

INDOOR UNIT FOR AN AIR CONDITIONER

FIELD OF INVENTION

The present invention relates to an indoor unit for an air conditioner.

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BACKGROUND OF THE INVENTION

It is known that an indoor unit for an air conditioner includes connection pipes in which refrigerant flows and each of which extends from inside of the indoor unit to outside of the indoor unit in right and left direction the indoor unit, so as to facilitate the installation of the connection pipe related equipment in the limited space, for example the building room, as disclosed in
10 Chinese Utility Model Publication No. CN 208042562 U hereinafter called a prior art.

In particular, there are the abovementioned needs in case of the installation of a duct type indoor unit for an air conditioner to a ceiling of the room.

The prior art further discloses that air from a fan is blown toward a heat exchanger directly. Since there is a temperature difference between air and a surface of the heat exchanger
15 is large, there is a possibility that the dew condensation occurs on the area of the connection pipes.

If the dew condensation occurs in the indoor unit for the air conditioner, the dew condensation can spread near the installation area of the indoor unit and becomes a water leakage which can further become the cause of the spread of bacteria and occurrence of molds, thereby
20 causes the generation of foul smell inside of a room.

Therefore, the development of the indoor unit for the air conditioner that is easily installed to the room and prevents the dew condensation inside of the indoor unit is required.

CITATION LIST

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Patent Literature

PTL 1: Chinese Utility Model Publication No. CN 208042562 U

SUMMARY OF THE INVENTION

It is an objective of the present invention to provide an indoor unit for the air conditioner including a pair of connection pipes, each of which extends to outside of the indoor unit in right

and left direction of the indoor unit, the indoor unit which is capable of being easily installed to the room and preventing the dew condensation inside of the indoor unit.

In order to achieve the above objective, an embodiment of the present invention provides an indoor unit for an air conditioner including a fan blowing air toward the front direction of the indoor unit; a heat exchanger which exchanges heat between refrigerant and air blown from the fan; a casing which houses the fan and the heat exchanger; a partition wall which is provided in a space inside of the casing between a fan storage area for storing the fan and a heat exchanger storage area for storing the heat exchanger; a pair of connection pipes including one connection pipe in which liquid refrigerant flows and the other connection pipe in which gas refrigerant flows, each of which connects to the heat exchanger, extends in right and left direction of the indoor unit, and has connection parts at both ends; and a connection pipe storage member which is formed by a first wall surface member on a fan side and a second wall surface member on a heat exchanger side, in which a connection pipe storage area is formed between the fan storage area and the heat exchanger storage area, and the pair of the connection pipes are housed in the connection pipe storage area.

As a physical phenomenon, in case of the retention of air, the lower the temperature of the surface of the equipment is, the larger the possibility of the occurrence of the dew condensation occurs in the indoor unit for the air conditioner.

Firstly, according to the embodiment of the present invention, the partition wall is provided in a space inside of the casing between a fan storage area for storing the fans and a heat exchanger storage area for storing the heat exchanger.

As such, the dew condensation inside of the fan storage area can be prevented due to the heat which is generated from the fan.

Secondly, according to the embodiment of the present invention, the connection pipe storage area which is formed in the connection pipe storage member and in which the pair of the connection pipes are housed, is formed between the fan storage area and the heat exchanger storage area.

Since the connection pipe storage area serves as a heat buffer area between the fan storage area and the heat exchanger storage area, the dew condensation in the connection pipe storage area which is formed by the first wall surface member and the second wall surface member of the connection pipe storage member can be prevented.

Moreover, since the pair of the connection pipes are housed in the connection pipe storage area, the limited space in the indoor unit can be efficiently utilized.

Therefore, the indoor unit for the air conditioner is easily installed to the room and prevents the dew condensation inside of the indoor unit.

In the indoor unit for the air conditioner of the embodiment of the present invention, two connection pipes on one side of the indoor unit extends through one connection pipe opening to
5 the outside of the casing, a pair of connection parts are provided on both sides of the connection pipe, and seals are attached around the connection pipes so as to hermetically close the connection pipe opening.

