



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 659 343 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **24.05.2006 Bulletin 2006/21**
(51) Int Cl.: **F24F 1/00 (2006.01)**

(21) Application number: **05024653.7**

(22) Date of filing: **11.11.2005**

(84) Designated Contracting States: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR Designated Extension States: AL BA HR MK YU (30) Priority: 23.11.2004 KR 2004096306 (71) Applicant: LG Electronics Inc. Yongdungpo-gu Seoul (KR) (72) Inventors: • Il, Nahm Hwang Suji-eup, Yongin-si, Gyeonggi-do (KR)	• Do, Yong Ha Anyang-si, Gyeonggi-do (KR) • Ki, Bum Kim Seoul (KR) • Ki, Baik Kwon Gwangmyeong-si, Gyeonggi-do (KR) • Baik, Young Chung 213-2, Yongjong-dong Gyeyang-gu Incheon (KR) (74) Representative: Beyer, Andreas et al Wuesthoff & Wuesthoff Patent- und Rechtsanwälte Schweigerstrasse 2 81541 München (DE)
--	--

(54) **Indoor unit of air conditioner**

(57) An indoor unit of an air conditioner is disclosed. The air conditioner is an apparatus that cools or heats an indoor space by circulating refrigerant in one direction or another. The indoor unit of the air conditioner comprises a case spaced apart from the ceiling of a room by a

predetermined distance, an indoor heat exchanger provided in the case to heat or cool the room, and a fan and fan motor provided in the case to suction and discharge air.

EP 1 659 343 A2

Description

[0001] This application claims the benefit of the Korean Patent Application No. P2004-96306, filed on November 23, 2004, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to an air conditioner, and more particularly, to the installation structure of an indoor unit of an air conditioner that supplies outside air into a room or indoor air to the outside of the room.

Discussion of the Related Art

[0003] Generally speaking, an air conditioner is an apparatus that cools or heats an indoor space by circulating refrigerant in one direction or another.

[0004] Air conditioners are classified into a general air conditioner in which a single indoor unit is connected to a single outdoor unit, and a multi-type air conditioner in which a plurality of indoor units is connected to a single outdoor unit.

[0005] Cooling and heating systems of both the general air conditioner and the multi-type air conditioner are substantially identical to each other in view of a basic refrigerant circulating manner in spite of a difference in the number of indoor units.

[0006] The cooling and heating system of the air conditioner serves to cool or heat an indoor space by circulating refrigerant in one direction or another under the control of a controller.

[0007] When the air conditioner is operated in a cooling mode, compressed refrigerant from a compressor is condensed in an outdoor heat exchanger, and then, is pumped to an expander. After being expanded in the expander, the refrigerant is subjected to heat exchange with indoor air in an indoor heat exchanger to thereby produce cool air. Thereby, by discharging the cool air to an indoor space, the air conditioner performs cooling of the indoor space.

[0008] In such a cooling mode, the outdoor heat exchanger functions as a condenser, and the indoor heat exchanger functions as an evaporator.

[0009] A heating mode of the air conditioner is substantially similar to the above-described cooling mode except for the fact that the refrigerant is circulated in the opposite direction. Thus, the explanation of the heating mode will be omitted hereinafter.

[0010] One difference between the heating mode and the cooling mode is that, when the air conditioner is operated in the heating mode, the indoor heat exchanger functions as a condenser and the outdoor heat exchanger functions as an evaporator.

[0011] Air conditioners are usually mounted to certain

indoor spaces or walls of rooms of stores, offices, houses, etc. for performing indoor cooling or heating operations. As one example of the air conditioners, there is a ceiling-mounted air conditioner configured to be mounted to the ceiling of a room to heat or cool the room.

[0012] The ceiling-mounted air conditioner has an advantage in that it is less restricted by space as compared to wall-mount or floor-standing air conditioners because it is mounted to the ceiling that is a relatively useless portion of an indoor space. Also, discharging cool air from the ceiling is advantageous because the cool air can be spread with a relatively fast flow rate. By virtue of these and other various advantages, the demand of ceiling-mounted air conditioners is gradually increasing.

