

(19)



(11)

EP 1 925 887 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
30.08.2017 Bulletin 2017/35

(51) Int Cl.:
F24F 11/00 ^(2006.01)

(21) Application number: **07108537.7**

(22) Date of filing: **21.05.2007**

(54) **Apparatus and method for controlling air current in sleep mode of air conditioner**

Vorrichtung und Verfahren zur Steuerung des Luftstroms einer Klimaanlage im Schlafmodus

Appareil et procédé de contrôle du courant d'air en mode de veille pour un climatiseur

(84) Designated Contracting States:
ES GB IT

(30) Priority: **22.11.2006 KR 20060116079**

(43) Date of publication of application:
28.05.2008 Bulletin 2008/22

(73) Proprietor: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-do, 443-742 (KR)

(72) Inventors:
• **Song, Myung Seob**
Gyeonggi-do (KR)

- **Seo, Kook Jeong,**
No.101-1304, Cheongdeokmaeul-gwangdo-
Giheung-gu, Yongin-si,
Gyeonggi-do (KR)
- **Kim, Hyung Chel**
Busan (KR)

(74) Representative: **Grünecker Patent- und**
Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)

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EP 1 925 887 B1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 2006-0116079, filed November 22, 2006, in the Korean Intellectual Property Office.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a method for controlling an air current in a sleep mode of an air conditioner to save power, and more particularly, to an apparatus and method for controlling an air current in a sleep mode of an air conditioner, in which the directions of air discharged through discharge holes while creating a comfortable sleeping environment.

2. Description of the Related Art

[0003] Generally, air conditioners are apparatuses for cooling or heating an indoor space, and supplies cool or warm air due to characteristics of that a refrigerant absorbs surrounding heat when the refrigerant in a liquid state is evaporated and emits the heat when the refrigerant is liquefied using a conventional refrigerating cycle obtained by circulating the refrigerant.

[0004] Recently, the air conditioners are operated in various automatic modes for creating a comfortable indoor environment including a dehumidifying mode for dehumidifying without changing an indoor temperature. The above various automatic modes include a sleep mode, which is selected by a user when the user wants to sleep.

[0005] A sleep mode of a conventional air conditioner employs a method for controlling the directions of discharged air such that an air current is not directly transferred to a user in a sleeping state. The Korean Patent Laid-open Publication No. 2002-0002796 discloses such an air conditioner.

[0006] The air conditioner disclosed in the Patent is operated in a sleep mode for providing a comfortable sleeping environment by adjusting the angles of blades according to the direction of air, selected by a user, in an initial state of the sleep mode so as to control the directions of air discharged through discharge holes, and by adjusting the angles of the blades to produce an indirect wind in which the discharged air is not directly transferred to the user, when a designated time has elapsed.

[0007] In the above conventional method for controlling the directions of the discharged air, when a designated time from the start of the sleep mode has elapsed, the indirect wind in which the air current is not directly transferred to the user, is produced. Since the air current always produces the indirect wind regardless of temperature to be controlled, cool air is not directly transferred to the user. Thus, the user cannot easily fall asleep in

the sweltering heat on tropical night in summer.

[0008] Further, the number of rotations of an indoor fan is regularly adjusted in the sleep mode of the air conditioner regardless of whether a compressor is operated, thus increasing user sensitivity to the air current when the compressor is switched off and causing discomfort to the user. Thereby, power consumption is increased also.

[0009] EP 1 811 239 A2 discloses a method of controlling a blowing direction in a sleeping operation of an air conditioner. The air conditioner comprises a main body having at least one discharge port through which heat-exchanged air is discharged. The method comprises determining whether or not a current operation mode is the sleeping operation, determining whether or not a sleeping operation period is input if it is determined that the current operation mode is the sleeping operation, and controlling flow of air discharged through the discharge port according to subdivided modes of the sleeping operation if it is determined that the sleeping operation period is input, the subdivided modes comprising an initial sleeping mode corresponding to an initial stage of the sleeping operation, an in-sleeping mode corresponding to a middle stage of the sleeping operation, and an awakening mode corresponding to a final stage of the sleeping operation.

SUMMARY OF THE INVENTION

[0010] It is the object of the present invention to provide an improved apparatus and method for controlling an air current in a sleep mode of an air conditioner.

[0011] This object is solved by the subject matter of the independent claims.

[0012] Preferred embodiments are defined by the dependent claims.

[0013] According to an aspect of the present invention, there is provided an apparatus and method for controlling an air current in a sleep mode of an air conditioner, in which the directions of discharged air are controlled according to an indoor temperature in the sleep mode, thus providing a comfortable sleeping environment to a user. Therefore, one aspect of the invention is to provide an apparatus and method for controlling an air current in a sleep mode of an air conditioner, in which the directions of discharged air are controlled according to an indoor temperature in the sleep mode, thus providing a comfortable sleeping environment to a user.

[0014] A non-claimed embodiment discloses to provide an apparatus and method for controlling an air current in a sleep mode of an air conditioner, in which the volume of discharged air is controlled by adjusting a number of rotations of an indoor unit according to whether a compressor is operated, thus reducing power consumption while reducing user sensitivity to the air current.

[0015] In accordance with one aspect, the present invention provides a method for controlling an air current in a sleep mode of an air conditioner having blades for

adjusting directions of discharged air, comprising determining whether the inputted operating mode is the sleep mode; sensing an indoor temperature, when it is determined that the inputted operating mode is the sleep mode; and comparing the sensed indoor temperature with a set control temperature, and adjusting the directions of the discharged air according to the results of the comparison.

[0016] The control temperature is set by user's instructions, or is set to a default value, which is predetermined.

[0017] The adjustment of the directions of the discharged air includes controlling the directions of discharged air to produce one selected from the group consisting of an indirect wind, an indirect intermittent wind, and a direct intermittent wind according to the results of the comparison.

[0018] The indirect wind is produced by locating the blades at angles, where a user does not directly sense the air current, when the indoor temperature is lower than the control temperature.

[0019] The indirect intermittent wind is produced by swinging the blades such that the time for locating the blades at angles, where a user does not directly sense the air current, is longer than the time for locating the blades at angles, where the user directly senses the air current, when the indoor temperature is not lower than the control temperature and is not higher than a first temperature, which is higher than the control temperature.

[0020] The direct intermittent wind is produced by swinging the blades such that the time for locating the blades at angles, where a user directly senses the air current, is longer than the time for locating the blades at angles, where the user does not directly sense the air current, when the indoor temperature is higher than the first temperature. A non-claimed embodiment discloses a method for controlling an air current in a sleep mode of an air conditioner having an indoor fan for adjusting volume of discharged air, comprising determining whether the inputted operating mode is the sleep mode; sensing an indoor temperature, when it is determined that the inputted operating mode is the sleep mode; determining whether a compressor is operated by comparing the sensed indoor temperature with a set control temperature; and differently adjusting the minimum number of rotations of the indoor fan according to the results of the determination.

