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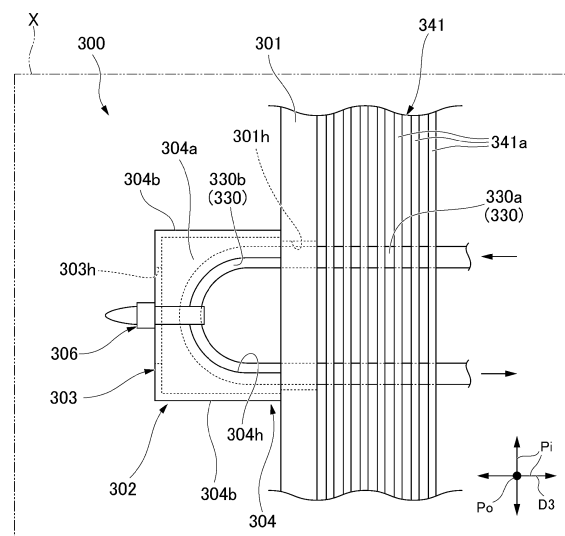
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(54) **HEAT EXCHANGER FIXING PLATE, HEAT EXCHANGER AND INDOOR UNIT**

(57) A heat exchanger fixing plate according to the present disclosure is for fixing a heat exchanger main body including a heat transfer tube through which a refrigerant is flowed to an inside of a casing of an indoor unit, the heat transfer tube is formed of a plurality of straight tube parts extending in the width direction of the casing and a plurality of curved hairpin parts each connecting end portions of the straight tube parts adjacent to each other. The heat exchanger fixing plate includes a fixing plate main body extending in a direction intersecting the width direction of the casing and having a plurality of insertion holes through which the hairpin parts are allowed to be inserted toward one side in the width direction, and a cover installed on the fixing plate main body to cover the hairpin part protruding from the fixing plate main body toward one side in the width direction and having a first through hole passing through an inner arc of the hairpin part.

FIG. 2



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present disclosure relates to a heat exchanger fixing plate, a heat exchanger and an indoor unit.

Description of Related Art

[0002] For example, Japanese Unexamined Patent Application, First Publication No. 2014-070759 discloses a heat exchanger fixing plate for fixing a heat exchanger in a casing of an indoor unit. The heat exchanger is fixed in the casing by inserting hairpin parts of a plurality of heat transfer tubes of the heat exchanger into the heat exchanger fixing plate. The hairpin parts protruding from the heat exchanger fixing plate are each covered with an insertion part in a state of being inserted into the insertion part.

SUMMARY OF THE INVENTION

[0003] Incidentally, when vibration occurs in the heat transfer tube due to a flow of a refrigerant, maintenance is performed on the indoor unit, or the like, a force in a direction in which the heat transfer tube is inserted into the heat exchanger fixing plate may act from the hairpin part to the insertion part. In the technology described in Japanese Unexamined Patent Application, First Publication No. 2014-070759, the hairpin part of the heat transfer tube may collide with the insertion part.

[0004] The present disclosure has been made to solve the above-described problems, and an objective thereof is to provide a heat exchanger fixing plate, a heat exchanger, and an indoor unit in which collision of a heat transfer tube with a hairpin part can be suppressed.

[0005] In order to solve the problems described above, a first heat exchanger fixing plate according to the present disclosure is for fixing a heat exchanger main body including a heat transfer tube through which a refrigerant is flowed to an inside of a casing of an indoor unit, the heat transfer tube is formed of a plurality of straight tube parts extending in a width direction of the casing and a plurality of curved hairpin parts each connecting end portions of the straight tube parts adjacent to each other, the heat exchanger fixing plate includes: a fixing plate main body extending in a direction intersecting the width direction of the casing and having a plurality of insertion holes through which the hairpin parts are allowed to be inserted toward a first side in the width direction; and a cover which is installed on the fixing plate main body to cover the hairpin part protruding from the fixing plate main body toward a first side in the width direction and having a first through hole passing through an inner arc of the hairpin part.

[0006] Also, a second heat exchanger fixing plate ac-

cording to the present disclosure is for fixing a heat exchanger main body including a heat transfer tube through which a refrigerant is flowed to an inside of a casing of an indoor unit, the heat transfer tube is formed of a plurality of straight tube parts extending in the width direction of the casing and a plurality of curved hairpin parts each connecting end portions of the straight tube parts adjacent to each other, the heat exchanger fixing plate includes: a fixing plate main body extending in a direction intersecting the width direction of the casing and having a plurality of insertion holes through which the hairpin parts are allowed to be inserted toward a first side in the width direction; a cover which is installed on the fixing plate main body and including a topside part facing the hairpin part in the width direction; and a tying member tying the hairpin part and the cover together by being wound over an inner arc of the hairpin part and the topside part of the cover.

[0007] Also, a heat exchanger according to the present disclosure includes: the heat exchanger fixing plate; and the heat exchanger main body which is fixed to the inside of the casing via the heat exchanger fixing plate, wherein the heat exchanger main body includes a fin group adjacent to the fixing plate main body in the width direction and formed of a plurality of fins each extending in a direction intersecting the width direction and aligned in the width direction.

[0008] Also, an indoor unit according to the present disclosure includes a casing, a fan accommodated in the casing and introducing air into the casing; and a heat exchanger accommodated in the casing, wherein the heat exchanger is configured to exchange heat between the air and the refrigerant.

[0009] According to the present disclosure, a heat exchanger fixing plate, a heat exchanger, and an indoor unit in which a collision of a heat transfer tube with a hairpin part can be suppressed can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a perspective view illustrating a schematic configuration of an indoor unit according to an embodiment of the present disclosure.

FIG. 2 is a view of a cover of a heat exchanger fixing plate according to a first embodiment of the present disclosure from an out-of-plane direction.

FIG. 3 is a view of the cover of the heat exchanger fixing plate according to the first embodiment of the present disclosure from an in-plane direction.

FIG. 4 is a view of a cover of a heat exchanger fixing plate according to a second embodiment of the present disclosure from an out-of-plane direction.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Hereinafter, an indoor unit according to embod-

iments of the present disclosure will be described on the basis of the drawings.

