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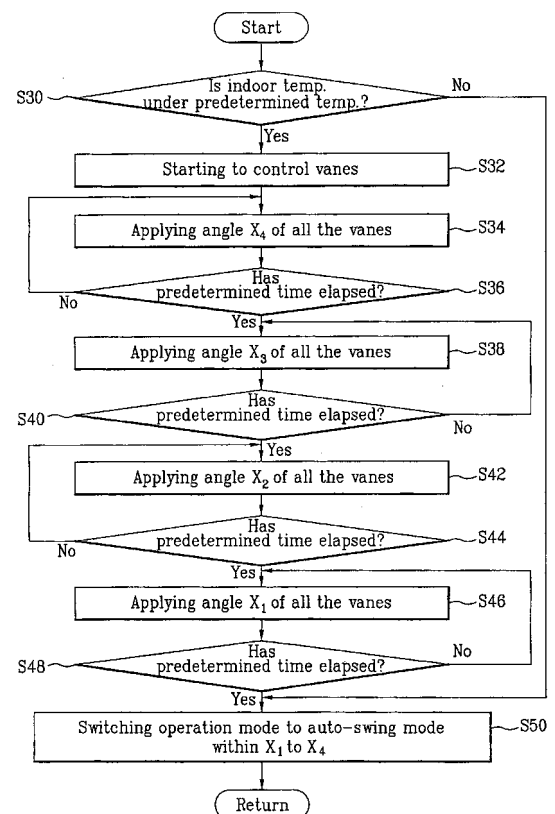
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(54) Method of controlling vanes of ceiling type air conditioner

(57) A method of controlling a ceiling type air conditioner to rapidly generate uniform airflow in a room is disclosed. The method includes the steps of controlling the angle of the vanes (21-24) to be a predetermined maximum angle ( $X_4$ ) to increase the airflow to a maximum airflow when initiating the ceiling type air conditioner, and decreasing the angle of the vanes from the maximum angle to a predetermined minimum angle ( $X_1$ ) step by step by a predetermined time interval to adjust the airflow. The airflow with the maximum rate can be supplied when initiating the air conditioner such that the chilled/heated airflow rapidly reaches the floor to improve the satisfaction of people in the indoor region. The rate of the airflow varies as time passes so that the uniform airflow can be rapidly supplied and the air conditioning efficiency can be improved.

FIG. 3



## Description

**[0001]** This application claims the benefit of Korean Patent Application No. P2005-0038853 filed on MAY 10, 2005, which is hereby incorporated by reference as if fully set forth herein.

**[0002]** The present invention relates to an air conditioner, and more particularly, to a method of controlling a ceiling type air conditioner to rapidly generate uniform airflow in a room.

**[0003]** In general, air conditioners are grouped into a stand type air conditioner, and a wall type air conditioner, and perform cooling and heating operations by adjusting direction of airflow using vanes.

**[0004]** Among them, the ceiling type air conditioner is mounted in the ceiling to supply airflow of a predetermined temperature to a room. The ceiling type air conditioner maintains the predetermined temperature by opening/closing the vanes positioned at the side of the ceiling type air conditioner to adjust the airflow.

**[0005]** Generally, a refrigerating cycle device, as shown in FIG. 1, includes a compressor 10 for compressing refrigerant into high-temperature-and-high-pressure refrigerant, a condenser 20 for changing the high-temperature-and-high-pressure refrigerant into a liquid refrigerant and discharging latent heat of the refrigerant to the exterior, an expansion device 30 for reducing the pressure of the refrigerant whose phase is changed into the liquid phase, and an evaporator 40 for evaporating the liquid refrigerant expanded by the expansion device 30 into vapor phase and absorbing external heat.

**[0006]** Here, since the condenser 20 and the evaporator 40 perform heat-exchange with the exterior, they are known as heat-exchangers.

**[0007]** The above-described refrigerating cycle device is employed in refrigerators for storing food in a fresh state using heat discharged from the condenser 20 and chilled air generated by the evaporator 40 and in air conditioners for maintaining comfortable indoor environment.