[0021] The adjustment of the minimum number of rotations of the indoor fan includes adjusting the minimum number of rotations of the indoor fan when the compressor is switched off to be smaller than the minimum number of rotations of the indoor fan when the compressor is switched on.

[0022] In accordance with another aspect, the present invention provides an apparatus for controlling an air current in a sleep mode of an air conditioner, comprising blades for adjusting the directions of discharged air; an input unit for selecting an operating mode according to user's instructions; a temperature sensing unit for sens-

ing an indoor temperature when the sleep mode is selected by the input unit; and a control unit for comparing the sensed indoor temperature with a set control temperature and adjusting the directions of the blades according to the results of the comparison, so as to control the directions of the discharged air.

[0023] The control unit controls the directions of the discharged air by locating the directions of the blades at angles to produce an indirect wind, where a user does not directly sense the air current, when the indoor temperature is lower than the control temperature.

[0024] The control unit controls the directions of the discharged air by swinging the blades such that the time for locating the blades at angles, where a user does not directly sense the air current, is longer than the time for locating the blades at angles, where the user directly senses the air current, to produce an indirect intermittent wind, when the indoor temperature is not lower than the control temperature and is not higher than a first temperature, which is higher than the control temperature.

[0025] The control unit controls the directions of the discharged air by swinging the blades such that the time for locating the blades at angles, where a user directly senses the air current, is longer than the time for locating the blades at angles, where the user does not directly sense the air current, to produce a direct intermittent wind, when the indoor temperature is higher than the first temperature.

[0026] The apparatus further comprises an indoor fan for controlling volume of the discharged air, and the control unit determines whether a compressor is operated according to the results of the comparison, and differently adjusting the minimum number of rotations of the indoor fan according to the results of the determination.

[0027] In accordance with another non-claimed embodiment, there is provided an apparatus for controlling an air current in a sleep mode of an air conditioner, comprising an indoor fan for adjusting volume of discharged air; an input unit for selecting an operating mode according to user's instructions; a temperature sensing unit for sensing an indoor temperature when the sleep mode is selected by the input unit; and a control unit for comparing the sensed indoor temperature with a set control temperature, determining whether a compressor is operated according to the results of the comparison, and differently adjusting the minimum number of rotations of the indoor fan according to the results of the determination.

[0028] The control unit controls the minimum number of rotations of the indoor fan when the compressor is switched off to be smaller than the minimum number of rotations of the indoor fan when the compressor is switched on.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodi-

ments, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of an indoor unit of an air conditioner in accordance with the present invention;

FIG. 2 is a control diagram or an apparatus for controlling an air current in a sleep mode of the air conditioner in accordance with one embodiment of the present invention;

FIG. 3 is a flow chart illustrating a method for controlling an air current in a sleep mode of an air conditioner by adjusting directions of discharged air in accordance with one embodiment of the present invention; and

FIG. 4 is a flow chart illustrating a method for controlling an air current in a sleep mode of an air conditioner by adjusting a number of rotations of an indoor fan for saving power in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Reference will now be made in detail to the embodiments of the present invention, an example of which is illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the annexed drawings.

[0031] FIG. 1 is a perspective view of an indoor unit of an air conditioner in accordance with the present invention, more particularly, a stand-type air conditioner, in which air is discharged from three surfaces.

[0032] As shown in FIG. 1, suction holes 12 for inhaling indoor air therethrough are formed through the lower portions of the side surfaces of an indoor unit 10, and a plurality of discharge holes 14, 16, and 18 for discharging the air, inhaled through the suction holes 12, to an indoor space therethrough are formed through the upper portion of the indoor unit 10.

[0033] The plurality of discharge holes 14, 16, and 18 include a left discharge hole 14 formed through the upper portion of the left side surface of the indoor unit 10, a right discharge hole 16 formed through the upper portion of the right side surface of the indoor unit 10, and a front discharge hole 18 formed through the central portion of the front surface of the indoor unit 10.

[0034] Blades 14a, 16a, and 18a for opening and closing the discharge holes 14, 16, 18 and adjusting the directions of air discharged through the discharge holes 14, 16, and 18 are respectively provided in the discharge holes 14, 16, and 18. First to third stepping motors 14b, 16b, and 18b for rotating the blades 14a, 16a, and 18a are respectively provided at the blades 14a, 16a, and 18a.

[0035] The first to third stepping motors 14b, 16b, and 18b for separately rotating the blades 14a, 16a, and 18a

provided in the discharge holes 14, 16, and 18 are respectively provided at the blades 14a, 16a, and 18a, and rotate the blades 14a, 16a, and 18a at designated angles according to rotating amounts thereof.

[0036] When a variable reluctance type stepping motor having an excellent rotational angle resolution is used as the first to third stepping motors 14b, 16b, and 18b, the blades 14a, 16a, and 18a can change their directions continuously as well as by stages, thus being operated in a swing mode. Any power unit, which can change the directions of the blades 14a, 16a, and 18a continuously as well as by stages, may be used as the first to third stepping motors 14b, 16b, and 18b.

[0037] The stepping motors 14b, 16b, and 18b are driven, and thus rotate connection members (not shown) connected to driving shafts of the stepping motors 14b, 16b, and 18b. Thereby, the rotational angles of the blades 14a, 16a, and 18a are changed. The directions of air discharged through the discharge holes 14, 16, and 18 are adjusted according to the changed rotational angles of the blades 14a, 16a, and 18a, and the discharge holes 14, 16, and 18 are opened and closed according to the rotational angles of the blades 14a, 16a, and 18a. The blades 14a, 16a, and 18a are rotated in the range of an angle of 0° to 70°.

[0038] For convenience of description, the blade 14a provided in the left discharge hole 14 is referred to as the left blade, the blade 16a provided in the right discharge hole 16 is referred to as the right blade, and the blade 18a provided in the front discharge hole 18 is referred to as the front blade.

[0039] An indoor heat exchanger 20 for converting indoor air inhaled through the suction holes 12 into cool air or warm air through latent heat of vaporization of a refrigerant and an indoor fan 22 for blowing the air, which has been heat-exchanged by the indoor heat exchanger 20, are installed in the indoor unit 10.

[0040] FIG. 2 is a control diagram of an apparatus for controlling an air current in a sleep mode of an air conditioner in accordance with one embodiment of the present invention. The apparatus includes an input unit 100, an indoor temperature sensing unit 110, a control unit 120, a compressor driving unit 130, an indoor fan driving unit 140, a blade driving unit 150, and a display unit 160.

[0041] The input unit 100 includes a key operating unit or a remote controller signal receiving unit so as to input an operating mode (for example, a cooling, heating or sleep mode) and operation data, such as a control temperature (Ts), a designated volume of air, and a designated direction of air. The indoor temperature sensing unit 110 senses the temperature (Tr) of indoor air inhaled into the indoor unit 10.