<First embodiment>

(Indoor unit)

[0012] An indoor unit is a device provided indoors and conditioning indoor air by exchanging heat between a refrigerant that is exchanged with an outdoor unit provided outdoors and the indoor air. An air conditioner is constituted by an indoor unit and an outdoor unit. In the present embodiment, an example in which an air conditioner performs a cooling operation will be described.

[0013] As illustrated in FIG. 1, the indoor unit 100 includes a casing 1, a fan 2, a heat exchanger 3 and a filter part 4.

(Casing)

[0014] The casing 1 is constituted by a plurality of panels and is provided on a wall surface W in a room. The casing 1 forms an outer casing of the indoor unit 100 and defines a housing space R for accommodating devices of various types therein. The casing 1 has a mounting surface 11, an upper surface 12, a lower surface 13, a front surface 14 and side surfaces.

[0015] The mounting surface 11 is a surface facing the wall surface W. The mounting surface 11 is fixed to the wall surface W in the room via mounting members or the like. In the present embodiment, a direction in which the wall surface W and the mounting surface 11 face each other is referred to as an "installation direction D1." That is, the installation direction D1 is a direction perpendicular to the wall surface W. The mounting surface 11 has a rectangular shape when viewed in the installation direction D1.

[0016] In the present embodiment, "the installation direction D1" includes a first direction horizontally approaching the wall surface W and a second direction horizontally separating from the wall surface W.

[0017] The upper surface 12 faces upward in a vertical direction D2 and connected to an upper side edge of the mounting surface 11 in the vertical direction D2. A suction port for introducing indoor air into the housing space R is preferably formed on the upper surface 12. The upper surface 12 is curved downward in the vertical direction D2 as separating from the mounting surface 11 in the installation direction D1. The upper surface 12 has a rectangular shape when viewed above in the vertical direction D2.

[0018] The lower surface 13 faces downward in the vertical direction D2 and connected to a lower side edge of the mounting surface 11 in the vertical direction D2. A blowout port for discharging the air introduced from the upper surface 12 side is preferably formed on the lower surface 13. The lower surface 13 in the present embodiment is curved upward in the vertical direction D2 as

separating from the mounting surface 11 in the installation direction D1. The lower surface 13 has a rectangular shape when viewed below in the vertical direction D2.

[0019] The vertical direction D2 in the present embodiment is a direction being parallel to a direction of gravity. The "upward in the vertical direction D2" means a direction from the lower surface 13 toward the upper surface 12. The "downward in the vertical direction D2" means a direction from the upper surface 12 toward the lower surface 13, which is opposite to the upward in the vertical direction D2.

[0020] The front surface 14 is a surface located opposite to the mounting surface 11 in the installation direction D1 and extending so as to be parallel to the wall surface W. The front surface 14 is connected to front edges of the upper surface 12 and the lower surface 13 in the installation direction D1. The front surface 14 has a rectangular shape when viewed in the installation direction D1.

[0021] Here, the mounting surface 11, the upper surface 12, the lower surface 13 and the front surface 14 have a width direction D3 perpendicular to the installation direction D1 and the vertical direction D2 as a longitudinal direction.

[0022] The side surfaces are a pair of surfaces that close a cylindrical space (housing space R), which extends in the width direction D3 and is formed by the mounting surface 11, the upper surface 12, the lower surface 13 and the front surface 14, from a first side and a second side in the width direction D3. The side surfaces are connected over the end portions of all the mounting surface 11, the upper surface 12, the lower surface 13 and the front surface 14 on the first side and the second side in the width direction D3.

(Fan)

[0023] The fan 2 is a cross-flow fan extending in the width direction D3 in the housing space R and capable of introducing air into the casing 1. The fan 2 rotates in the housing space R to suction indoor air from the suction port on the upper surface 12 side and blow out the suctioned air from the blowout port on the lower surface 13 side.

(Heat exchanger)

[0024] The heat exchanger 3 is provided to surround the fan 2 from an outer circumference in the housing space R. The heat exchanger 3 includes a heat exchanger main body 30 and a heat exchanger fixing plate 300.

(Heat exchanger main body)

[0025] The heat exchanger main body 30 extends in the width direction D3 and exchanges heat between the air suctioned into the housing space R by the fan 2 and the refrigerant. The heat exchanger main body 30 in-

cludes a first heat exchange part 31, a second heat exchange part 32, a third heat exchange part 33, a fourth heat exchange part 34 and a connection member.

[0026] The first heat exchange part 31 is placed in the housing space R so as to be above the fan 2 in the vertical direction D2 and closer to the mounting surface 11 than the fan 2 in the installation direction D1. The first heat exchange part 31 includes a fin group 311 and a heat transfer tube 310.

[0027] The fin group 311 is formed by a plurality of flat plate-shaped fins 311a extending in a direction intersecting the width direction D3 and disposed at regular intervals in the width direction D3. The fins 311a are formed of a metal such as aluminum.

[0028] The heat transfer tube 310 is a tube formed of a metal such as copper through which the refrigerant flows. The heat transfer tube 310 includes a plurality of straight tube parts 310a and a plurality of hairpin parts 310b.

[0029] The straight tube parts 310a are cylindrical tubes extending in the width direction D3. The straight tube parts 310a extend to penetrate the fins 311a, which are disposed in the width direction D3 in the fin group 311, in the width direction D3.

[0030] The hairpin parts 310b are tubes each connecting end portions in the width direction D3 of the straight tube parts 310a adjacent to each other. The hairpin part 310b is a U-shaped bent tube that is curved so that a direction in which the refrigerant flows in the straight tube part 310a is turned by 180°.

[0031] In the present embodiment, a configuration in which the heat transfer tube 310 includes 18 straight tube parts 310a and 17 hairpin parts 310b is an exemplary example. In FIG. 1, only nine hairpin parts 310b of the first heat exchange part 31 disposed on a first side of the fin group 311 in the width direction D3 are illustrated. The remaining eight hairpin parts 310b are disposed on a second side of the fin group 311 in the width direction D3 to connect end portions of the adjacent straight tube parts 310a on a second side in the width direction D3 so that the refrigerant sequentially flows through the straight tube parts 310a.