According to the embodiment of the present invention, since the connection pipe opening is hermetically closed by the seal, the seal prevents moist air from flowing into the connection
10 pipe storage area. Therefore, the dew condensation inside of the connection pipe storage area can be more efficiently prevented.

In the indoor unit for the air conditioner of the embodiment of the present invention, an outer periphery of a cross section of the connection pipe storage member in front and rear direction of the indoor unit includes the first wall surface member which is formed along the
15 outer shape of the fans and the second wall surface member which is formed along the outer shape of the heat exchanger.

According to the embodiment of the present invention, since the first wall surface member is formed along the outer shape of the fans and the second wall surface member is formed along the outer shape of the heat exchanger, the limited space in the indoor unit can be
20 more efficiently utilized. The dew condensation inside of the connection pipe storage member can be furthermore efficiently prevented.

In the indoor unit for the air conditioner of the embodiment of the present invention, the partition wall is positioned above the connection pipe storage member, a fan discharge port of the fan is provided so as to penetrate the partition wall.

25 According to the embodiment of the present invention, since the fan discharge port of the fan is provided so as to penetrate the partition wall, it is possible to increase the available space for the connection pipe storage area without interrupting the air flow from the fan to the heat exchanger. As such, the limited space in the indoor unit can be more efficiently utilized.

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BRIEF DESCRIPTION OF DRAWINGS

The principle of the present invention and its advantages will become apparent in the following description taking in consideration with the accompanying drawings in which:

FIG.1A and FIG.1B are perspective views of an indoor unit 1 for an air conditioner according to an embodiment of the present invention;

FIG.2 is a bottom view of the indoor unit 1 of FIG.1A and FIG.1B, from which the bottom cover 10b is removed;

5 FIG.3 is a sectional view taken along line III-III of FIG.2;

FIG.4 is an enlarged view of the area A surrounded by the broken line of FIG.3;

FIG.5A to FIG.5D are explanation views of a first wall surface member 62 and second wall surface member 64 which constitute a connection pipe storage member 60; and

FIG.6A and FIG.6B are explanation views of seals 70a, 70b of FIG.2.

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DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Hereinafter, an embodiment of the present invention will be described in detail with reference to FIG.1A to FIG.6B.

In the following detailed description, relative positional terms such as “front”, “rear”,
15 “right” and “left” correspond to those directions considered from the direction of the flow of air which the indoor unit 1 blows.

FIG. 1A and FIG. 1B are perspective views of an indoor unit 1 for an air conditioner according to an embodiment. FIG.2 is a bottom view of the indoor unit 1, from which the bottom cover 10b, which is not illustrated, is removed. FIG.3 is a sectional view taken along line III-III
20 of FIG.2. The arrows described in FIG.3 show a flow of air.

The indoor unit 1 is a duct type indoor unit which is installed to a ceiling of the building room, etc. The indoor unit 1 is connected with an outdoor unit (not shown) which is mounted outdoors via both a pipe for gas refrigerant and a pipe for liquid refrigerant. The indoor unit 1, the outdoor unit and the refrigerant pipes constitute the air conditioner. The indoor unit 1
25 performs the cooling operation and so on by selecting the operation mode by using the selection device, such as a remote controller.

As shown in FIG.1A to FIG.3, the indoor unit 1 has a casing 10 which houses various components, such as fans 30 and a heat exchanger 40. The casing 10 is formed in a rectangular parallelepiped shape extending in right and left direction and constituted by a top cover 10a, a
30 bottom cover 10b, a left cover 10c, a right cover 10d, and a rear cover 10e.

The indoor unit 1 is opened at its front to blow cooling air to the room, and the indoor unit 1 has air suction openings 12 (See FIG.3.) for the fans 30 at its rear to suck air from outside to the fans 30. Each of the left cover 10c and the right cover 10d includes a connection pipe

opening 14 through which both a gas refrigerant connection pipe 52 and a liquid refrigerant connection pipe 54 extend from inside of the indoor unit 1 to outside of the indoor unit 1.