[0042] The control unit 120 is a micro computer for controlling a cooling, heating or sleep operation according to the operating mode inputted by the input unit 100. In the sleep mode, the control unit 120 adjusts the angles of the blades 14a, 16a, and 18a according to the results

of comparison between the indoor temperatures (T_r) and the control temperature (T_s) to control the directions of air discharged through the discharge holes 14, 16, and 18, and differently adjusts the number of rotations of the indoor fan 22 according to whether a compressor 132 is operated to control the volume of the discharged air.

[0043] In the sleep mode, the control unit 120 adjusts the angles of the blades 14a, 16a, and 18a according to the results of the comparison between the indoor temperatures (T_r) and the control temperature (T_s), thus controlling the directions of air discharged through the discharge holes 14, 16, and 18. The above directions of air controlled by the control unit 120 are defined, as follows.

[0044] First, the discharged air having a direction, which directly faces a user so as to sense an air current, by adjusting the angles of the blades 14a, 16a, and 18a, is defined as a direct wind, the discharged air having a direction, which does not directly face the user so as not to sense an air current, by adjusting the angles of the blades 14a, 16a, and 18a, is defined as an indirect wind, and the discharged air having a direction, which intermittently faces the user so as to intermittently sense an air current, by adjusting the angles of the blades 14a, 16a, and 18a, is defined as an intermittent wind.

[0045] Here, the intermittent wind is obtained by the reciprocation (swing) of the blades 14a, 16a, and 18a between an angle producing the direct wind and an angle producing the indirect wind. Particularly, the intermittent wind, which is obtained by the stay of the blades 14a, 16a, and 18a at the angle producing the direct wind for a longer time than the angle producing the indirect wind, is defined as a direct intermittent wind, and the intermittent wind, which is obtained by the stay of the blades 14a, 16a, and 18a at the angle producing the indirect wind for a longer time than the angle producing the direct wind, is defined as an indirect intermittent wind.

[0046] The angles of the blades 14a, 16a, and 18a producing the direct wind, the indirect wind, the direct intermittent wind, and the indirect intermittent wind and the times to blowing the direct wind, the indirect wind, the direct intermittent wind, and the indirect intermittent wind are stored in a ROM table of the control unit 120.

[0047] For example, in the stand-type air conditioner, in which air is discharged from three surfaces, in accordance with the present invention, when the front blade 18a turns in the downward direction, air discharged through the front discharge hole 18 produces a direct wind, and when the front blade 18a turns in the horizontal or upward direction, air discharged through the front discharge hole 18 produces an indirect wind. Further, when the left and right blades 14a and 16a turn in the convergent direction, air discharged through the left and right discharge holes 14 and 16 produces a direct wind, and when the left and right blades 14a and 16a turn in the divergent direction, air discharged through the left and right discharge holes 14 and 16 produces an indirect wind.

[0048] Accordingly, as the results of the comparison between the indoor temperature (T_r) and the control tem-

perature (T_s), when the indoor temperature (T_r) is lower than the control temperature (T_s) ($T_r < T_s$), the control unit 120 controls the directions of air discharged through the discharge holes 14, 16, and 18 so as to produce the indirect wind, when the indoor temperature (T_r) is not lower than the control unit (T_s) and is not higher than the control temperature (T_s) + P ($T_s \leq T_r \leq T_s + P$), the control unit 120 controls the directions of air discharged through the discharge holes 14, 16, and 18 so as to produce the indirect intermittent wind, and when the indoor temperature (T_r) is higher than the control temperature (T_s) + P ($T_r > T_s + P$), the control unit 120 controls the directions of air discharged through the discharge holes 14, 16, and 18 so as to produce the direct intermittent wind. Here, the control temperature (T_s) may be a temperature, which is set by a user, or a temperature pattern, which is programmed in the sleep mode.

[0049] The compressor driving unit 130 controls the operation of the compressor 132 according to the control signal of the control unit 120, and the indoor fan driving unit 140 controls the operation of the indoor fan 22 according to the control signal of the control unit 120.

[0050] The blade driving unit 150 includes the stepping motors 14b, 16b, and 18b for controlling the positions and the swing angles of the blades 14a, 16a, and 18a so as to adjust the directions of air discharged through the discharge holes 14, 16, and 18 according to the control signal of the control unit 120.

[0051] The display unit 160 displays the operating state and the error mode of the air conditioner according to the display control signal of the control unit 120. The display unit 160 visually displays the directions of the blades 14a, 16a, and 18a, which are changed by stages, thus informing the present directions of the blades 14a, 16a, and 18a to a user.

[0052] Hereinafter, a method for controlling an air current in a sleeping mode of an air conditioner using the above apparatus will be described.

[0053] First, discharged air having a direction, which makes a user directly sense an air current, is defined as a direct wind, discharged air having a direction, which does not make the user directly sense the air current, is defined as an indirect wind, and discharged air having a direction, which makes the user intermittently sense an air current, is defined as an intermittent wind. Particularly, the intermittent wind, in which the time for blowing the direct wind is longer than the time for blowing the indirect wind, is defined as a direct intermittent wind, and the intermittent wind, in which the time for blowing the indirect wind is longer than the time for blowing the direct wind, is defined as an indirect intermittent wind.

[0054] In the stand-type air conditioner, in which air is discharged from three surfaces, in accordance with the present invention, when the front blade 18a turns in the downward direction and the left and right blades 14a and 16a turn in the convergent direction, air discharged through the discharge holes 14, 16, and 18 produces a direct wind, and when the front blade 18a turns in the

horizontal or upward direction and the left and right blades 14a and 16a turn in the divergent direction, air discharged through the discharge holes 14, 16, and 18 produces an indirect wind. Further, when the front blade 19a swings up and down and the left and right blades 14a and 16a swing right and left, air discharged through the discharge holes 14, 16, and 18 produces an intermittent wind.

[0055] FIG. 3 is a flow chart illustrating a method for controlling an air current in a sleep mode of an air conditioner in accordance with the present invention. Hereinafter, a cooling operation of the air conditioner will be described.

[0056] First, an operating mode (for example, a cooling, heating or sleep mode) and operation data (for example, a sleep operation time, a control temperature, etc. in the sleep mode) corresponding to the operating mode are inputted to the control unit 120 through the input unit 100 according to user's instructions.

[0057] The control unit 120 determines whether a sleep mode is inputted (S200). When it is determined that the sleep mode is not inputted, the control unit 120 operates the compressor 132 through the compressor driving unit 130, and adjusts the positions of the blades 14a, 16a, and 18a and the volume of air discharged from the indoor fan 22 according to values set by the user, thus performing a normal cooling operation (S202).

[0058] As the results of the determination, when it is determined that the sleep mode is inputted, the control unit 120 determines whether the sleep operation time is inputted through the input unit 100 according to user's instructions, before the sleep mode is operated (S204). When it is determined that the sleep operation time is not inputted, the control unit 120 sets the sleep operation time to a default value (approximately 8 hours), which is predetermined in the control unit 120 (usually, a period from the time of going to bed to the time of getting up from bed) (S206).