**[0008]** FIG. 2 is a view illustrating an external view of an apparatus to which a vane control of a conventional ceiling type air conditioner is applied. The apparatus, as shown in the drawing, performs air conditioning by opening/closing four vanes 21 to 24 simultaneously using a single stepping motor 25, a gear train 26, and a universal joint 27.

**[0009]** Here, the opening/closing of the vanes 21 to 24 is carried out to heat a floor rapidly when indoor temperature is under a predetermined temperature.

**[0010]** The vanes 21 to 24 are simultaneously opened at a predetermined angle to guide the airflow to flow in desired directions.

**[0011]** As such, since the ceiling type air conditioner is mounted on the ceiling, in comparison to the conventional air conditioner installed at a predetermined position of an indoor to condition air within a restricted space, the ceiling type air conditioner conditions and disperses in-

door air uniformly.

**[0012]** However, since in the conventional air conditioner the vanes are simultaneously opened and closed at a fixed angle, it takes a long time for the heated airflow to arrive at the floor. Thus, whole indoor temperature cannot be uniformly increased.

**[0013]** Due to this, since the uniformly heated airflow cannot be supplied evenly to the entire indoor region, the air conditioning efficiency is deteriorated and persons feel discomfort.

**[0014]** Accordingly, present invention is directed to a method of controlling vanes of a ceiling type air conditioner that substantially obviate one or more problems due to limitations and disadvantages of the related art.

**[0015]** A first object of the present invention is to provide a method of controlling vanes of a ceiling type air conditioner to rapidly supply heated/chilled airflow to the floor when initiating the ceiling type air conditioner to satisfy persons in the indoor region.

**[0016]** A second object of the present invention is to provide a method of controlling vanes of a ceiling type air conditioner to supply optimized airflow as time passes to minimize discomfort that a user may feel due to the airflow.

**[0017]** Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

**[0018]** To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of controlling vanes of a ceiling type air conditioner including a plurality of the vanes for adjusting a direction of an airflow, the method includes the step of (a) varying an angle of the vanes step by step during the operation of the ceiling type air conditioner to adjust the airflow.

**[0019]** The step (a) includes the sub-steps of (1) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow when initiating the ceiling type air conditioner, (2) decreasing the angle of the vanes from the maximum angle to a predetermined minimum angle step by step by a predetermined time interval to adjust the airflow, and the method further includes the sub-step of (3) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle after the angle of the vanes firstly reaches the minimum angle.

**[0020]** Otherwise, the step (a) includes the sub-steps of (4) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow when starting the air conditioning, and (5) switching an operation mode of the ceiling type air con-

ditioner to an auto-swing mode of continuously varying the angle of the vanes within a maximum angle to a minimum angle when a predetermined time has elapsed.

**[0021]** Otherwise, the step (a) includes the sub-steps of (6) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow and to detect an indoor temperature periodically when initiating the ceiling type air conditioner, and (7) switching an operation mode of the ceiling type air conditioner to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the detected indoor temperature reaches a predetermined temperature.

**[0022]** Here, the maximum angle is set to an angle less than 90 degrees, and the minimum angle is set to an angle greater than 20 degrees.

**[0023]** In another aspect of the present invention, a method of controlling vanes of a ceiling type air conditioner including a plurality of the vanes for adjusting a direction of an airflow, the method includes the step of (a) detecting an indoor temperature when carrying out an air conditioning function and varying an angle of the vanes according to the detected indoor temperature to adjust the airflow step by step.

**[0024]** When the ceiling type air conditioner is operated in a heating mode, the step (a) includes the sub-steps of (1) detecting the indoor temperature when initiating the ceiling type air conditioner, (2) controlling the angle of the vanes to be a predetermined maximum angle when the detected indoor temperature is under a predetermined temperature, (3) decreasing the angle of the vanes from the maximum angle to a predetermined angle step by step by a uniform time interval to adjust the airflow, and (4) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the angle of the vanes reaches the minimum angle.

**[0025]** Otherwise, when the ceiling type air conditioner is operated in a cooling mode, the step (a) includes the sub-steps of (1) detecting the indoor temperature when initiating the ceiling type air conditioner, (2) controlling the angle of the vanes to be a predetermined maximum angle when the detected indoor temperature is above a predetermined temperature, (3) decreasing the angle of the vanes from the maximum angle to a predetermined angle step by step by a uniform time interval to adjust the airflow, and (4) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the angle of the vanes reaches the minimum angle.