[0032] The refrigerant that has flowed into one straight tube part 310a flows through the one straight tube part 310a in the width direction D3, and then flows into another straight tube part 310a adjacent thereto through the hairpin part 310b. This flow of the refrigerant is sequentially repeated, and thereby the refrigerant circulates through the straight tube parts 310a and the hairpin parts 310b of the heat transfer tube 310 in the first heat exchange part 31. Cold heat of the refrigerant is conducted to the fins 311a of the first heat exchange part 31 via tube walls of the straight tube parts 310a.

[0033] The second heat exchange part 32 is placed in the housing space R so as to be above the fan 2 in the vertical direction D2 and further from the mounting surface 11 than the fan 2 in the installation direction D1. The second heat exchange part 32 includes a fin group 321

and a heat transfer tube 320.

[0034] The fin group 321 is formed by a plurality of fins 321a extending in a direction intersecting the width direction D3 and disposed at regular intervals in the width direction D3. The fins 321a are formed of a metal such as aluminum.

[0035] The fin group 321 of the second heat exchange part 32 and the fin group 311 of the first heat exchange part 31 are integrally fixed by a connection member connecting them in the installation direction D1. The positional relationship between the first heat exchange part 31 and the second heat exchange part 32 is defined by the connection member.

[0036] The heat transfer tube 320 is a tube formed of a metal such as copper through which the refrigerant flows. The heat transfer tube 320 includes a plurality of straight tube parts 320a and a plurality of hairpin parts 320b.

[0037] The straight tube parts 320a are cylindrical tubes extending in the width direction D3. The straight tube parts 320a extend to penetrate the fins 321a, which are disposed in the width direction D3 in the fin group 321, in the width direction D3.

[0038] The hairpin parts 320b are tubes each connecting end portions in the width direction D3 of the straight tube parts 320a adjacent to each other. The hairpin part 320b is a U-shaped bent tube that is curved so that a direction in which the refrigerant flows in the straight tube part 320a is turned by 180°.

[0039] In the present embodiment, as in the heat transfer tube 310 of the first heat exchange part 31, a configuration in which the heat transfer tube 320 includes 18 straight tube parts 320a and 17 hairpin parts 320b is an exemplary example. In FIG. 1, only nine hairpin parts 320b of the second heat exchange part 32 disposed on a first side of the fin group 321 in the width direction D3 are illustrated. The remaining eight hairpin parts 320b are disposed on a second side of the fin group 321 in the width direction D3 to connect end portions of the adjacent straight tube parts 320a on a second side in the width direction D3 so that the refrigerant sequentially flows through the straight tube parts 320a.

[0040] The refrigerant that has flowed into one straight tube part 320a flows through the one straight tube part 320a in the width direction D3, and then flows into another straight tube part 320a adjacent thereto through the hairpin part 320b. This flow of the refrigerant is sequentially repeated, and thereby the refrigerant circulates through the straight tube parts 320a and the hairpin parts 320b of the heat transfer tube 320 in the second heat exchange part 32. Cold heat of the refrigerant is conducted to the fins 321a of the second heat exchange part 32 via tube walls of the straight tube parts 320a.

[0041] The third heat exchange part 33 is placed in the housing space R so as to be further from the mounting surface 11 than the fan 2 in the installation direction D1. The third heat exchange part 33 includes a fin group 331 and a heat transfer tube 330.

[0042] The fin group 331 is formed by a plurality of fins 331a extending in a direction intersecting the width direction D3 and disposed at regular intervals in the width direction D3. The fins 331a are formed of a metal such as aluminum.

[0043] The fin group 331 of the third heat exchange part 33 and the fin group 321 of the second heat exchange part 32 are integrally fixed by a connection member connecting them in the vertical direction D2. The positional relationship between the second heat exchange part 32 and the third heat exchange part 33 is defined by the connection member.

[0044] The heat transfer tube 330 is a tube formed of a metal such as copper through which the refrigerant flows. The heat transfer tube 330 includes a plurality of straight tube parts 330a and a plurality of hairpin parts 330b.

[0045] The straight tube parts 330a are cylindrical tubes extending in the width direction D3. The straight tube parts 330a extend to penetrate the fins 331a, which are disposed in the width direction D3 in the fin group 331, in the width direction D3.

[0046] The hairpin parts 330b are tubes each connecting end portions in the width direction D3 of the straight tube parts 330a adjacent to each other. The hairpin part 330b is a U-shaped bent tube that is curved so that a direction in which the refrigerant flows in the straight tube part 330a is turned by 180°.

[0047] In the present embodiment, a configuration in which the heat transfer tube 330 includes eight straight tube parts 330a and seven hairpin parts 330b is an exemplary example. In FIG. 1, only four hairpin parts 330b of the third heat exchange part 33 disposed on a first side of the fin group 331 in the width direction D3 are illustrated. The remaining three hairpin parts 330b are disposed on a second side of the fin group 331 in the width direction D3 to connect end portions of the adjacent straight tube parts 330a on a second side in the width direction D3 so that the refrigerant sequentially flows through the straight tube parts 330a.

[0048] The refrigerant that has flowed into one straight tube part 330a flows through the one straight tube part 330a in the width direction D3, and then flows into another straight tube part 330a adjacent thereto through the hairpin part 330b. This flow of the refrigerant is sequentially repeated, and thereby the refrigerant circulates through the straight tube parts 330a and the hairpin parts 330b of the heat transfer tube 330 in the third heat exchange part 33. Cold heat of the refrigerant is conducted to the fins 331a of the third heat exchange part 33 via tube walls of the straight tube parts 330a.

[0049] The fourth heat exchange part 34 is placed in the housing space R so as to be below the fan 2 in the vertical direction D2 and further from the mounting surface 11 than the fan 2 in the installation direction D1. The fourth heat exchange part 34 includes a fin group 341 and a heat transfer tube 340.

[0050] The fin group 341 is formed by a plurality of fins

341a extending in a direction intersecting the width direction D3 and disposed at regular intervals in the width direction D3. The fins 341a are formed of a metal such as aluminum.

[0051] The fin group 341 of the fourth heat exchange part 34 and the fin group 331 of the third heat exchange part 33 are integrally fixed by a connection member connecting them in the vertical direction D2. The positional relationship between the third heat exchange part 33 and the fourth heat exchange part 34 is defined by the connection member.