The inner space of the indoor unit 1 is mainly constituted by a fan storage area 20 for storing the fans 30, and a heat exchanger storage area 22 for storing the heat exchanger 40, and
5 a connection pipe storage area 24 which is formed between the fan storage area 20 and the heat exchanger storage area 22. The pair of the connection pipes 52, 54 are housed in the connection pipe storage area 24. A partition wall 26 is provided in a space inside of the casing 10 between the fan storage area 20 and the heat exchanger storage area 22 and positioned above the connection pipe storage area 24.

10 The fans 30 suck air through the air suction openings 12 from the outside and blow air toward the front direction of the indoor unit 1.

As shown in FIG.3, the fan 30 mainly includes blades 34 which are rotated and driven by being connected to the fan motor 32 via a rotational shaft 38. When the blades 34 are rotated and driven by the fan motor 32, the fan 30 sucks air through the air suction opening 12 from the
15 outside and blows air from a fan discharge port 36 toward the front direction of the indoor unit 1.

The fan discharge port 36 of the fan 30 is formed to penetrate the partition wall 26, so that the available space for the connection pipe storage area 24 without interrupting the air flow from the fan 30 to the heat exchanger 40 is increased as well as the retention of air in the heat
20 exchanger storage area is prevented.

The heat exchanger 40 exchanges the heat between air and the refrigerant. The heat exchanger 40 has a structure where refrigerant flows inside paths provided inside. More specifically, the heat exchanger 40 is a fin-and-tube heat exchanger called a cross-fin type that has numerous heat transfer fins placed a predetermined interval apart from each other and plural
25 heat transfer tubes disposed in a state where they penetrate these heat transfer fins in their plate thickness direction.

The end of refrigerant connection tube of the heat exchanger 40, in which the liquid refrigerant flows, is connected to the liquid refrigerant connection pipe 54, and the other end of the refrigerant connection tube of the heat exchanger 40, in which the gas refrigerant flows, is
30 connected to the gas refrigerant connection pipe 52. Additionally, the heat exchanger 40 functions as an evaporator of the refrigerant during cooling and a condenser of the refrigerant during heating. As such, the heat exchanger 40 can perform heat exchange with air that has been blown out from the fans 30, and cool air during cooling or heat air during heating.

The pair of connection pipes 52,54 consist of the liquid refrigerant connection pipe 54 in which liquid refrigerant flows, and the gas refrigerant connection pipe 52 in which gas refrigerant flows. As shown in FIG.3 and FIG.4, each of the connection pipes 52,54 is covered with a heat insulating material 58. FIG.4 is an enlarged view of the area A surrounded by the broken line of
5 FIG.3

Each of connection pipes is connected with refrigerant connection tube and extends in parallel with right and left direction of the indoor unit 1 by utilizing, for example, a T-shaped pipe joint or a three-way valve. Moreover, each pipe has connection parts 56 at both ends. Two connection pipes 52,54 on one side of the indoor unit 1 extends through one connection pipe
10 opening 14 to the outside of the casing 10. The liquid refrigerant connection pipe 54 is connected with the pipe for liquid refrigerant by using the connection part 56. The gas refrigerant connection pipe 52 is connected with the pipe for gas refrigerant by using the connection part 56.

As such, the connection between the pair of connection pipes 52,54 and the pipes for
15 liquid/gas refrigerant becomes possible in the both sides of the indoor unit 1, so as to facilitate the installation of the connection pipes 52,54 related equipment in the limited space, for example the building room.

As shown in FIG.2 to FIG.4, in the indoor unit, the pair of connection pipes 52,54 are housed in the connection pipe storage area 24. The connection pipe storage area 24 that is inside
20 of a connection pipe storage member 60 is formed by a first wall surface member 62 on a fan 30 side and a second wall surface member 64 on a heat exchanger 40 side (See FIG.5A to FIG.5D), is located between the fan storage area 20 and the heat exchanger storage area 22.