[0013] FIG. 1 is a sectional view schematically illustrating the installation structure of a conventional ceiling-mounted air conditioner.

[0014] Referring to FIG. 1, an indoor unit 10 is embedded in the ceiling having a predetermined thickness D to cool or heat the interior of a room.

[0015] Although not shown, it goes without saying that a refrigerant pipe 11, connected to the indoor unit 10, is also connected to an outdoor unit (not shown) that is mounted at the outside of the room.

[0016] However, the conventional air conditioner configured as stated above has the following problems.

[0017] Firstly, the ceiling must be sufficiently thick to embed the indoor unit of the ceiling-mounted air conditioner. This limits the mounting places of the air conditioner.

[0018] Secondly, when the air conditioner is mounted in a room having a fairly high ceiling, cool air blown by the air conditioner may fail to reach users on the floor, resulting in an insufficient cooling efficiency.

[0019] Thirdly, when the ceiling-mounted air conditioner is operated in a heating mode, it suffers from an excess suction of air discharged therefrom, resulting in a poor air circulation therein.

SUMMARY OF THE INVENTION

[0020] Accordingly, the present invention is directed to an indoor unit of air conditioner that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0021] An object of the present invention is to provide an indoor unit of an air conditioner which is hung from the ceiling of a room at a position spaced apart from the ceiling of a room by a predetermined distance.

[0022] 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.

[0023] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, an indoor unit of an air conditioner comprises: a case spaced apart from the ceiling of a room by a predetermined distance; an indoor heat exchanger provided in the case and adapted to cool or heat the room; and a fan and fan motor provided in the case and adapted to suction and discharge air.

[0024] The indoor unit may further comprise refrigerant pipes connected to the case for the supply of refrigerant.

[0025] The indoor unit may further comprise a drain pipe to discharge condensate water, that is produced as the air passes through the indoor heat exchanger, to the outside of the indoor unit.

[0026] The drain pipe may be configured to discharge the produced condensate water to the outside of the room or a predetermined position of the room.

[0027] A fixing line may be provided between the case and the ceiling, and is adapted to support the case at a predetermined position spaced apart from the ceiling by the predetermined distance.

[0028] A first mount may be mounted at an upper end of the case, and a first end of the fixing line may be affixed to the first mount.

[0029] A control circuit unit may be provided in the first mount to control operation of the air conditioner.

[0030] A second mount may be mounted at the ceiling, and a second end of the fixing line may be affixed to the second mount.

[0031] The refrigerant pipes may be made of a flexible material.

[0032] The drain pipe may be made of a flexible material.

[0033] The indoor unit may further comprise a pipe cover configured to enclose the refrigerant pipes and the drain pipe to prevent the pipes from being exposed to the outside.

[0034] The pipe cover may be configured to enclose each of the refrigerant pipes and the drain pipe separately.

[0035] The pipe cover may be configured to enclose the refrigerant pipes and the drain pipe together.

[0036] The pipe cover may be made of a flexible material.

[0037] The indoor heat exchanger and an expander may be arranged in an upper portion of the case, and the fan and the fan motor may be arranged in a lower portion of the case.

[0038] The fan and the fan motor may be arranged in an upper portion of the case, and the indoor heat exchanger and an expander may be arranged in a lower portion of the case.

[0039] A drain pump may be provided in the case to discharge condensate water, that is produced by the indoor heat exchanger, to the outside of the indoor unit via the drain pipe.

[0040] In another aspect of the present invention, there is provided an indoor unit of an air conditioner comprising:

a case containing a fan motor and indoor heat exchanger therein and spaced apart from the ceiling of a room by a predetermined distance; refrigerant pipes extended from an outside place to the case; a fixing line provided between the case and the ceiling and adapted to support the case at a predetermined position spaced apart from the ceiling by the predetermined distance; and a condensate water sump to store the condensate water that is produced as air passes through the indoor heat exchanger.