[0052] The heat transfer tube 340 is a tube formed of a metal such as copper through which the refrigerant flows. The heat transfer tube 340 includes a plurality of straight tube parts 340a and a plurality of hairpin parts 340b.

[0053] The straight tube parts 340a are cylindrical tubes extending in the width direction D3. The straight tube parts 340a extend to penetrate the fins 341a, which are disposed in the width direction D3 in the fin group 341, in the width direction D3.

[0054] The hairpin parts 340b are tubes each connecting end portions in the width direction D3 of the straight tube parts 340a adjacent to each other. The hairpin part 340b is a U-shaped bent tube that is curved so that a direction in which the refrigerant flows in the straight tube part 340a is turned by 180°.

[0055] In the present embodiment, a configuration in which the heat transfer tube 340 includes four straight tube parts 340a and three hairpin parts 340b is an exemplary example. In FIG. 1, only two hairpin parts 340b of the fourth heat exchange part 34 disposed on a first side of the fin group 341 in the width direction D3 are illustrated. The remaining one hairpin part 340b is disposed on a second side of the fin group 341 in the width direction D3 to connect end portions of the adjacent straight tube parts 340a on a second side in the width direction D3 so that the refrigerant sequentially flows through the straight tube parts 340a.

[0056] The refrigerant that has flowed into one straight tube part 340a flows through the one straight tube part 340a in the width direction D3, and then flows into another straight tube part 340a adjacent thereto through the hairpin part 340b. This flow of the refrigerant is sequentially repeated, and thereby the refrigerant circulates through the straight tube parts 340a and the hairpin parts 340b of the heat transfer tube 340 in the fourth heat exchange part 34. Cold heat of the refrigerant is conducted to the fins 341a of the fourth heat exchange part 34 via tube walls of the straight tube parts 340a.

(Heat exchanger fixing plate)

[0057] The heat exchanger fixing plate 300 fixes the heat exchanger main body 30 to the casing 1 in the casing 1 (in the housing space R). The heat exchanger fixing plate 300 includes a fixing plate main body 301, a cover 302 and a tying member 306.

(Fixing plate main body)

[0058] The fixing plate main body 301 is a plate-shaped member that extends in a direction intersecting the width direction D3. The fixing plate main body 301 is fixed to the casing 1 on a first side in the width direction D3 with respect to the fin groups 311, 321, 331 and 341 of the heat exchange parts (the first heat exchange part 31 to the fourth heat exchange part 34) of the heat exchanger main body 30.

[0059] That is, the fin groups 311, 321, 331 and 341 of the heat exchange parts (the first heat exchange part 31 to the fourth heat exchange part 34) are disposed on a second side of the fixing plate main body 301 in the width direction D3 while they are adjacent to the fixing plate main body 301. The fixing plate main body 301 is formed of a material having flexibility such as, for example, a synthetic resin that is softer than the heat transfer tubes 310, 320, 330 and 340.

[0060] A plurality of insertion holes 301h through which the hairpin parts 310b, 320b, 330b and 340b of the heat exchange parts (the first heat exchange part 31 to the fourth heat exchange part 34) of the heat exchanger main body 30 can be inserted in the width direction D3 are formed in the fixing plate main body 301. The fixing plate main body 301 has the insertion holes 301h equal in number to the hairpin parts 310b, 320b, 330b and 340b of the heat exchanger main body 30.

[0061] The hairpin parts 310b, 320b, 330b and 340b are inserted through the insertion holes 301h of the fixing plate main body 301, and thereby the heat exchanger main body 30 is fixedly supported. In other words, the fixing plate main body 301 fixedly supports the heat exchanger main body 30 in a cantilevered manner. The hairpin parts 310b, 320b, 330b and 340b protrude from the fixing plate main body 301 to a first side in the width direction D3 when they are inserted through the insertion holes 301h.

(Cover)

[0062] The cover 302 is a member provided integrally with the fixing plate main body 301 and configured to cover each of the hairpin parts 320b and 330b which are part of the plurality of hairpin parts 310b, 320b, 330b and 340b protruding from the fixing plate main body 301 to a first side in the width direction D3.

[0063] The covers 302 of the present embodiment cover one of the hairpin parts 320b of the heat transfer tube 320 of the second heat exchange part 32, which is closer to the upper surface 12 than the other ones in the vertical direction D2, and one of the hairpin parts 330b of the heat transfer tube 330 of the third heat exchange part 33, which is further from the fan 2 than the other ones in the installation direction D1 and closer to the upper surface 12 than the other ones in the vertical direction D2. The cover 302 is formed of the same material as that of the fixing plate main body 301.

[0064] Hereinafter, a configuration of the cover 302 will be described by taking the cover 302 that covers the hairpin part 330b of the heat transfer tube 330 in the third heat exchange part 33 as an example.

[0065] As illustrated in FIG. 2, the cover 302 includes a topside part 303 and a side wall part 304.

[0066] An inside surface of the topside part 303 faces top of the hairpin part 330b in the width direction D3.

[0067] The side wall part 304 extends from the topside part 303 in the width direction D3 and is in contact with the fixing plate main body 301 in a state of surrounding the hairpin part 330b. The side wall part 304 includes a pair of first side wall parts 304a and a pair of second side wall parts 304b.

[0068] The pair of first side wall parts 304a are disposed to interpose the hairpin part 330b from both sides in a direction Po perpendicular to a virtual plane X extending along the hairpin part 330b. That is, the first side wall parts 304a are adjacent to each other in the direction Po so as to interpose the hairpin part 330b therebetween. A first through hole 304h passing through an inner arc of the hairpin part 330b is formed in the cover 302. Therefore, the first side wall parts 304a each have an opening of the first through hole 304h.

[0069] An opening area of the first through hole 304h when viewed in the direction perpendicular to the vertical plane X is larger than that of an inner arc of the hairpin part 330b when viewed in the same direction. The inner arc of the hairpin part 330b when viewed in the direction perpendicular to the vertical plane X is positioned on an inner side of the opening of the first through hole 304h when viewed in the same direction.