[0059] When it is determined that the sleep operation time is inputted, the control unit 120 determines whether the control temperature (Ts) in the sleep mode is inputted through the input unit 100 according to user's instructions (S208). When it is determined that the control temperature (Ts) in the sleep mode is not inputted, the control unit 120 sets the control temperature (Ts) to a default value, which is predetermined in the control unit 120, (S210).

[0060] As described above, when the sleep operation time and the control temperature (Ts) in the sleep mode are inputted to the control unit 120 according to user's instructions or are set to the default values, the control unit 120 senses an indoor temperature (Tr) through the indoor temperature sensing unit 110 so as to control the directions of air in the sleep mode (S212).

[0061] The control unit 120 compares the sensed indoor temperature (Tr) with the control temperature (Ts; approximately 27~28°C) (S214). As the results of the comparison, when it is determined that the sensed indoor

temperature (Tr) is lower than the control temperature (Ts), an indoor space has temperature conditions, which lowers the skin temperature of the user to go to bed, and thus the control unit 120 controls air discharged from the discharge holes 14, 16, and 18 to have a direction for producing an indirect wind so as to minimize the operation of a nerve center controlling the temperature of a human body (S216).

[0062] On the other hand, when it is determined that the sensed indoor temperature (Tr) is not lower than the control temperature (Ts), the control unit 120 determines whether the indoor temperature (Tr) is not lower than the control unit (Ts) and is not higher than the control temperature (Ts) + P (here, P is approximately 1°C) (S218). When it is determined that the indoor temperature (Tr) is not lower than the control unit (Ts) and is not higher than the control temperature (Ts) + P, the indoor space has temperature conditions, which maintains the comfortable state of the skin temperature of the user to go to bed, and thus the control unit 120 controls air discharged from the discharge holes 14, 16, and 18 to have a direction for producing an indirect intermittent wind (S220).

[0063] On the other hand, when it is determined that the sensed indoor temperature (Tr) is higher than the control temperature (Ts) + P, the indoor space has temperature conditions, which raises the skin temperature of the user, and thus control unit 120 controls air discharged from the discharge holes 14, 16, and 18 to have a direction for producing an direct intermittent wind so as to prevent the skin temperature from rising (S222).

[0064] As described above, the control unit 120 controls the directions of the air discharged from the discharge holes 14, 16, and 18 to produce the indirect wind, the indirect intermittent wind, or the direct intermittent wind according to the results of the comparison between the indoor temperature (Tr) and the control temperature (Ts), thus allowing the user to intermittently sense an air current and comfortably maintaining the skin temperature of the user. Further, the control unit 120 increases the control temperature (Ts), compared with the sleep mode of the conventional air conditioner, thus reducing power consumption.

[0065] Thereafter, the control unit 120 determines whether the predetermined sleep operation time has elapsed (S224). When it is determined that the sleep operation time has not elapsed, the method is fed back into the step S212. Thereby, in the sleep mode, the control unit 120 senses the indoor temperature (Tr), which is changed, and continuously controls the directions of the air discharged from the discharge holes 14, 16, and 18 to produce the indirect wind, the indirect intermittent wind, and the direct intermittent wind.

[0066] On the other hand, when it is determined that the sleep operation time has elapsed, the control unit 120 stops the operations of all loads, thus terminating the operation of the air conditioner in the sleep mode.

[0067] Hereinafter, a process for adjusting a number of rotations of the indoor fan 22 for saving power in the

sleep mode of the air conditioner in accordance with the present invention will be described.

[0068] FIG. 4 is a flow chart illustrating a method for controlling an air current in a sleep mode of an air conditioner by adjusting a number rotations of an indoor fan for saving power in accordance with another embodiment of the present invention. Some elements of FIG. 4 are substantially the same as those of FIG. 3, and a detailed description thereof will thus be omitted because it is considered to be unnecessary.

[0069] In FIG. 4, an operating mode (for example, a cooling, heating or sleep mode) and operation data (for example, a sleep operation time, a control temperature, etc. in the sleep mode) corresponding to the operating mode are inputted to the control unit 120 through the input unit 100 according to user's instructions.

[0070] The control unit 120 determines whether a sleep mode is inputted (S300). When it is determined that the sleep mode is not inputted, the control unit 120 performs a normal cooling operation (S302).

[0071] As the results of the determination, when it is determined that the sleep mode is inputted, the control unit 120 determines whether the sleep operation time is inputted through the input unit 100 according to user's instructions, before the sleep mode is operated (S304). When it is determined that the sleep operation time is not inputted, the control unit 120 sets a sleep operation time, which is predetermined in the control unit 120, to a default value (S306).

[0072] When it is determined that the sleep operation time is inputted, the control unit 120 determines whether the control temperature (Ts) in the sleep mode is inputted through the input unit 100 according to user's instructions (S308). When it is determined that the control temperature (Ts) in the sleep mode is not inputted, the control unit 120 sets a control temperature (Ts), which is predetermined in the control unit 120, to a default value (S310).

[0073] As described above, when the sleep operation time and the control temperature (Ts) in the sleep mode are inputted to the control unit 120 according to user's instructions or are set to the default values, the control unit 120 senses an indoor temperature (Tr) through the indoor temperature sensing unit 110 so as to switch on or off the compressor 132 (S312).

[0074] The control unit 120 determines whether the compressor 132 is switched on by comparing the indoor temperature (Tr) with the control temperature (Ts) (S314).

[0075] When it is determined that the compressor is switched on, the control unit 120 sets the minimum number of rotations of the indoor fan 22 to be larger than that of the indoor fan 22 when the compressor is switched off (S316). That is, the minimum number of rotations of the indoor fan 22 is set to approximately 300RPM.

[0076] When it is determined that the compressor is switched off, the control unit 120 sets the minimum number of rotations of the indoor fan 22 to be smaller than that of the indoor fan 22 (approximately, 300RPM)

when the compressor is switched on, as large as Q (approximately, 50RPM) (S318). That is, the minimum number of rotations of the indoor fan 22 is set to approximately 250RPM.

[0077] The minimum number of rotations of the indoor fan 22 when the compressor 132 is switched off is smaller than that of the indoor fan 22 when the compressor 132 is switched on, thus reducing user sensitivity to an air current when the discharged air produces an indirect wind while reducing power consumption.

[0078] Thereafter, the control unit 120 determines whether the predetermined sleep operation time has elapsed (S320). When it is determined that the sleep operation time has not elapsed, the method is fed back into the step S312. Thereby, in the sleep mode, the control unit 120 senses the indoor temperature (Tr), which has been changed, and adjusts the minimum number of rotations of the indoor fan 22 by determining whether the compressor 132 is switched on or off according to the results of the comparison between the indoor temperature (Tr) and the control temperature (Ts).

[0079] On the other hand, when it is determined that the sleep operation time has elapsed, the control unit 120 stops the operations of all loads, thus terminating the operation of the air conditioner in the sleep mode.