**[0026]** Here, in the step (3), the angle of the vanes is divided into a plurality of sub-angles within the maximum angle to the minimum angle and is decreased step by step by the sub-angles.

**[0027]** Moreover, the maximum angle is set to an angle less than 90 degrees, and the minimum angle is set to an angle greater than 20 degrees.

**[0028]** Thus, the airflow with the maximum rate can be

supplied when initiating the air conditioner such that the chilled/heated airflow rapidly reaches the floor to improve the satisfaction of people in the indoor region.

**[0029]** It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

**[0030]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

**[0031]** FIG. 1 is a view illustrating a refrigerating cycle device of a conventional air conditioner;

**[0032]** FIG. 2 is a view illustrating an external appearance of an apparatus to which a vane control of a conventional ceiling type air conditioner is applied;

**[0033]** FIG. 3 is a flowchart illustrating a vane controlling method of an air conditioner according to a preferred embodiment of the present invention; and

**[0034]** FIG. 4 is a view illustrating a direction of an airflow generated by the vane controlling method of an air conditioner according to the preferred embodiment of the present invention.

**[0035]** Reference will now be made in detail to the preferred embodiments of a method of controlling vanes of a ceiling type air conditioner, examples of which are illustrated in FIGS. 3 and 4.

**[0036]** Like references and like names of the components of the conventional ceiling type air conditioner described above with reference FIG. 2 are assigned to like components of a ceiling type air conditioner employing a method of controlling vanes of a ceiling type air conditioner according to a preferred embodiment of the present invention.

**[0037]** The method of controlling vanes of the ceiling type air conditioner, in order to increase feeling of satisfaction of people in a room with regard to the indoor air conditioning when the cooling/heating is initiated, controls a plurality of vanes 21 to 24 simultaneously and supplies a direct airflow.

**[0038]** The method is characterized in that a rate of the indoor airflow varies as time passes to minimize discomfort of people in a room due to the indoor airflow.

**[0039]** FIG. 3 illustrates the method of controlling vanes of the ceiling type air conditioner in a heating mode, and the method of controlling vanes of a ceiling type air conditioner according to the preferred embodiment of the present invention will be described in detail with reference to FIG. 3 as follows.

**[0040]** Firstly, a user starts the heating mode, and it is determined whether or not the indoor temperature is under a predetermined temperature (S30).

**[0041]** As a result of the determination (S30), when the indoor temperature is under the predetermined temperature, the plurality of vanes 21 to 24 is simultaneously

controlled (S32).

**[0042]** At this time, when the indoor temperature is under the predetermined temperature when initiating the heating mode, all the vanes 21 to 24 are driven at a fourth angle X4, a maximum angle, to maximize a airflow discharge passage of the vanes 21 to 24 (S34).

**[0043]** Since people in the indoor region feel discomfort due to the direct airflow when the ceiling type air conditioner is initiated, the angle of all the vanes 21 to 24 is controlled to be a maximum angle, that is, the fourth angle X4 such that the heated airflow rapidly reaches the floor.

**[0044]** In other words, when the angle of all the vanes 21 to 24 is controlled to be the fourth angle X4, the maximum angle, the rate of the airflow is increased to be a maximum rate to supply a direct airflow for increasing body temperatures of people in the indoor within a short period of time.

**[0045]** After that, when a predetermined time T has elapsed (S36), the angle of all the vanes 21 to 24 is adjusted to be a third angle X3, less than the fourth angle X4, to decrease the rate of the airflow (S38).

**[0046]** When the predetermined time T has elapsed after carrying out the process S38 (S40), the angle of all the vanes 21 to 24 is adjusted to be a second angle X2, less than the third angle X3, to further decrease the rate of the airflow (S42).

**[0047]** When the predetermined time T has elapsed after carrying out the process S42 (S44), the angle of all the vanes 21 to 24 is adjusted to be a first angle X1, less than the second angle X2, to further decrease the rate of the airflow (S46).