[0070] The pair of second side wall parts 304b are disposed to interpose the hairpin part 330b from both sides in a direction Pi parallel to the virtual plane X. That is, the second side wall parts 304b are adjacent to each other in the direction Pi so as to interpose the hairpin part 330b therebetween. The second side wall parts 304b are both integrally fixed to the first side wall parts 304a.

[0071] Here, as illustrated also in FIG. 3, the top side part 303, which is adjacent to the top of the hairpin part 330b in the width direction D3, has a second through hole 303h passing through the top side part 303 in the width direction D3. The opening area of the second through hole 303h when viewed from a first side in the width direction D3 is smaller than that of an outer edge of the hairpin part 330b when viewed from a first side in the width direction D3. Therefore, the outer edge of the hairpin part 330b is hidden by the topside part 303 when viewed from a first side in the width direction D3.

(Tying member)

[0072] The tying member 306 is tying the hairpin part 330b and the cover 302 together by being wound over the inner arc of the hairpin part 330b and the topside part 303, which is an end portion of the cover 302 on a first side in the width direction D3, through the first through

hole 304h.

[0073] The cover 302 is pressed against the fixing plate main body 301 by the tying member 306 that ties the topside part 303 and the hairpin part 330b together. As a specific example of the tying member 306, the tying band of INSULOK (registered trademark) manufactured by HellamanTyton Co., Ltd. can be mentioned.

(Filter part)

[0074] As illustrated in FIG. 1, the filter part 4 removes impurities such as dust contained in the air suctioned from the suction port. The filter part 4 is placed above the heat exchanger 3 in the vertical direction D2 in the housing space R. That is, the filter part 4 is positioned between the casing 1 and the heat exchanger 3. Therefore, the filter part 4 supplies the air from which impurities such as dust are removed to the heat exchanger 3.

(Operation and effects)

[0075] When the refrigerant flows through the heat transfer tubes 310, 320, 330 and 340, air in the vicinity of the heat transfer tubes 310, 320, 330 and 340 is cooled by cold heat of the refrigerant, and air in the vicinity of the fin groups 311, 321, 331 and 341 to which the cold heat of the refrigerant can be conducted via the heat transfer tubes 310, 320, 330 and 340 is cooled. When the air in the vicinity of the heat transfer tubes 310, 320, 330 and 340 and in the vicinity the fin groups 311, 321, 331 and 341 is cooled, moisture contained in the air is condensed (causes dew condensation) and generates droplets.

[0076] Also, when vibration due to the circulation of the refrigerant occurs in the heat transfer tubes 310, 320, 330 and 340, or when maintenance of the indoor unit 100 is performed, a force may act from the hairpin parts 320b and 330b toward the cover 302.

[0077] According to the above-described configuration, water vapor in the condensed air due to the cold heat of the refrigerant flowing in the hairpin parts 320b and 330b of the heat transfer tubes 320 and 330 can be diffused to the outside of the cover 302 through the first through hole 304h of the cover 302. Therefore, the moisture in the condensed air staying inside the cover 302 can be suppressed.

[0078] Also, the rigidity of the cover 302 reduces due to the cover 302 having the first through hole 304h. Therefore, an elastic force of the entire cover 302 increases. Therefore, for example, even if a force directed from the hairpin parts 320b and 330b toward the cover 302 acts from the hairpin parts 320b and 330b, the hairpin parts 320b and 330b colliding with other members can be suppressed.

[0079] Also, according to the above-described configuration, water vapor in the air condensed by the cold heat of the refrigerant flowing through the hairpin parts 320b and 330b can be diffused to the outside of the cover 302

through the second through hole 303h of the topside part 303.

[0080] Also, according to the above-described configuration, since the cover 302 has the through holes interposing the hairpin parts 320b and 330b from both sides in the direction Po perpendicular to the virtual plane X extending along the hairpin parts 320b and 330b, the rigidity of the entire cover 302 can be reduced more uniformly. Therefore, the elastic force of the entire cover 302 can be increased in a more balanced manner.

[0081] Also, according to the above-described configuration, since the tying member 306 ties the hairpin parts 320b and 330b and the cover 302 together, the cover 302 is pressed against the fixing plate main body 301. Therefore, for example, even if an external force is applied to the cover 302, the cover 302 being buckled can be suppressed.

[0082] Also, for example, when compared to a configuration in which the fixing plate main body 301 is directly tied to the hairpin parts 320b and 330b, a force of pulling the fixing plate main body 301 toward a first side in the width direction D3 does not act because the cover 302 is configured to be pressed against the fixing plate main body 301. Therefore, generation of gaps between the fixing plate main body 301 and the fins 311a, 321a, 331a and 341a positioned on the most a first side in the width direction D3 of the fin groups 311, 321, 331 and 341 can be suppressed.

[0083] Also, according to the above-described configuration, visibility of the inside of the cover 302 through the second through hole 303h can be improved. Therefore, a tying operation for tying the cover 302 and the hairpin parts 320b and 330b together at the time of manufacturing the indoor unit 100, assembly such as maintenance, or the like can be facilitated.

<Second embodiment>

[0084] A heat exchanger fixing plate 300 according to a second embodiment of the present disclosure will be described below with reference to FIG. 4. The heat exchanger fixing plate 300 described in the second embodiment is partially different in configuration from the heat exchanger fixing plate 300 of the first embodiment. Components the same as those in the first embodiment will be denoted by the same reference signs and detailed description thereof will be omitted.

(Heat exchanger fixing plate)

[0085] The heat exchanger fixing plate 300 fixes a heat exchanger main body 30 to a casing 1 inside the casing 1 (inside a housing space R). The heat exchanger fixing plate 300 includes a fixing plate main body 301, a cover 302a and a tying member 306. The fixing plate main body 301 of the present embodiment has the same configuration as the fixing plate main body 301 described in the first embodiment.

(Cover)

[0086] The cover 302a is provided integrally with the fixing plate main body 301, and covers hairpin parts 320b and 330b, which are part of a plurality of hairpin parts 310b, 320b, 330b and 340b protruding from the fixing plate main body 301 to a first side in a width direction D3, from a first side in the width direction D3.

[0087] Hereinafter, a configuration of the cover 302a will be described by taking the cover 302a that covers the hairpin part 330b of a heat transfer tube 330 in a third heat exchange part 33 as an example.