[0041] 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] 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:

[0043] FIG. 1 is a sectional view schematically illustrating the installation structure of a conventional ceiling-mounted air conditioner;

[0044] FIG. 2 is a sectional view schematically illustrating the installation structure of an indoor unit of an air conditioner according to a first embodiment of the present invention; and

[0045] FIG. 3 is a sectional view schematically illustrating the installation structure of an indoor unit of an air conditioner according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0046] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0047] Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts, and thus additional explanation will be omitted.

[0048] FIGs. 2 and 3 illustrate indoor units of air conditioners according to different embodiments of the present invention. FIG. 2 is a sectional view schematically illustrating the installation structure of an indoor unit of an air conditioner according to a first embodiment of the present invention. FIG. 3 is a sectional view schematically illustrating the installation structure of an indoor unit of an air conditioner according to a second embodiment of the present invention.

[0049] Hereinafter, the preferred embodiments of the present invention for concretely achieving the above object will be explained with reference to the accompanying drawings.

[0050] Also, since the general structure of an air conditioner, as will be described hereinafter, will be apparent to those skilled in the art, the illustration and explanation of remaining parts except for the structure of an indoor unit will be omitted. The same reference numbers will be used throughout the embodiments to refer to the same or like parts.

[0051] Referring first to FIG. 2, the indoor unit 100 of the air conditioner according to the first embodiment of the present invention includes a case 110, in which a fan motor 140 and an indoor heat exchanger 120 are mounted. The case 110 is spaced apart from the ceiling of a room by a predetermined distance L.

[0052] The case 110 defines the outer appearance of the indoor unit 100 of the air conditioner according to the present invention.

[0053] To the case 110 are connected refrigerant pipes 210 for use in the supply of refrigerant and a drain pipe 310 for drawing condensate water to the outside of the indoor unit 100.

[0054] Specifically, one end of each refrigerant pipe 210 is connected to the case 110 of the indoor unit 100, and the other end of the refrigerant pipe 210 is connected to an outdoor unit (not shown) mounted at the outside of the room.

[0055] As can be easily understood from FIG. 2, the refrigerant pipes 210 are extended through the ceiling between the indoor unit 100 and the outdoor unit (not shown).

[0056] Likewise, one end of the drain pipe 310 is connected to the case 110 of the indoor unit 100, and the other end of the drain pipe 310 is positioned to discharge condensate water, that is produced as air passes through the indoor heat exchanger 120, to a certain indoor or outdoor place.

[0057] A fixing line 410 is mounted between the case 110 and the ceiling to support the case 110 at a predetermined position spaced apart from the ceiling by the predetermined length L.

[0058] For the installation of the case 110, a first mount 510 is mounted to an upper end of the case 110, and a second mount 520 is mounted to the ceiling.

[0059] With this configuration, one end of the fixing line 410 is connected to the first mount 510, and the other end of the fixing line 410 is connected to the second mount 520.

[0060] In this case, it goes without saying that the fixing line 410 must be made of a material having a sufficient strength to support the case 110.

[0061] Generally, the fixing line 410 may have a chain or band shape.

[0062] As described above, the drain pipe 310, provided in the indoor unit 100, serves to discharge condensate water, that is produced as air passes through the indoor heat exchanger 120 during operation of the air conditioner, to the outside of the indoor unit 100.

[0063] For this, one end of the drain pipe 310 is fitted in the indoor unit 100, and the other end of the drain pipe

310 is mounted to discharge the condensate water to a predetermined indoor or outdoor place.

[0064] A condensate water sump 135 is provided in the case 110 to store the condensate water that is produced as air passes through the indoor heat exchanger 120.