**[0048]** Thus, the angle of the vanes 21 to 24 is decreased from the fourth angle X4 to the first angle X1 step by step by a unit of the predetermine time T to vary the rate of the airflow so that the indoor temperature can be increased while minimizing discomfort that people in the indoor region feel.

**[0049]** Continuously, when the predetermined time T has elapsed after carrying out the process S46 (S48), the mode of operation of the ceiling type air conditioner is switched to an auto-swing mode in which the angle of all the vanes 21 to 24 continuously varies within a range of the first angle X1 to the fourth angle X4 (S50).

**[0050]** Thus, when initiating the ceiling type air conditioner, the angle of the vanes 21 to 24 varies from the fourth angle X4 to the first angle X1 step by step to rapidly increase the indoor temperature, and after that, when the indoor temperature is increased somewhat (that is, when the angle of the vanes 21 to 24 has reached the first angle X1 as the minimum angle), the operation mode of the ceiling type air conditioner is switched to the auto-swing mode to minimize the discomfort that people in the indoor region feel.

**[0051]** Meanwhile, when the indoor temperature at the initiation of the ceiling type air conditioner is above the predetermined temperature T as a result of the determination in the process S30, the auto-swing mode in which

the angle of the vanes 21 to 24 continuously varies is directly started to carry out the air conditioning.

**[0052]** Moreover, the vanes 21 to 24 may be controlled to directly enter the auto-swing mode when the process of decreasing the angle of the vanes 21 to 24 from the fourth angle X4 to the first angle X1 step by step is omitted and when the predetermined time has elapsed at a state of driving the angle of the vanes 21 to 24 at the fourth angle X4 when initiating the ceiling type air conditioner.

**[0053]** All the vanes 21 to 24 of the ceiling type air conditioner employing the method of controlling vanes according to the preferred embodiment of the present invention, as shown in FIG. 4, are controlled such that the angle of the vanes 21 to 24 varies within the range of the minimum angle X1 to the maximum angle X4.

**[0054]** In other words, the angle within the range of the minimum angle X1 to the maximum angle X4 is divided into multiple angles to control the angle of the vanes 21 to 24 step by step.

**[0055]** Here, the fourth angle X4 is the maximum angle, which is set to about 90 degrees, and the first angle X1 is the minimum angle, which is set to an angle above 20 degrees.

**[0056]** For example, the angel of the vanes 21 to 24 are set such that the first angle X1 is 30 degrees, the second angle X2 is 40 degrees, the third angle X3 is 60 degrees, and the fourth angle X4 is 70 degrees.

**[0057]** Meanwhile, a method of controlling vanes of the ceiling type air conditioner in a cooling mode according to the preferred embodiment of the present invention is similar to the method of controlling vanes of a ceiling type air conditioner in the heating mode.

**[0058]** When the user starts the cooling mode and it is determined that the indoor temperature is above the predetermined temperature T, the angle of vanes 21 to 24 is controlled to be the maximum angle X4 to supply the airflow with the maximum rate. At this time, the chilled airflow rapidly reaches the floor to supply a direct airflow to people in the indoor region.

**[0059]** After that, the angle of the vanes 21 to 24 varies step by step to rapidly decrease the indoor temperature and to supply a uniform airflow.

**[0060]** Like this, when carrying out the cooling mode and the indoor temperature is under the predetermined temperature, the mode of operation of the ceiling type air conditioner is switched to the auto-swing mode to carry out the cooling mode.

**[0061]** Advantages of the method of controlling vanes of a ceiling type air conditioner according to the preferred embodiment of the present invention will be described as follows.

**[0062]** Firstly, the airflow with the maximum rate can be supplied when initiating the ceiling type air conditioner such that the chilled/heated airflow rapidly reaches the floor to increase the satisfaction of people in the indoor region with respect to the indoor air conditioning.

**[0063]** Secondly, the rate of the airflow varies as time passes so that the uniform airflow can be rapidly supplied

and the air conditioning efficiency can be improved.

**[0064]** Thirdly, since the airflow is continuously varied after the airflow with the maximum rate is supplied when initiating the ceiling type air conditioner, the discomfort with respect to the airflow can be minimized.