[0088] As illustrated in FIG. 4, the cover 302a includes a topside part 303a and a connection part 305.

[0089] An inside surface of the topside part 303a faces top of the hairpin part 330b in the width direction D3.

[0090] Here, the area of a surface of the topside part 303a facing a first side in the width direction D3 when viewed from a first side in the width direction D3 is larger than that of an outer edge of the hairpin part 330b when viewed from a first side in the width direction D3, and the outer edge of the hairpin part 330b when viewed from a first side in the width direction D3 is hidden by the topside part 303a.

[0091] The connection part 305 extends from the fixing plate main body 301 to a first side in the width direction D3 and has a columnar shape that supports the topside part 303a.

[0092] Therefore, in the present embodiment, the topside part 303a and the connection part 305 constitute the eave-shaped cover 302a that covers the hairpin part 330b from a first side in the width direction D3.

(Tying member)

[0093] The tying member 306 is a member capable of tying the hairpin part 330b and the cover 302a together by being wound over the inside of a curve of the hairpin part 330b and a surface of the topside part 303a of the cover 302a facing a first side in the width direction D3 through a first through hole 304h.

(Operation and effects)

[0094] According to the above-described configuration, the same operation and effects as those of the first embodiment can be obtained. Also, since the connection part 305 has a configuration having a columnar shape that extends from the fixing plate main body 301 to a first side in the width direction D3 and supports the topside part 303a, compared to the configuration of the side wall part 304 surrounding the hairpin parts 320b and 330b described in the first embodiment, moisture does not stay on the cover 302a when moisture contained in the air condenses.

<Other embodiments>

[0095] While embodiments of the present disclosure have been described in detail with reference to the drawings, the specific configurations are not limited to the embodiments, and additions, omissions, substitutions, and other changes to the configurations can be made within a scope not departing from the gist of the present disclosure. Also, the present disclosure is not to be considered as being limited by the embodiments and is only limited by the scope of the claims.

[0096] Further, in the above-described embodiment, the numbers of the straight tube parts 310a, 320a, 330a and 340a, and the hairpin parts 310b, 320b, 330b and 340b of the heat transfer tubes 310, 320, 330 and 340 in each of the heat exchange parts (the first heat exchange part 31 to the fourth heat exchange part 34) are not limited to the above-described numbers.

[0097] Also, the above-described embodiment may have a configuration in which all the hairpin parts 310b, 320b, 330b and 340b of the heat transfer tubes 310, 320, 330 and 340 are covered by the cover 302 or 302a. Also, the cover 302 or 302a may be configured to cover only one hairpin part 310b, 320b, 330b, or 340b.

[0098] Also, in the above-described embodiment, the covers 302 and 302a may be formed of a material different from that of the fixing plate main body 301.

[0099] Also, in the above-described embodiment, a configuration of the heat exchanger fixing plate 300 that fixes the heat exchanger main body 30 to the casing 1 in the casing 1 of the indoor unit 100 has been described, but the present disclosure is not limited to the indoor unit 100. The heat exchanger fixing plate 300 may fix the heat exchanger main body to, for example, a casing inside the casing of an outdoor unit.

[0100] Also, the tying member 306 in the above-described embodiment is not limited to a tying band. The tying member 306 may be formed of a material such as a thread or a wire as long as it is a member capable of tying the hairpin part 310b, 320b, 330b, or 340b and the cover 302 or 302a together through the first through hole 304h.

<Appendix>

[0101] The heat exchanger fixing plate, the heat exchanger and the indoor unit described in each embodiment are understood, for example, as follows.

(1) A first aspect of the heat exchanger fixing plate 300 is for fixing a heat exchanger main body 30 including heat transfer tubes 310, 320, 330 and 340 through which a refrigerant is flowed to an inside of a casing of an indoor unit, the heat transfer tube are each formed of a plurality of straight tube parts 310a, 320a, 330a and 340a extending in the width direction D3 of the casing 1 and a plurality of hairpin parts 310b, 320b, 330b and 340b connecting adjacent end

portions of the straight tube parts 310a, 320a, 330a and 340a. The heat exchanger fixing plate 300 includes: a fixing plate main body 301 extending in a direction intersecting the width direction D3 of the casing 1 and having a plurality of insertion holes 301h through which the hairpin parts 310b, 320b, 330b and 340b are allowed to be inserted toward a first side in the width direction D3; and a cover 302 which is installed on the fixing plate main body 301 to cover the hairpin parts 310b, 320b, 330b and 340b protruding from the fixing plate main body 301 toward a first side in the width direction D3 and having a first through hole 304h an inner arc of each of the hairpin parts 310b, 320b, 330b and 340b.

Thereby, water vapor in condensed air due to cold heat of the refrigerant flowing in the hairpin parts 310b, 320b, 330b and 340b can be diffused to the outside of the cover 302 through the first through hole 304h of the cover 302. Also, since rigidity of the cover 302 is reduced due to the cover 302 having the first through hole 304h, the elastic force of the entire cover 302 can be increased.

(2) In a second aspect of the heat exchanger fixing plate 300 according to the first aspect of the heat exchanger fixing plate 300, the cover 302 may include a second through hole 303h which is formed in a topside part of the cover 302 corresponding to a top of each of the hairpin parts 310b, 320b, 330b and 340b and passing through the topside part of the cover 302 in the width direction D3, wherein an opening area of the second through hole may be smaller than that of a profile of each of the hairpin parts 310b, 320b, 330b and 340b when viewed from a first side in the width direction D3.

Thereby, water vapor in the condensed air due to the cold heat of the refrigerant flowing in the hairpin parts 310b, 320b, 330b and 340b can be diffused to the outside of the cover 302 through the second through hole 303h.

(3) In a third aspect of the heat exchanger fixing plate 300 according to the first or second aspect of the heat exchanger fixing plate 300, openings of first through hole 304h may be formed on both side parts of the cover 302 interposing each of the hairpin parts 310b, 320b, 330b and 340b therebetween.

Thereby, rigidity of the entire cover 302 can be uniformly reduced.