FIG.5A is a perspective view when viewed from the indoor unit 1 left side and the fan 30 side, FIG.5B is a perspective view when viewed from the indoor unit 1 left side and the heat
25 exchanger 40 side, FIG.5C is a perspective view when viewed from the indoor unit 1 right side and the heat exchanger 40 side, and FIG.5D is a perspective view when viewed from the indoor unit 1 right side and the fan 30 side.

As shown in FIG.3, FIG.4, and FIG.5A to FIG.5D, the connection pipe storage member 60 is formed longitudinally and opened in the right and left ends of the connection pipe storage
30 member 60. When the connection pipe storage member 60 and the connection pipes 52,54 are installed in the indoor unit 1, seals 70a,70b in shown in FIG.6A and FIG.6B are fitted in the right and left ends of the connection pipe storage member 60 and attached around the connection pipes 52,54 to hermetically close the connection pipe opening 14, so that the seals 70a,70b prevent

moist air from flowing into the connection pipe storage area 24. Therefore, the dew condensation inside of the connection pipe storage area 24 can be more efficiently prevented.

As it is clear from a cross section shape in a short length direction of the connection pipe storage member 60, the first wall surface member 62 on the fan 30 side is formed along the outer shape of the fans 30, and the second wall surface member 64 on the heat exchanger 40 side is formed along the outer shape of the heat exchanger 40, so that the volume of the connection pipe storage area 24 becomes large.

Next, the operation of the indoor unit 1 during cooling will be provided with reference to FIG. 1A to FIG. 4.

10 Firstly, when the fans 30 are operated, the fans 30 suck air through the air suction openings 12 from the outside and blow air toward the front direction of the indoor unit 1.

Secondly, air which is discharged from the fans 30 through the fan discharge ports 36 is fed to the heat exchanger 40. The heat exchanger 40 functions as an evaporator of the refrigerant during cooling by air blown from the fans 30, thereby the heat exchanger 40 can perform heat exchange with air that has been blown out from the fans 30, and cool air during cooling.

Finally, cooling air is fed to the building room.

As such, the dew condensation inside of the fan storage area 20 can be prevented due to the heat which is generated from the fan 30. Since the connection pipe storage area 24 which is formed between the fan storage area 20 and the heat exchanger storage area 22, serves as a heat buffer area between the fan storage area 20 and the heat exchanger storage area 22, the dew condensation on the first wall surface member 62 on the fan 30 side and the second wall surface member 64 on the heat exchanger 40 of the connection pipe storage member 60 can be prevented.

Moreover, since the first wall surface member 62 on the fan 30 side is formed along the outer shape of the fans 30 and the second wall surface member 64 on the heat exchanger 40 side is formed along the outer shape of the heat exchanger 40, the limited space in the indoor unit 1 can be more efficiently utilized. The dew condensation inside of the connection pipe storage member 60 can be furthermore efficiently prevented.

Although specific embodiments of the invention have been disclosed and described as well as illustrated in the accompanying drawings, it is simply for the purpose of better understanding of the principle of the present invention and it is not as a limitation of the scope and spirit of the teaching of the present invention. Adaption and modification to various structures such as design or material of the invention, mounting mechanism of various parts and

elements or embodiments are possible and apparent to a skilled person without departing from the scope of the present invention which is to be determined by the claims.

List of reference:

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| 5 | 1 indoor unit |
| | 10 casing |
| | 10a top cover |
| | 10b bottom cover |
| | 10c left cover |
| 10 | 10d right cover |
| | 10e rear cover |
| | 12 air suction opening |
| | 14 connection pipe opening |
| | 20 fan storage area |
| 15 | 22 heat exchanger storage area |
| | 24 connection pipe storage area |
| | 26 partition wall |
| | 30 fan |
| | 32 fan motor |
| 20 | 34 blade |
| | 36 fan discharge port |
| | 38 rotational shaft |
| | 40 heat exchanger |
| | 52 gas refrigerant connection pipe |
| 25 | 54 liquid refrigerant connection pipe |
| | 56 connection part |
| | 58 heat insulating material |
| | 60 connection pipe storage member |
| | 62 first wall surface member |
| 30 | 64 second wall surface member |
| | 70a, 70b seal |