[0080] As apparent from the above description, the present invention provides an apparatus and method for controlling an air current in a sleep mode of an air conditioner, in which the directions of air discharged through discharge holes are differently adjusted according to the results of the comparison between an indoor temperature and a control temperature in the sleep mode so as to provide a comfortable sleeping environment to a user, and the control temperature is increased so as to reduce power consumption.

[0081] Further, since the volume of the discharged air is controlled by adjusting a number of rotations of an indoor unit according to whether a compressor is switched on, thus reducing power consumption while reducing user sensitivity to the air current.

[0082] Although embodiments of the invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the scope defined in the claims.

Claims

1. A method for controlling an air current in a sleep mode of an air conditioner having at least one blade for adjusting directions of discharged air, comprising:
 - determining (S200) whether the sleep mode is inputted;
 - sensing (S212) an indoor temperature, when it is determined that the sleep mode is inputted;
 - and

comparing (S214, S218) the sensed indoor temperature with a set control temperature, and adjusting (S216, S220, S222) the directions of the discharged air according to the results of the comparison,

characterized in that the adjustment of the directions of the discharged air includes controlling the directions of discharged air to produce one selected from the group consisting of an indirect wind, an indirect intermittent wind, and a direct intermittent wind according to the results of the comparison, wherein the indirect intermittent wind is produced by swinging the at least one blade (14a, 16a, 18a) such that the time for locating the at least one blade at angles, where a user does not directly sense the air current, is longer than the time for locating the at least one blade at angles, where the user directly senses the air current, when the indoor temperature is not lower than the control temperature and is not higher than a first temperature, which is higher than the control temperature.

2. The method according to claim 1, wherein the control temperature is set by user's instructions.
3. The method according to claim 1, wherein the control temperature is set to a default value, to which is predetermined.
4. The method according to claim 1, wherein the indirect wind is produced by locating the at least one blade (14a, 16a, 18a) at angles, where a user does not directly sense the air current, when the indoor temperature is lower than the control temperature.
5. The method according to claim 1, wherein the direct intermittent wind is produced by swinging the at least one blade (14a, 16a, 18a) such that the time for locating the at least one blade at angles, where a user directly senses the air current, is longer than the time for locating the at least one blade at angles, where the user does not directly sense the air current, when the indoor temperature is higher than the first temperature.
6. An apparatus for controlling an air current in a sleep mode of an air conditioner, comprising:

at least one blade (14a, 16a, 18a) for adjusting directions of discharged air;
an input unit (100) for selecting an operating mode according to user's instructions;
a temperature sensing unit (110) for sensing an indoor temperature when the sleep mode is selected by the input unit (100); and
a control unit (120) for comparing the sensed

indoor temperature with a set control temperature and adjusting the directions of the at least one blade according to the results of the comparison, so as to control the directions of the discharged air,

characterized in that the control unit (120) is adapted to control the directions of the discharged air by swinging the at least one blade such that the time for locating the at least one blade at angles, where a user does not directly sense the air current, is longer than the time for locating the at least one blade at angles, where the user directly senses the air current, to produce an indirect intermittent wind, when the indoor temperature is not lower than the control temperature and is not higher than a first temperature, which is higher than the control temperature.

7. The apparatus according to claim 6, wherein the control unit (120) is adapted to control the directions of the discharged air by locating the directions of the at least one blade (14a, 16a, 18a) at angles to produce an indirect wind, where a user does not directly sense the air current, when the indoor temperature is lower than the control temperature.
8. The apparatus according to claim 6, wherein the control unit (120) is further adapted to control the directions of the discharged air by swinging the at least one blade such that the time for locating the at least one blade at angles, where a user directly senses the air current, is longer than the time for locating the at least one blade at angles, where the user does not directly sense the air current, to produce a direct intermittent wind, when the indoor temperature is higher than the first temperature.
9. The apparatus according to claim 6, further comprising an indoor fan (22) for controlling volume of the discharged air, wherein the control unit (120) is further adapted to determine whether a compressor (132) is operated according to the results of the comparison, and differently adjusting the minimum number of rotations of the indoor fan (22) according to the results of the determination.

Patentansprüche

1. Verfahren zum Steuern eines Luftstroms in einem Schlafmodus einer Klimaanlage mit mindestens eine Lamelle zum Anpassen der Richtungen der ausgestoßenen Luft, umfassend:

Bestimmen (S200), ob der Schlafmodus eingegeben ist;

- Ermitteln (S212) einer Innentemperatur, wenn bestimmt wird, dass der Schlafmodus eingegeben ist; und
 Vergleichen (S214, S218), der ermittelten Innentemperatur mit einer eingestellten Steuertemperatur und Anpassen (S216, S220, S222) der Richtungen der ausgestoßenen Luft entsprechend den Ergebnissen des Vergleichs, **dadurch gekennzeichnet, dass** die Anpassungen der Richtungen der ausgestoßenen Luft das Steuern der Richtungen der ausgestoßenen Luft beinhaltet, um eines zu erzeugen, das aus der Gruppe gewählt wird, die aus einem indirekten Wind, einem indirekten intermittierenden Wind und einem direkten intermittierenden Wind besteht, entsprechend den Ergebnissen des Vergleichs, wobei der indirekte intermittierende Wind durch Schwingen der mindestens einen Lamelle (14a, 16a, 18a) solcherart erzeugt wird, dass die Zeit zum Positionieren der mindestens einen Lamelle auf Winkeln, auf welchen der Benutzer den Luftstrom nicht direkt spürt, länger als die Zeit zum Positionieren der einen Lamelle auf Winkeln ist, auf welchen der Benutzer den Luftstrom direkt spürt, wenn die Innentemperatur nicht niedriger als die Steuertemperatur und nicht höher als eine erste Temperatur ist, die höher als die Steuertemperatur ist.
2. Verfahren nach Anspruch 1, wobei die Steuertemperatur durch die Anweisungen des Benutzers eingestellt wird.
 3. Verfahren nach Anspruch 1, wobei die Steuertemperatur auf einen Standardwert eingestellt wird, der vorgegeben ist.
 4. Verfahren nach Anspruch 1, wobei der indirekte Wind durch Positionieren der mindestens einen Lamelle (14a, 16a, 18a) auf Winkeln erzeugt wird, auf welchen ein Benutzer den Luftstrom nicht direkt spürt, wenn die Innentemperatur niedriger als die Steuertemperatur ist.
 5. Verfahren nach Anspruch 1, wobei der indirekte intermittierende Wind durch Schwingen der mindestens einen Lamelle (14a, 16a, 18a) solcherart erzeugt wird, dass die Zeit zum Positionieren der mindestens einen Lamelle auf Winkeln, auf welchen der Benutzer den Luftstrom direkt spürt, länger als die Zeit zum Positionieren der einen Lamelle auf Winkeln ist, auf welchen der Benutzer den Luftstrom nicht direkt spürt, wenn die Innentemperatur höher als die erste Temperatur ist.
 6. Vorrichtung zum Steuern eines Luftstroms in einem Schlafmodus einer Klimaanlage, umfassend:
 - mindestens eine Lamelle (14a, 16a, 18a) zum Anpassen der Richtungen der ausgestoßenen Luft;
 - eine Eingabeeinheit (100) zum Auswählen eines Betriebsmodus entsprechend den Anweisungen des Benutzers;
 - eine Temperaturermittlungseinheit (110) zum Ermitteln einer Innentemperatur, wenn der Schlafmodus durch die Eingabeeinheit (100) ausgewählt wird; und
 - eine Steuereinheit (120) zum Vergleichen der ermittelten Innentemperatur mit einer eingestellten Steuertemperatur und Anpassen der Richtungen der mindestens einen Lamelle entsprechend den Ergebnissen des Vergleichs, um die Richtungen der ausgestoßenen Luft zu steuern, **dadurch gekennzeichnet, dass** die Steuereinheit (120) dazu eingerichtet ist, die Richtungen der ausgestoßenen Luft durch Schwingen der mindestens einen Lamelle solcherart zu steuern, dass die Zeit zum Positionieren der mindestens einen Lamelle auf Winkeln, auf welchen ein Benutzer den Luftstrom nicht direkt spürt, länger als die Zeit zum Positionieren der mindestens einen Lamelle auf Winkeln ist, auf welchen der Benutzer den Luftstrom direkt spürt, um einen indirekten intermittierenden Wind zu erzeugen, wenn die Innentemperatur nicht niedriger als die Steuertemperatur und nicht höher als eine erste Temperatur ist, die höher als die Steuertemperatur ist.
 7. Vorrichtung nach Anspruch 6, wobei die Steuereinheit (120) dazu eingerichtet ist, die Richtungen der ausgestoßenen Luft durch Positionieren der Richtungen der mindestens einen Lamelle (14a, 16a, 18a) auf Winkeln zu steuern, um einen indirekten Wind zu erzeugen, auf welchen ein Benutzer den Luftstrom nicht direkt spürt, wenn die Innentemperatur niedriger als die Steuertemperatur ist.
 8. Vorrichtung nach Anspruch 6, wobei die Steuereinheit (120) des Weiteren dazu eingerichtet ist, die Richtungen der ausgestoßenen Luft durch Schwingen der mindestens einen Lamelle solcher Art zu steuern, dass die Zeit zum Positionieren der mindestens einen Lamelle auf Winkeln, auf welchen ein Benutzer den Luftstrom direkt spürt, länger als die Zeit zum Positionieren der einen Lamelle auf Winkeln ist, auf welchen der Benutzer den Luftstrom nicht direkt spürt, um einen direkten intermittierenden Wind zu erzeugen, wenn die Innentemperatur höher als die erste Temperatur ist.
 9. Vorrichtung nach Anspruch 6, des Weiteren umfassend einen Innenventilator (22), zum Steuern der Menge der ausgestoßenen Luft,

