1


10
AIR-CONDITIONING UNIT
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CONTROL UNIT
INPUT UNIT
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INTERNAL THERMOMETER
30
EXTERNAL THERMOMETER
40

Fig. 2

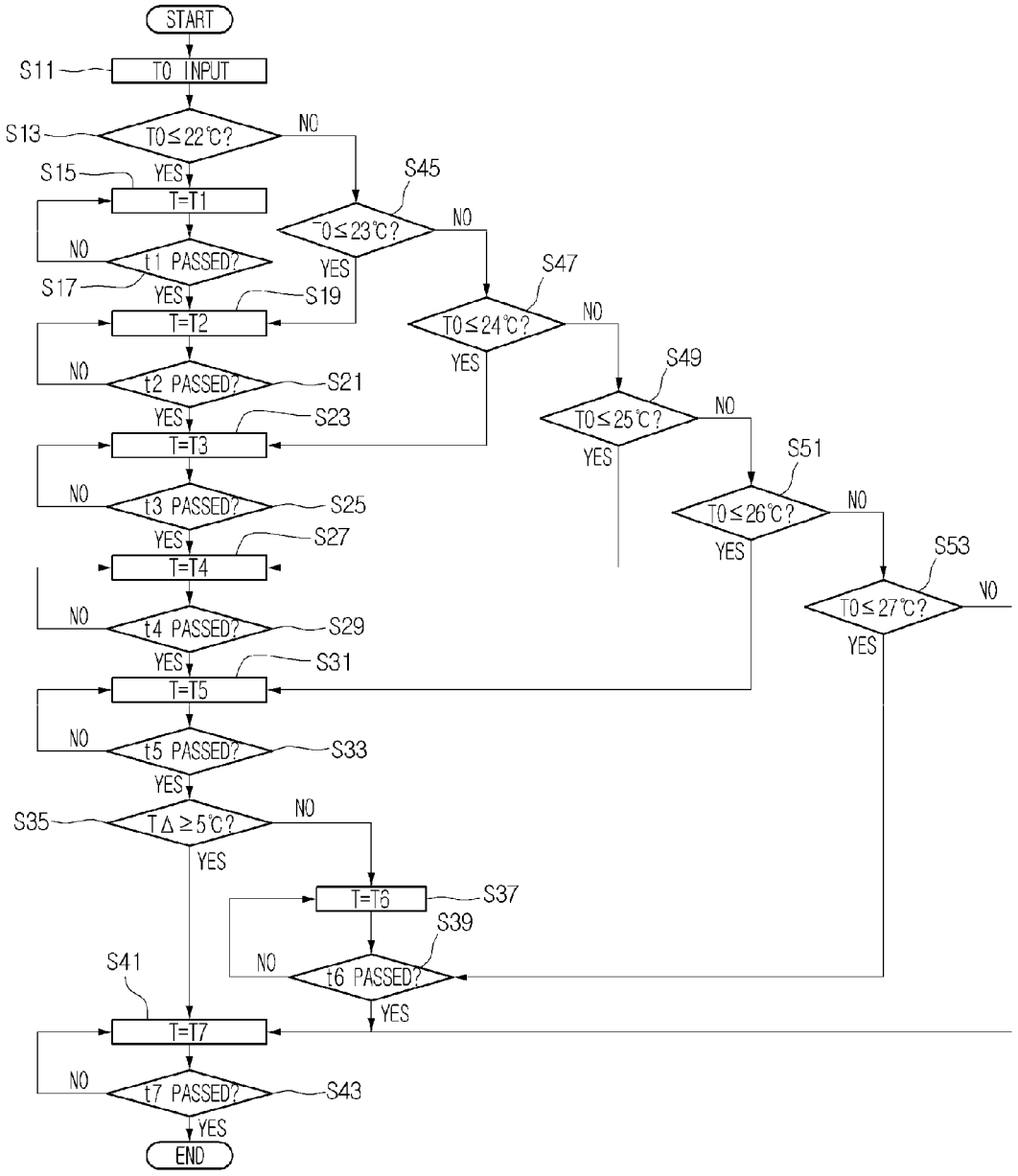
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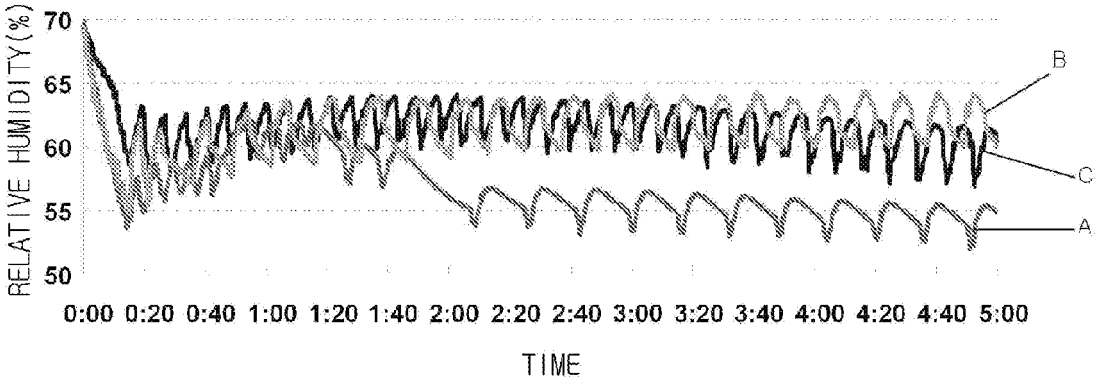
Fig. 3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