[0065] The drain pipe 310 is connected to a drain pump 130 mounted in the condensate water sump 135 to allow the condensate water, stored in the condensate water sump 135, to be pumped and discharged to the outside of the indoor unit 100.

[0066] With this configuration, as the drain pump 130 is operated, the condensate water, gathered in the condensate water sump 135, is discharged to the outside of the indoor unit 100 via the drain pipe 310 during the operation of the air conditioner.

[0067] A control circuit unit 550 is provided in the first mount 510 to control the operation of the air conditioner according to the present invention.

[0068] Generally, the indoor unit 100 is provided with a remote controller (not shown) to be operated in accordance with operation of the remote controller. The remote controller has a receiver and a transmitter, which are electrically connected to the control circuit unit 550.

[0069] Preferably, the refrigerant pipes 210 and the drain pipe 310 are made of flexible materials for easy installation of the indoor unit 100.

[0070] When it is desired to move the indoor unit 100 to an appropriate installation position, flexibility of the refrigerant pipes 210 and the drain pipe 310 is helpful to allow the indoor unit 100 to be more easily displaced and mounted.

[0071] To prevent the refrigerant pipes 210 and the drain pipe 310 from being exposed to the outside, a pipe cover 231 encloses both the pipes 210 and 310.

[0072] The pipe cover 231 is used in order to improve the outer appearance of the air conditioner and to prevent damage to the refrigerant pipes 210 and the drain pipe 310, thereby enabling more stable installation of the air conditioner.

[0073] In this case, it goes without saying that the pipe cover 231 also must be made of a flexible material in the same manner as the refrigerant pipes 210 and the drain pipe 310 for easy installation of the indoor unit 100.

[0074] Although not shown, the indoor unit 100 is provided with an expander (not shown). Usually, a linear expansion valve (LEV) is used as the expander.

[0075] The case 110 has an air suction hole 112 formed at an upper surface thereof to introduce indoor air into the indoor unit 100, and an air discharge hole 111 formed at a lower surface thereof to discharge the air, passed through the indoor heat exchanger 120, from the indoor unit 100.

[0076] Now, the operation of the first embodiment of the present invention will be explained.

[0077] Similar to a general air conditioner, in the air conditioner according to the first embodiment of the present invention, high-temperature and high-pressure

refrigerant refrigerant from a compressor of an outdoor unit is introduced into an outdoor heat exchanger (not shown) to thereby be condensed via heat exchange with outside air in accordance with rotation of an outdoor fan (not shown).

[0078] Next, the condensed refrigerant is introduced into the indoor unit 100 mounted in a room via the refrigerant pipe 210.

[0079] The refrigerant, introduced into the indoor unit 100, is expanded while passing through an expander (not shown). Thereby, the refrigerant is introduced into the indoor heat exchanger 120 of the indoor unit 100 in a low-temperature and low-pressure state.

[0080] After that, as the fan motor 140 and a fan 145 are rotated, the refrigerant is subjected to heat exchange with indoor air in the indoor heat exchanger 120, thereby producing cool air.

[0081] By discharging the cool air, produced via the above-described manner, into the room, the air conditioner performs cooling of an indoor space.

[0082] Meanwhile, in the case of the indoor unit 100 according to the first embodiment of the present invention, only the refrigerant pipes 210 and the drain pipe 310 are mounted to the ceiling, and the case 110 is hung from the ceiling by means of the fixing line 410 at a position spaced apart from the ceiling by the predetermined distance L.

[0083] In the present embodiment, since the refrigerant pipes 210 and the drain pipe 310, which are made of flexible materials, are connected to the case 110, and the indoor air is suctioned via the air suction holes 112 formed at the upper surface of the case 110 and is discharged via the air discharge hole 111 formed at the lower surface of the case 110, the circulation of indoor air inside the indoor unit can be more actively achieved as compared to a conventional indoor unit.

[0084] Also, hanging the indoor unit between the ceiling and floor, instead of embedding the indoor unit in the ceiling, allows airflow to more readily reach a user located on the floor.