wobei die Steuereinheit (120) des Weiteren zum Bestimmen eingerichtet ist, ob ein Kompressor (132) betätigt wird, entsprechend den Ergebnissen des Vergleichs, und zum unterschiedlichen Anpassen der Mindestanzahl an Umdrehungen des Innenventilator (42) entsprechend den Ergebnissen der Bestimmung.

Revendications

1. Procédé de contrôle du courant d'air en mode de veille pour un climatiseur possédant au moins une lame de réglage des directions de l'air diffusé, consistant:

à déterminer (S200) si l'on est passé en mode de veille;
à détecter une température intérieure, si l'on détermine que l'on est passé en mode de veille; et à comparer (S214, S218) la température intérieure détectée avec une température de contrôle fixée, et à ajuster (S216, S220, S222) les directions de l'air diffusé en fonction des résultats de la comparaison,

caractérisé en ce que le réglage des directions de l'air diffusé comprend le contrôle des directions de l'air diffusé pour produire un élément choisi parmi le groupe constitué par un vent indirect, un vent intermittent indirect et un vent intermittent direct en fonction des résultats de la comparaison,

dans lequel le vent intermittent indirect est produit en faisant pivoter ladite au moins une lame (14a, 16a, 18a) pour que le temps mis pour disposer ladite au moins une lame à des angles auxquels un utilisateur ne détecte pas directement le courant d'air, soit plus long que le temps mis pour disposer ladite au moins une lame à des angles auxquels l'utilisateur détecte directement le courant d'air, lorsque la température intérieure n'est pas inférieure à la température de contrôle et n'est pas supérieure à une première température, elle-même supérieure à la température de contrôle.

2. Procédé selon la revendication 1, dans lequel la température de contrôle est définie par les instructions de l'utilisateur.
3. Procédé selon la revendication 1, dans lequel la température de contrôle est fixée à une valeur par défaut, laquelle est prédéterminée.
4. Procédé selon la revendication 1, dans lequel le vent indirect est produit en disposer ladite au moins une lame (14a, 16a, 18a) à des angles auxquels un utilisateur ne détecte pas directement le courant d'air,

lorsque la température intérieure est inférieure à la température de contrôle.

5. Procédé selon la revendication 1, dans lequel le vent intermittent direct est produit en faisant pivoter ladite au moins une lame (14a, 16a, 18a) pour que le temps mis pour disposer ladite au moins une lame à des angles auxquels un utilisateur détecte directement le courant d'air, soit plus long que le temps mis pour disposer ladite au moins une lame à des angles auxquels l'utilisateur ne détecte pas directement le courant d'air, lorsque la température intérieure est supérieure à la première température.

6. Appareil de contrôle d'un courant d'air en mode de veille pour un climatiseur, comprenant:

au moins une lame (14a, 16a, 18a) pour régler les directions de l'air diffusé;

une unité d'entrée (100) pour sélectionner un mode de fonctionnement selon les instructions de l'utilisateur;

une unité de détection de température (110) pour détecter une température intérieure lorsque le mode de veille est sélectionné par l'unité d'entrée (100); et

une unité de contrôle (120) pour comparer la température intérieure détectée avec une température de commande fixée et régler les directions de ladite au moins une lame selon les résultats de la comparaison, de manière à contrôler les directions de l'air diffusé,

caractérisé en ce que l'unité de contrôle (120) est prévu pour contrôler les directions de l'air diffusé en faisant pivoter ladite au moins une lame pour que le temps mis pour disposer ladite au moins une lame à des angles auxquels un utilisateur ne détecte pas directement le courant d'air, soit plus long que le temps mis pour disposer ladite au moins une lame à des angles auxquels l'utilisateur détecte directement le courant d'air, pour produire un vent intermittent indirect, lorsque la température intérieure n'est pas inférieure à la température de contrôle et n'est pas supérieure à une première température, qui est supérieure à la température de contrôle.

7. Appareil selon la revendication 6, dans lequel l'unité de contrôle (120) est prévue pour contrôler les directions de l'air diffusé en disposant les directions de ladite au moins une lame (14a, 16a, 18a) à des angles de nature à produire un vent indirect, où un utilisateur ne détecte pas directement le courant d'air, lorsque la température intérieure est inférieure à la température de contrôle.