### Claims

1. A method of controlling vanes of a ceiling type air conditioner including a plurality of the vanes for adjusting a direction of an airflow, the method comprising the step of:
    - (a) varying an angle of the vanes step by step during the operation of the ceiling type air conditioner to adjust the airflow.
  2. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 1, wherein the step (a) comprises the sub-steps of:
    - (1) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow when initiating the ceiling type air conditioner; and
    - (2) decreasing the angle of the vanes from the maximum angle to a predetermined minimum angle step by step by a predetermined time interval to adjust the airflow.
  3. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 2, wherein, in the sub-step (2), the angle of the vanes is divided into a plurality of sub-angles within the maximum angle to the minimum angle and is decreased step by step by the sub-angles.
  4. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 2, further comprising the step of (3) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle after the angle of the vanes firstly reaches the minimum angle.
  5. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 1, wherein the step (a) comprises the sub-steps of:
    - (4) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow when starting the air conditioning; and
    - (5) switching an operation mode of the ceiling type air conditioner to an auto-swing mode of continuously varying the angle of the vanes within a maximum angle to a minimum angle when
- a predetermined time has elapsed.
  6. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 1, wherein the step (a) comprises the sub-steps of:
    - (6) controlling the angle of the vanes to be a predetermined maximum angle to increase the airflow to a maximum airflow and to detect an indoor temperature periodically when initiating the ceiling type air conditioner; and
    - (7) switching an operation mode of the ceiling type air conditioner to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the detected indoor temperature reaches a predetermined temperature.
  7. The method of controlling vanes of a ceiling type air conditioner as set forth in any one of claims 2, 5, and 6, wherein the maximum angle is set to an angle less than 90 degrees.
  8. The method of controlling vanes of a ceiling type air conditioner as set forth in any one of claims 2, 5, and 6, wherein the minimum angle is set to an angle greater than 20 degrees.
  9. A method of controlling vanes of a ceiling type air conditioner including a plurality of the vanes for adjusting a direction of an airflow, the method comprising the step of:
    - (a) detecting an indoor temperature when carrying out an air conditioning function and varying an angle of the vanes according to the detected indoor temperature to adjust the airflow step by step.
  10. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 9, wherein when the ceiling type air conditioner is operated in a heating mode, the step (a) comprises the sub-steps of:
    - (1) detecting the indoor temperature when initiating the ceiling type air conditioner;
    - (2) controlling the angle of the vanes to be a predetermined maximum angle when the detected indoor temperature is under a predetermined temperature;
    - (3) decreasing the angle of the vanes from the maximum angle to a predetermined angle step by step by a uniform time interval to adjust the airflow; and
    - (4) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the angle of the vanes

reaches the minimum angle.

11. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 10, wherein the step (a) further comprises the sub-step of (5) controlling the angle of the vanes in the auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the detected indoor temperature is above the predetermined temperature. 5 10
12. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 9, wherein when the ceiling type air conditioner is operated in a cooling mode, the step (a) comprises the sub-steps of: 15
- (1) detecting the indoor temperature when initiating the ceiling type air conditioner;
- (2) controlling the angle of the vanes to be a predetermined maximum angle when the detected indoor temperature is above a predetermined temperature; 20
- (3) decreasing the angle of the vanes from the maximum angle to a predetermined angle step by step by a uniform time interval to adjust the airflow; and 25
- (4) switching an operation mode to an auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the angle of the vanes reaches the minimum angle. 30
13. The method of controlling vanes of a ceiling type air conditioner as set forth in claim 12, wherein the step (a) further comprises the sub-step of (5) controlling the angle of the vanes in the auto-swing mode of continuously varying the angle of the vanes within the maximum angle to the minimum angle when the detected indoor temperature is under the predetermined temperature. 35 40
14. The method of controlling vanes of a ceiling type air conditioner as set forth in claims 10 or 12, wherein in the step (3), the angle of the vanes is divided into a plurality of sub-angles within the maximum angle to the minimum angle and is decreased step by step by the sub-angles. 45
15. The method of controlling vanes of a ceiling type air conditioner as set forth in claims 10 or 12, wherein the maximum angle is set to an angle less than 90 degrees. 50
16. The method of controlling vanes of a ceiling type air conditioner as set forth in claims 10 or 12, wherein the minimum angle is set to an angle greater than 20 degrees. 55