[0085] Another advantage of such an installation structure according to the first embodiment of the present invention is that the air conditioner can be mounted even if the thickness of the ceiling is too small to embed the air conditioner.

[0086] Although the first embodiment of the present invention illustrates and explains an installation structure in which the indoor heat exchanger 120 and the expander (not shown) are arranged in an upper portion of the case 110 and the fan 145 and the fan motor 140 are arranged in a lower portion of the case 110, it can be considered that the fan 145 and the fan motor 140 are arranged in the upper portion of the case and the indoor heat exchanger 120 and the expander (not shown) are arranged in the lower portion of the case, as in the second embodiment of the present invention as shown in FIG. 3.

[0087] Referring to FIG. 3, when the fan 145 and the fan motor 140 are arranged in the lower portion of an

indoor unit 100, it is preferable that air suction holes 113 be formed at opposite lateral surfaces of a case 110.

[0088] In this case, a plurality of louvers 113a are mounted at the air suction holes 113 to open or close the holes 113.

[0089] To the case 110 are connected the refrigerant pipes 210 for use in the supply of refrigerant and the drain pipe 310 for drawing condensate water to the outside of the indoor unit 100.

[0090] Between the case 110 and the ceiling is mounted the fixing line 410 to support the case 110 at a position spaced apart from the ceiling by the predetermined distance L.

[0091] The case 110 is provided at an upper end thereof with the first mount 510, and the ceiling is provided with the second mount 520, so that one end of the fixing line 410 is connected to the first mount 510, and the other end of the fixing line 410 is connected to the second mount 520.

[0092] In this case, the fixing line 410 is made of a material having a sufficient strength to support the case 110.

[0093] The drain pipe 310 is affixed at one end thereof to the indoor unit 100, and the other end of the drain pipe 310 is positioned at a predetermined indoor or outdoor place suitable to discharge condensate water.

[0094] The condensate water sump 135 is provided in the case 110 to store condensate water produced as air passes through the indoor heat exchanger 120.

[0095] The drain pipe 310 is connected with the drain pump 130 mounted in the condensate water sump 135. The drain pump 130 serves to pump and discharge condensate water, gathered in the condensate water sump 135, to the outside of the indoor unit 100.

[0096] With this configuration, as the drain pump 130 is operated, the condensate water, gathered in the condensate water sump 135, is discharged to the outside of the indoor unit 100 via the drain pipe 310 during operation of the air conditioner.

[0097] The control circuit unit 550 is provided in the first mount 510 to control the operation of the air conditioner according to the present invention.

[0098] The refrigerant pipes 210 and the drain pipe 310 are covered with the pipe cover 231.

[0099] The operating principle of the indoor unit 100 of the air conditioner according to the second embodiment of the present invention configured as stated above is identical to that of the first embodiment, and thus the explanation thereof will be omitted.

[0100] Also, it goes without saying that the installation structure of the indoor unit of the air conditioner as stated above is applicable to a multi-type air conditioner in which a plurality of indoor units is connected to a single outdoor unit.

[0101] Therefore, the above-described embodiments must be considered for exemplifying the invention rather than for limiting the scope of the invention. The accompanying claims and equivalents thereof are included in

the scope and spirit of the invention.

[0102] As apparent from the above description, an indoor unit of an air conditioner according to different embodiments of the present invention comprises a case, which contains a fan motor and an indoor heat exchanger arranged therein and is hung from the ceiling of a room to be spaced apart from the ceiling by a predetermined distance. Refrigerant pipes are extended from a certain outside place to the case. Also, a fixing line, having a chain shape, is provided between the case and the ceiling to support the case at a predetermined position spaced apart from the ceiling.

[0103] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. An indoor unit of an air conditioner comprising:

a case spaced apart from the ceiling of a room by a predetermined distance;
an indoor heat exchanger provided in the case and adapted to cool or heat the room; and
a fan and fan motor provided in the case and adapted to suction and discharge air.