8. Appareil selon la revendication 6, dans lequel l'unité

de contrôle (120) est en outre prévue pour contrôler les directions de l'air diffusé en faisant pivoter ladite au moins une lame pour que le temps mis pour disposer ladite au moins une lame à des angles auxquels un utilisateur détecte directement le courant d'air, soit plus long que le temps mis pour disposer ladite au moins une lame à des angles auxquels l'utilisateur ne détecte pas directement le courant d'air, pour produire un vent intermittent direct, lorsque la température intérieure est supérieure à la première température.

9. Appareil selon la revendication 6, comprenant en outre un ventilateur intérieur (22) pour contrôler le volume de l'air diffusé, dans lequel l'unité de contrôle (120) est en outre prévue pour déterminer si un compresseur (132) est actionné en fonction des résultats de la comparaison et ajuster de manière différente le nombre minimal de rotations du ventilateur intérieur (22) en fonction des résultats de la détermination.

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Fig. 1

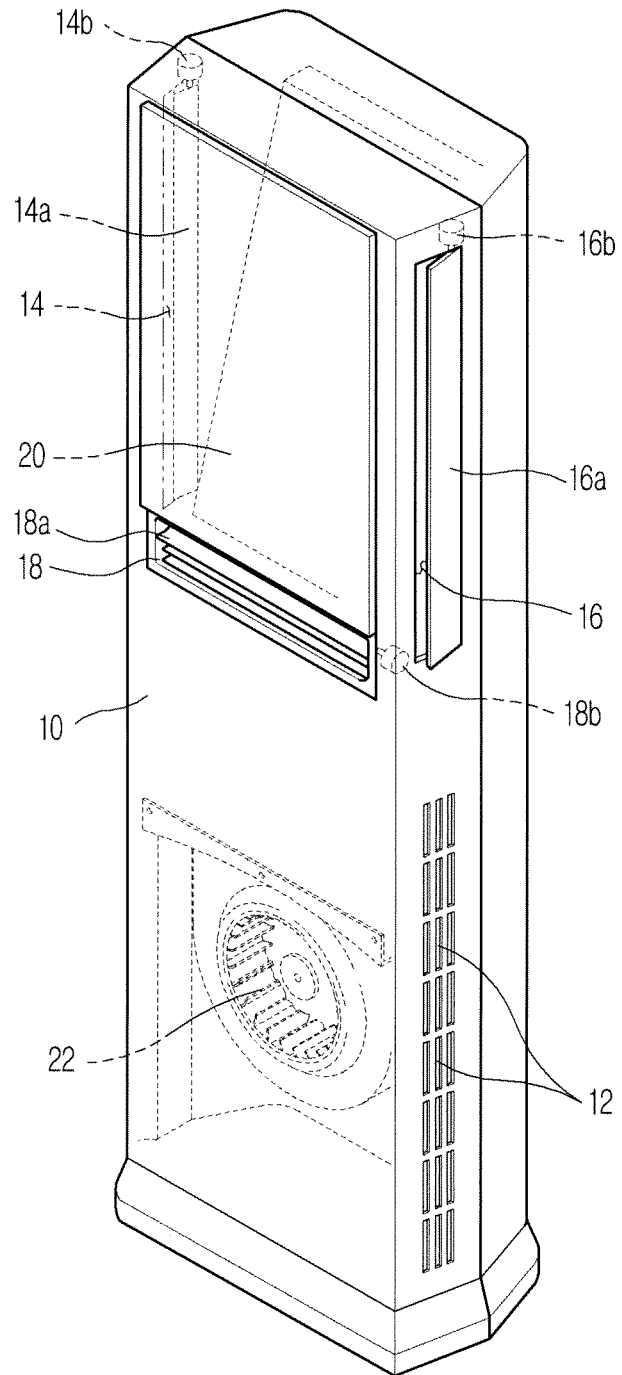


Fig. 2

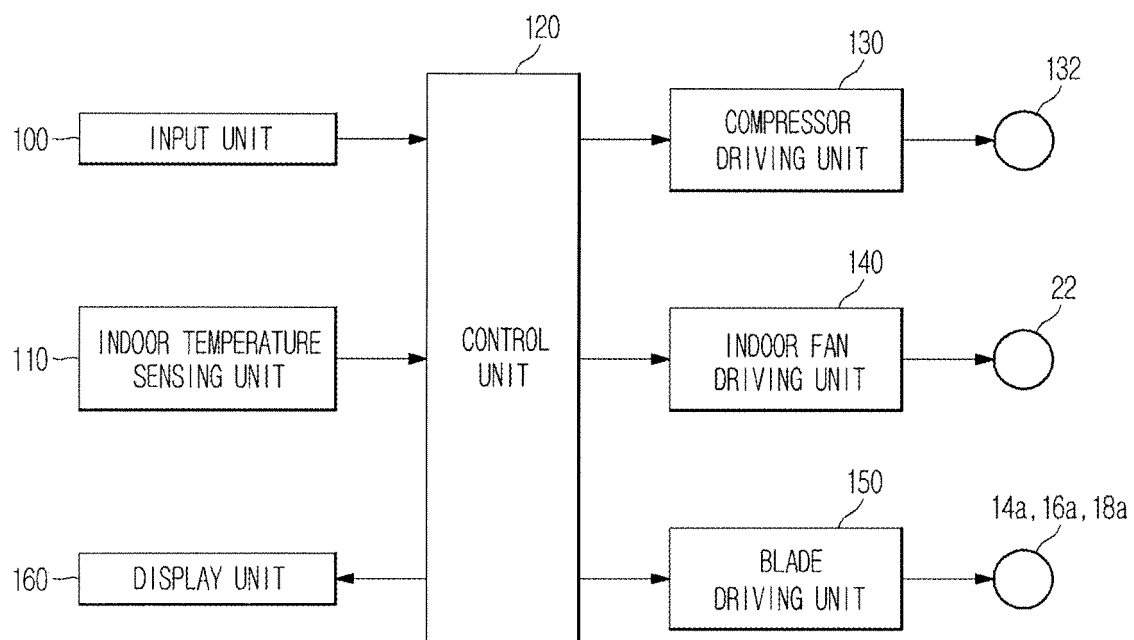


Fig. 3

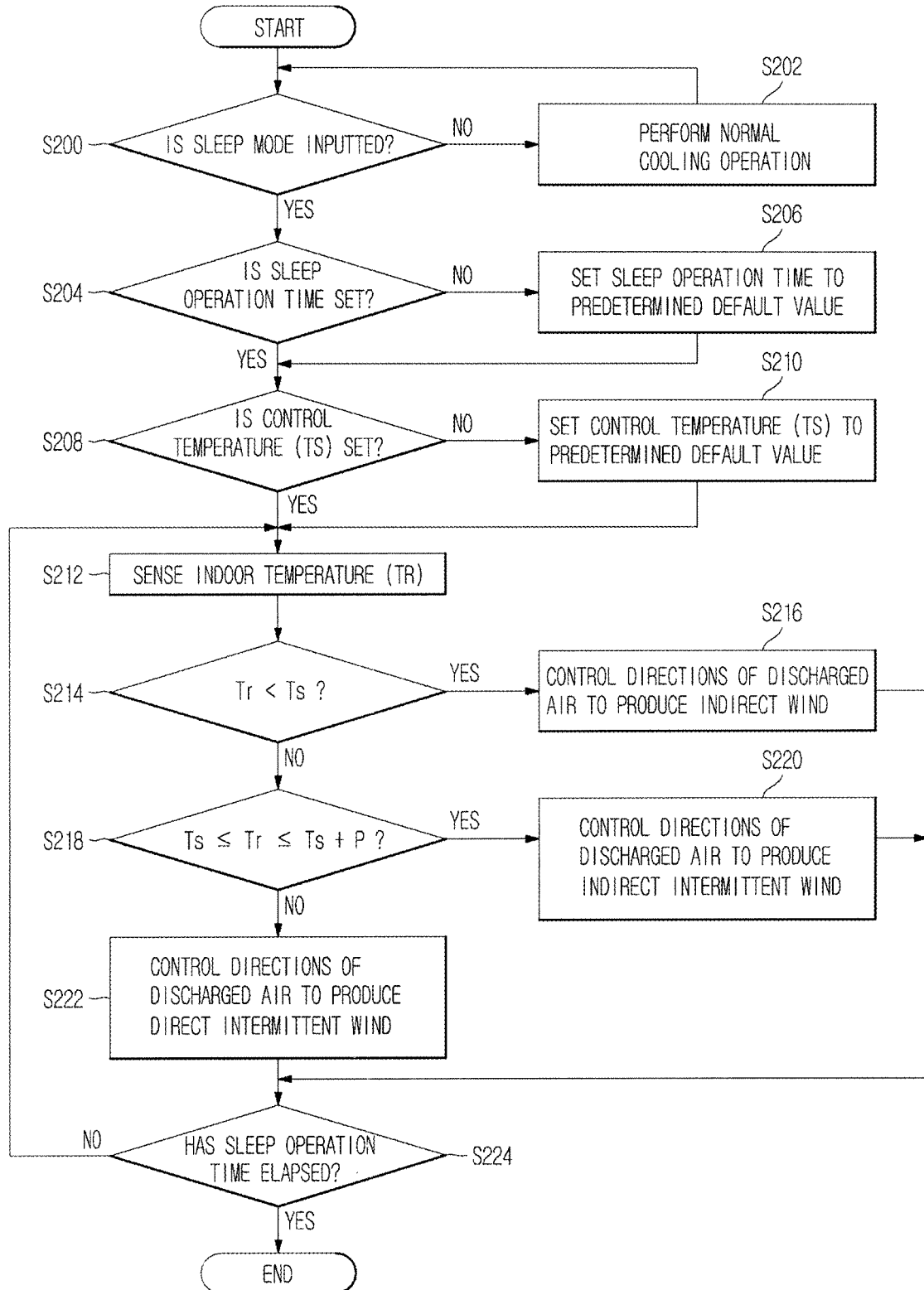
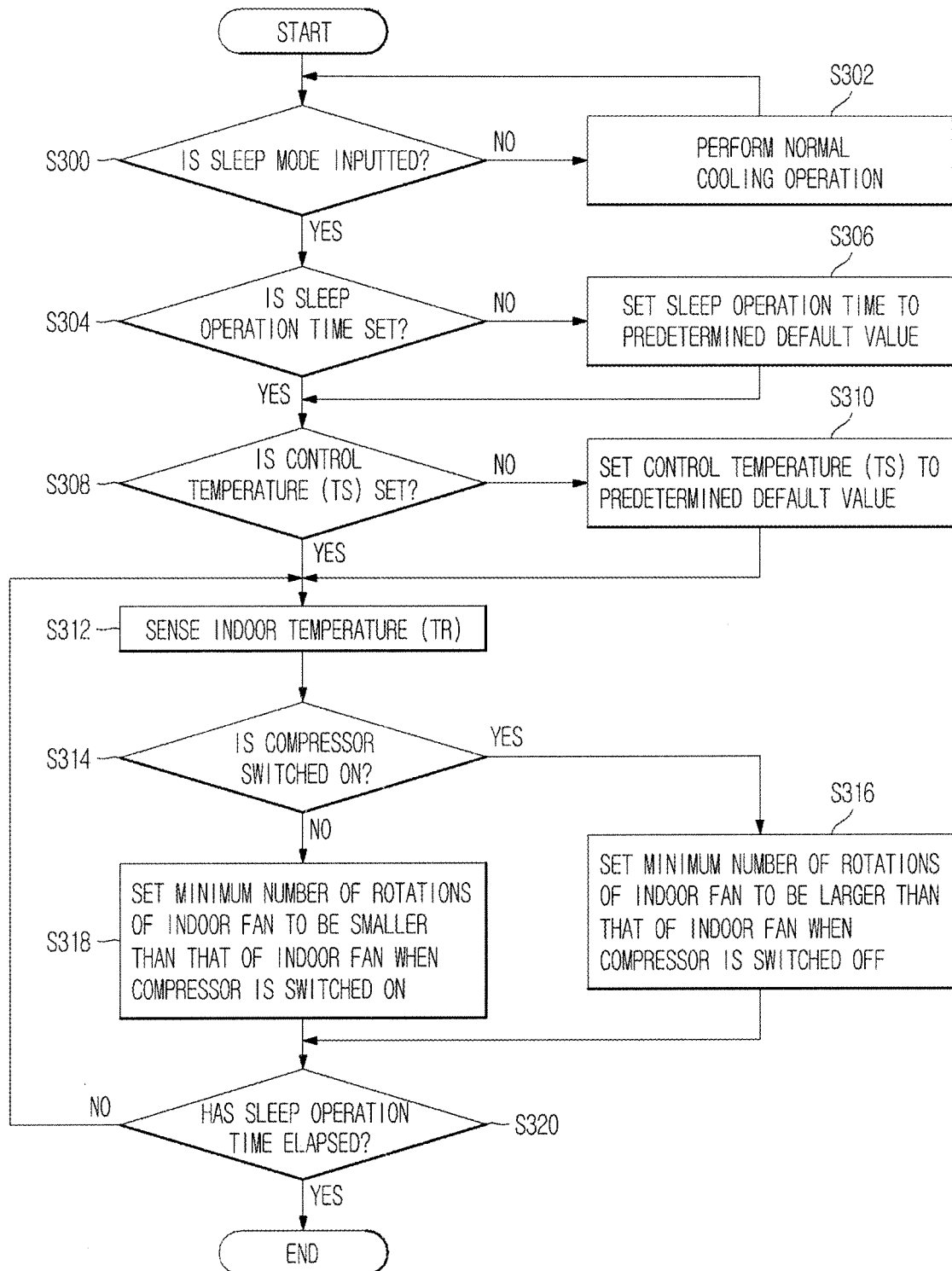


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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