FIG. 1  
Related Art

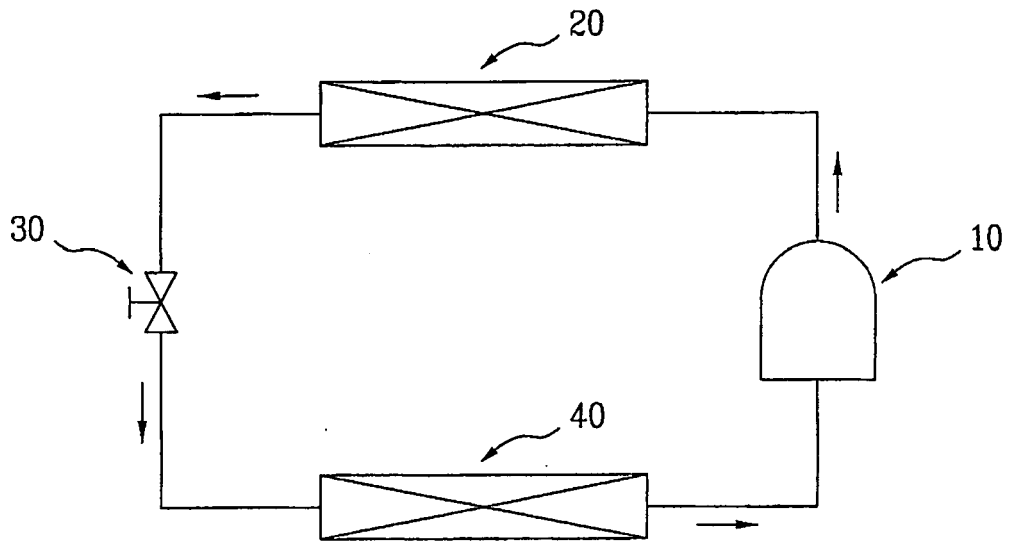


FIG. 2

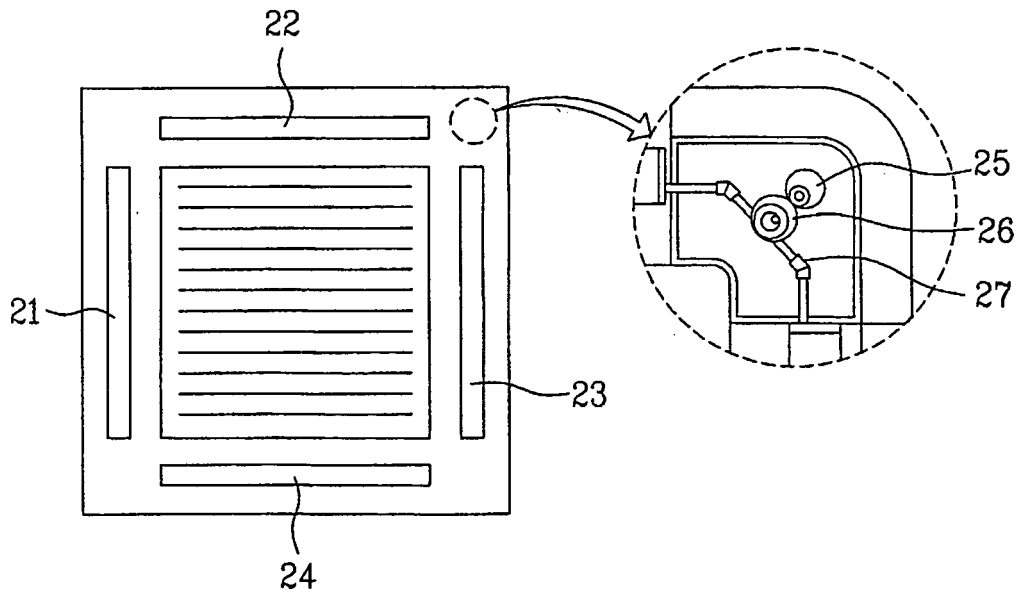