2. The indoor unit as set forth in claim 1, further comprising:

refrigerant pipes connected to the case for the supply of refrigerant.

3. The indoor unit as set forth in claim 2, further comprising:

a drain pipe to discharge condensate water, that is produced as the air passes through the indoor heat exchanger, to the outside of the indoor unit.

4. The indoor unit as set forth in claim 1, wherein a fixing line is provided between the case and the ceiling, and is adapted to support the case at a predetermined position spaced apart from the ceiling by the predetermined distance.

5. The indoor unit as set forth in claim 4, wherein a first mount is mounted at an upper end of the case, and the lower end of the fixing line is affixed to the first mount.

6. The indoor unit as set forth in claim 5, wherein a

control circuit unit is provided in the first mount to control operation of the air conditioner.

7. The indoor unit as set forth in claim 4, wherein a second mount is mounted at the ceiling, and the upper end of the fixing line is affixed to the second mount.

8. The indoor unit as set forth in claim 3, further comprising a pipe cover configured to enclose the refrigerant pipes and the drain pipe to prevent the pipes from being exposed to the outside.

9. The indoor unit as set forth in claim 8, wherein the pipe cover is configured to enclose each of the refrigerant pipes and the drain pipe separately.

10. The indoor unit as set forth in claim 8, wherein the pipe cover is configured to enclose the refrigerant pipes and the drain pipe together.

11. The indoor unit as set forth in claim 1, wherein the indoor heat exchanger and an expander are arranged in an upper portion of the case, and the fan and the fan motor are arranged in a lower portion of the case.

12. The indoor unit as set forth in claim 1, wherein the fan and the fan motor are arranged in an upper portion of the case, and the indoor heat exchanger and an expander are arranged in a lower portion of the case.

13. The indoor unit as set forth in claim 1, wherein a drain pump is provided in the case to discharge condensate water, that is produced by the indoor heat exchanger, to the outside of the indoor unit via the drain pipe.

14. An indoor unit of an air conditioner comprising:

a case containing a fan motor and indoor heat exchanger therein and spaced apart from the ceiling of a room by a predetermined distance; refrigerant pipes extended from an outside place to the case;

a fixing line provided between the case and the ceiling and adapted to support the case at a predetermined position spaced apart from the ceiling by the predetermined distance; and
a condensate water sump to store the condensate water that is produced as air passes through the indoor heat exchanger.