FIG. 3

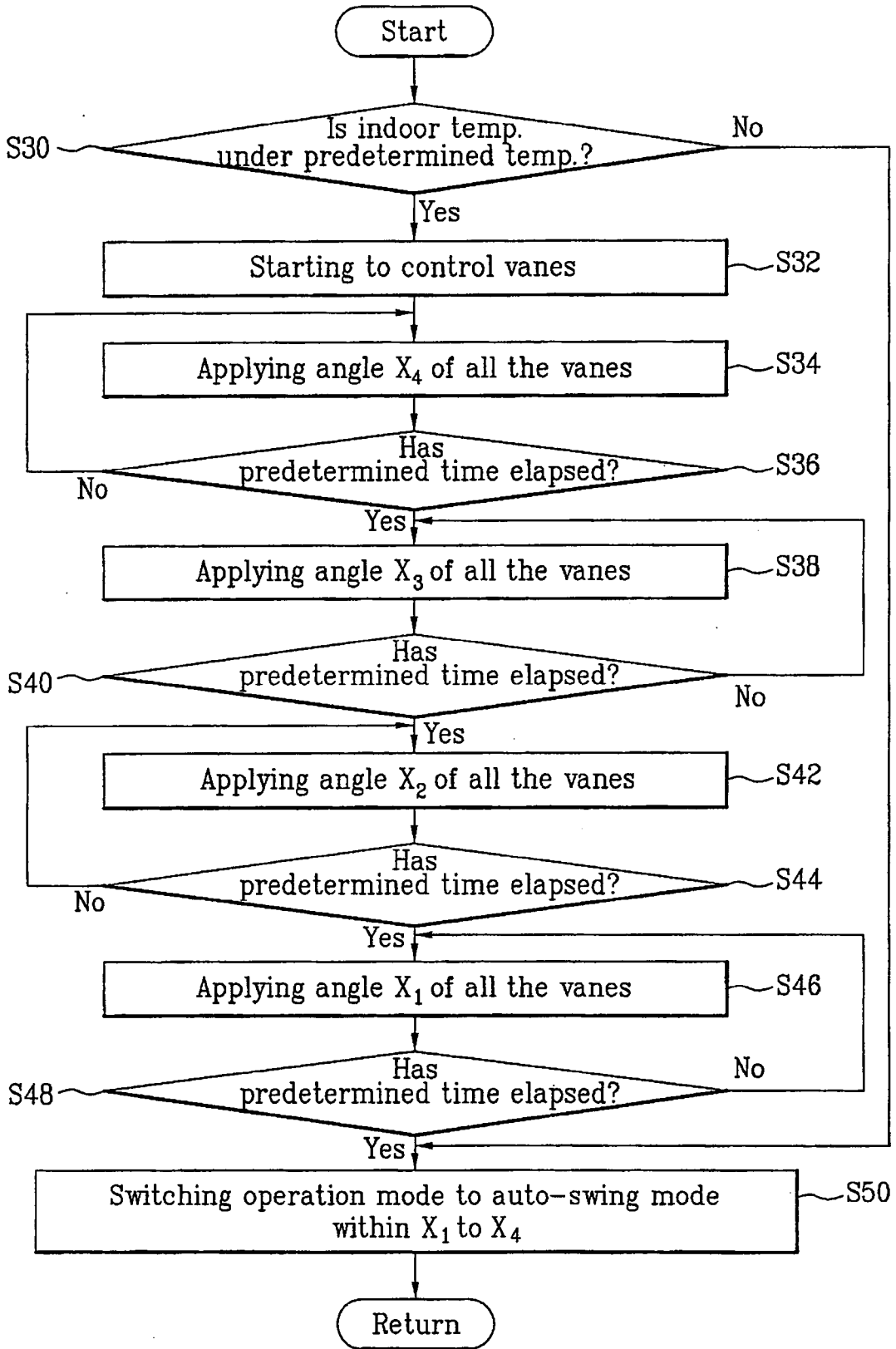
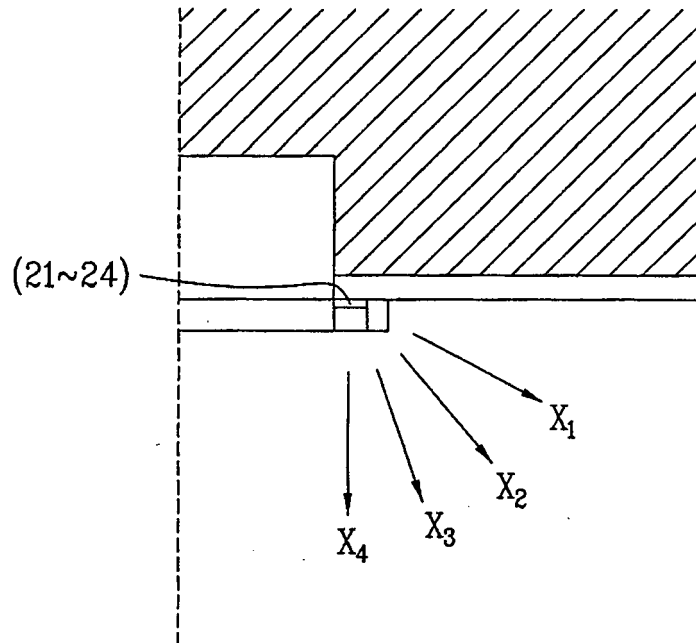


FIG. 4





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 08, 30 June 1999 (1999-06-30) -& JP 11 063627 A (FUNAI ELECTRIC CO LTD), 5 March 1999 (1999-03-05) * abstract *	1-3,9, 10,12	INV. F24F11/00
X	----- US 5 193 742 A (BYUN ET AL) 16 March 1993 (1993-03-16) * column 5, line 39 - column 10, line 5; figures 4-10 *	1-3,9,12	
X	----- US 4 782 999 A (ISHII ET AL) 8 November 1988 (1988-11-08) * column 5, line 41 - column 7, line 51; figures 5,7,8 *	1,9,10	
X	----- US 4 738 116 A (HIMENO ET AL) 19 April 1988 (1988-04-19) * column 3, line 3 - column 6, line 40; figures 1,8-11 *	1,9	
X	----- US 5 251 814 A (WARASHINA ET AL) 12 October 1993 (1993-10-12) * column 6, line 43 - column 14, line 64; figures 10-15 *	1,9	TECHNICAL FIELDS SEARCHED (IPC) F24F
X	----- PATENT ABSTRACTS OF JAPAN vol. 014, no. 228 (M-0973), 15 May 1990 (1990-05-15) & JP 02 057850 A (FUJITSU GENERAL LTD), 27 February 1990 (1990-02-27) * abstract *	1,9,10	
	----- -/--		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 August 2006	Examiner Lienhard, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	PATENT ABSTRACTS OF JAPAN vol. 014, no. 228 (M-0973), 15 May 1990 (1990-05-15) & JP 02 057849 A (FUJITSU GENERAL LTD), 27 February 1990 (1990-02-27) * abstract *	1,9	
A	----- US 2004/244391 A1 (KOUNO SHIGETOMI ET AL) 9 December 2004 (2004-12-09) * abstract; figure 9 * -----	1,9,10, 12	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>29 August 2006</b>	Examiner <b>Lienhard, D</b>
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

1

EPC FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 00 9544

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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29-08-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 11063627	A	05-03-1999	NONE	
US 5193742	A	16-03-1993	DE 4202798 A1 IT 1254293 B JP 4295532 A	13-08-1992 14-09-1995 20-10-1992
US 4782999	A	08-11-1988	GB 2208543 A	05-04-1989
US 4738116	A	19-04-1988	AU 572028 B2 AU 5979686 A CA 1271630 A1 CN 86104721 A GB 2178160 A KR 8903797 B1	28-04-1988 15-01-1987 17-07-1990 25-02-1987 04-02-1987 04-10-1989
US 5251814	A	12-10-1993	GB 2260831 A	28-04-1993
JP 02057850	A	27-02-1990	JP 1774779 C JP 4067097 B	14-07-1993 27-10-1992
JP 02057849	A	27-02-1990	JP 1774778 C JP 4067096 B	14-07-1993 27-10-1992
US 2004244391	A1	09-12-2004	AU 2003254916 A1 CN 1708661 A EP 1530008 A1 WO 2004016993 A1 JP 2004076974 A	03-03-2004 14-12-2005 11-05-2005 26-02-2004 11-03-2004

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- KR P20050038853 [0001]