FIG. 1
Prior Art

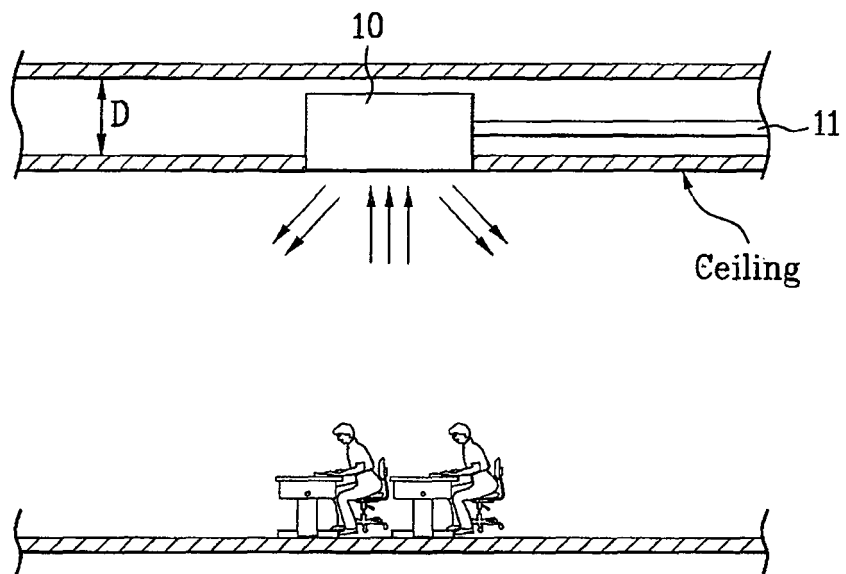


FIG. 2

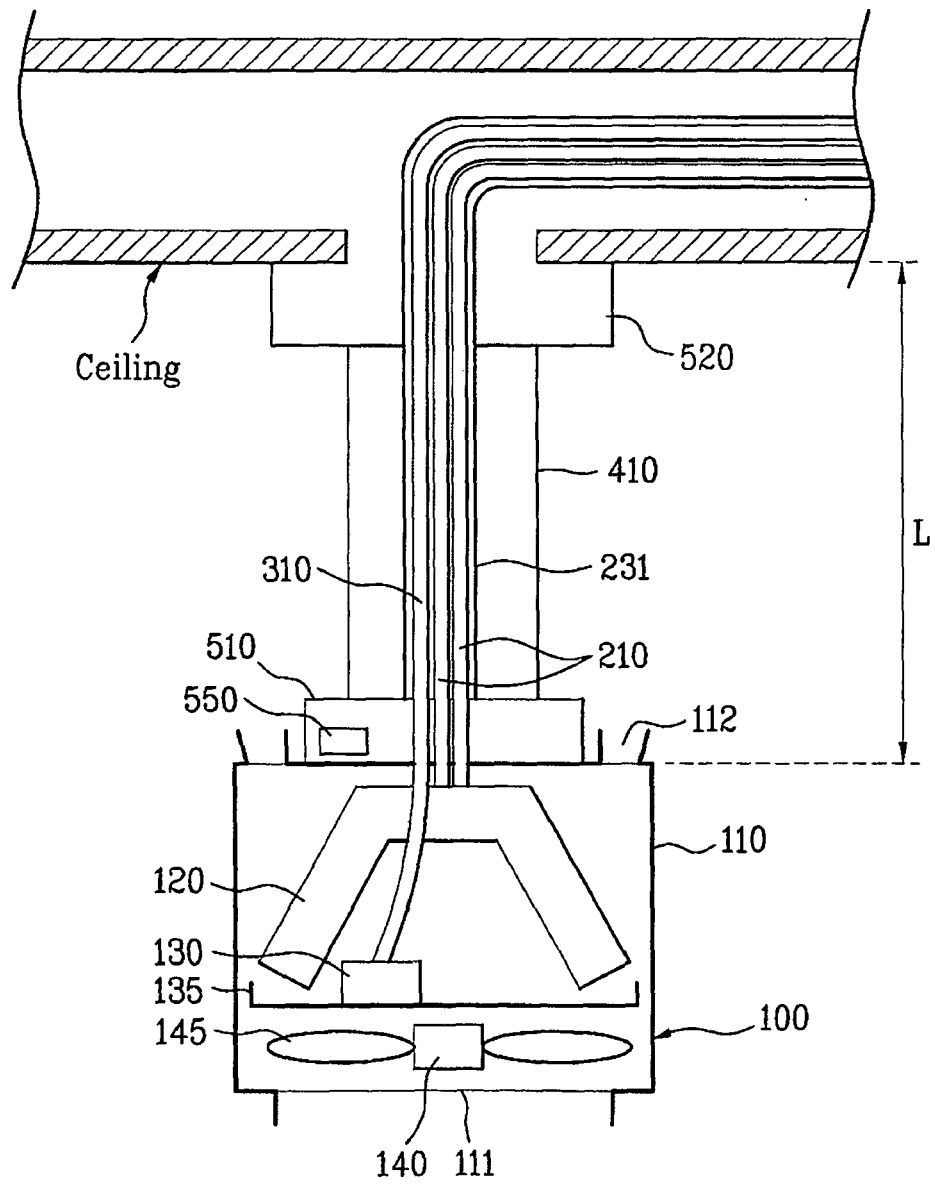


FIG. 3