(4) A fourth aspect of the heat exchanger fixing plate 300 according to the third aspect of the heat exchanger fixing plate 300 may further include a tying member 306 tying each of the hairpin parts 310b, 320b, 330b and 340b to the cover 302 by being wound over the inner arc of each of the hairpin parts 310b, 320b, 330b and 340b and a topside part of the cover 302 corresponding to a top of each of the hairpin parts 310b, 320b, 330b and 340b through the first through hole 304h.

Thereby, the cover 302 can be pressed against the

fixing plate main body 301.

(5) A fifth aspect of the heat exchanger fixing plate 300 is for fixing a heat exchanger main body 30 including heat transfer tubes 310, 320, 330 and 340 through which a refrigerant is flowed to an inside of a casing 1 of an indoor unit 100, the heat transfer tubes 310, 320, 330 and 340 are each formed of a plurality of straight tube parts 310a, 320a, 330a and 340a extending in the width direction D3 of the casing 1 and a plurality of hairpin parts 310b, 320b, 330b and 340b connecting adjacent end portions of the straight tube parts 310a, 320a, 330a and 340a. The heat exchanger fixing plate 300 includes: a fixing plate main body 301 extending in a direction intersecting the width direction D3 of the casing 1 and having a plurality of insertion holes 301h through which the hairpin parts 310b, 320b, 330b and 340b are allowed to be inserted toward a first side in the width direction D3; a cover 302a which is installed on the fixing plate main body 301 and having a top-side part 303 or 303a facing the hairpin parts 310b, 320b, 330b and 340b from a first side in the width direction D3; and a tying member 306 tying each of the hairpin parts 310b, 320b, 330b and 340b and the cover 302 together by being wound over an inner arc of each of the hairpin parts 310b, 320b, 330b and 340b and the topside part 303 or 303a of the cover 302.

Thereby, the same operation as described above can be obtained. Also, when moisture contained in the air condenses, no moisture is stayed on the cover 302a.

(6) A sixth aspect of the heat exchanger 3 includes: any one of the first to fifth aspects of the heat exchanger fixing plate 300; and the heat exchanger main body 30 which is fixed to the inside of the casing 1 via the heat exchanger fixing plate 300, wherein the heat exchanger main body 300 includes fin groups 311, 321, 331 and 341 adjacent to the fixing plate main body 301 in the width direction D3 and formed of a plurality of fins 311a, 321a, 331a and 341a extending in a direction intersecting the width direction D3 and aligned in the width direction D3.

Thereby, since the cover 302 or 302a is pressed against the fixing plate main body 301, a force of pulling the fixing plate main body 301 toward a first side in the width direction D3 is not generated when compared to a configuration in which the fixing plate main body 301 is directly tied to the cover 302 or 302a.

(7) A seventh aspect of the indoor unit 100 includes: a casing 1; a fan 2 accommodated in the casing 1 and introducing air into the casing 1; and the heat exchanger 3 of (6) accommodated in the casing 1, wherein the heat exchanger 3 is configured to exchange heat between the air and the refrigerant.

EXPLANATION OF REFERENCES

[0102]

1 Casing
 2 Fan
 3 Heat exchanger
 4 Filter part
 11 Mounting surface
 12 Upper surface
 13 Lower surface
 14 Front surface
 30 Heat exchanger main body
 31 First heat exchange part
 32 Second heat exchange part
 33 Third heat exchange part
 34 Fourth heat exchange part
 100 Indoor unit
 300 Heat exchanger fixing plate
 301 Fixing plate main body
 301h Insertion hole
 302 Cover
 303, 303a Topside part
 303h Second through hole
 304 Side wall part
 304a First side wall part
 304b Second side wall part
 304h First through hole
 305 Connection part
 306 Tying member
 310, 320, 330, 340 Heat transfer tube
 310a, 320a, 330a, 340a Straight tube part
 310b, 320b, 330b, 340b Hairpin part
 311, 321, 331, 341 Fin group
 311a, 321a, 331a, 341a Fin
 D1 Installation direction
 D2 Vertical direction
 D3 Width direction
 O1 First axis
 O2 Second axis
 Pi In-plane direction
 Po Out-of-plane direction
 R Housing space
 W Wall surface
 X Virtual surface

portions of the straight tube parts (310a, 320a, 330a, 340a) adjacent to each other, the heat exchanger fixing plate (300) comprising:

- 5 a fixing plate main body (301) extending in a direction intersecting the width direction (D3) of the casing (1) and having a plurality of insertion holes (301h) through which the hairpin parts (310b, 320b, 330b, 340b) are allowed to be inserted toward one side in the width direction (D3); and
- 10 a cover (302) which is installed on the fixing plate main body (301) to cover the hairpin part (310b, 320b, 330b, 340b) protruding from the fixing plate main body (301) toward one side in the width direction (D3) and having a first through hole (304h) passing through an inner arc of the hairpin part (310b, 320b, 330b, 340b).
- 20 2. The heat exchanger fixing plate (300) according to claim 1, wherein the cover (302) includes a second through hole (303h) which is formed in a topside part (303, 303a) of the cover (302) corresponding to a top of the hairpin part (310b, 320b, 330b, 340b) and passing through the topside part (303, 303a) of the cover (302) in the width direction (D3), wherein an opening area of the second through hole (303h) is smaller than that of a profile of the hairpin part (310b, 320b, 330b, 340b) when viewed from one side in the width direction (D3).
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- 30 3. The heat exchanger fixing plate (300) according to claim 1 or 2, wherein openings of the first through hole (304h) are formed on both side parts of the cover (1) interposing the hairpin part (310b, 320b, 330b, 340b) therebetween.
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- 40 4. The heat exchanger fixing plate (300) according to claim 3, further comprising a tying member (306) tying the hairpin part and the cover (1) together by being wound over the inner arc of the hairpin part (310b, 320b, 330b, 340b) and a topside part of the cover (1) corresponding to a top of the hairpin part (310b, 320b, 330b, 340b) through the first through hole (304h).
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5. A heat exchanger fixing plate (300) for fixing a heat exchanger main body (30) including a heat transfer tube (310, 320, 330, 340) through which a refrigerant is flowed to an inside of a casing (1) of an indoor unit (100), the heat transfer tube (310, 320, 330, 340) is formed of a plurality of straight tube parts (310a, 320a, 330a, 340a) extending in the width direction (D3) of the casing (1) and a plurality of curved hairpin parts (310b, 320b, 330b, 340b) each connecting end portions of the straight tube parts (310a, 320a, 330a, 340a) adjacent to each other, the heat exchanger fixing plate (300) comprising:

Claims

1. A heat exchanger fixing plate (300) for fixing a heat exchanger main body (30) including a heat transfer tube (310, 320, 330, 340) through which a refrigerant is flowed to an inside of a casing (1) of an indoor unit (100), the heat transfer tube (310, 320, 330, 340) is formed of a plurality of straight tube parts (310a, 320a, 330a, 340a) extending in the width direction of the casing (1) and a plurality of curved hairpin parts (310b, 320b, 330b, 340b) each connecting end

a fixing plate main body (301) extending in a direction intersecting the width direction (D3) of the casing (1) and having a plurality of insertion holes (301h) through which the hairpin parts (310b, 320b, 330b, 340b) are allowed to be inserted toward one side in the width direction (D3);
 a cover (302) which is installed on the fixing plate main body (301) and including a topside part (303, 303a) facing the hairpin part (310b, 320b, 330b, 340b) in the width direction (D3); and
 a tying member (306) tying the hairpin part (310b, 320b, 330b, 340b) and the cover (302) together by being wound over an inner arc of the hairpin part (310b, 320b, 330b, 340b) and the topside part (303, 303a) of the cover (302).

6. A heat exchanger (3) comprising:

the heat exchanger fixing plate (300) according to any one of claims 1 to 5; and
 the heat exchanger main body (30) which is fixed to the inside of the casing (1) via the heat exchanger fixing plate (300), wherein the heat exchanger main (30) body includes a fin group (311, 321, 331, 341) adjacent to the fixing plate main body (300) in the width direction (D3) and formed of a plurality of fins (311a, 321a, 331a, 341a) each extending in a direction intersecting the width direction (D3) and aligned in the width direction (D3).

7. An indoor unit (100) comprising:

a casing (1) ;
 a fan (2) accommodated in the casing (1) and adapted to introduce air into the casing (1); and
 the heat exchanger (3) according to claim 6 which is accommodated in the casing (1), wherein the heat exchanger (3) is configured to exchange heat between the air and the refrigerant.

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FIG. 1

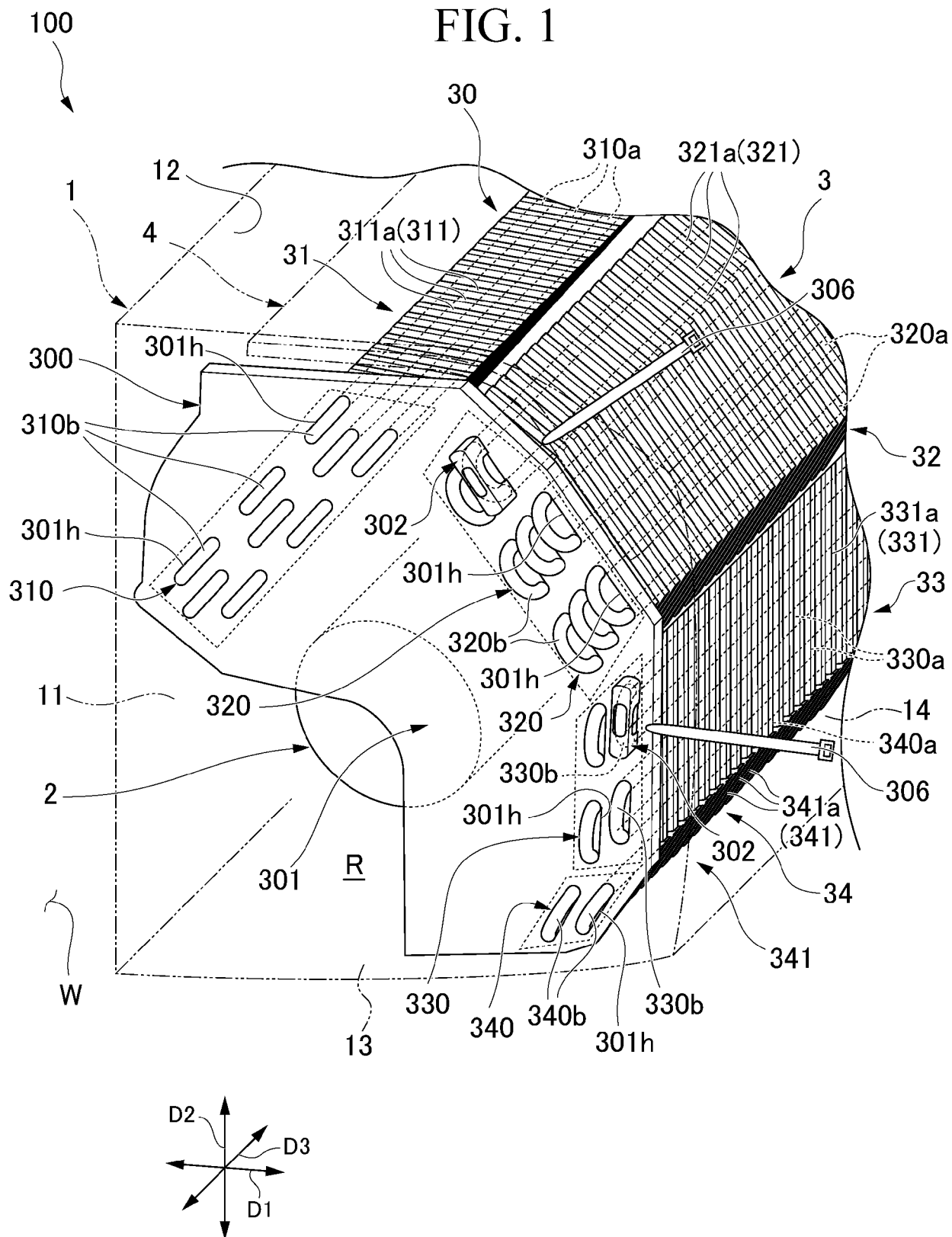


FIG. 2

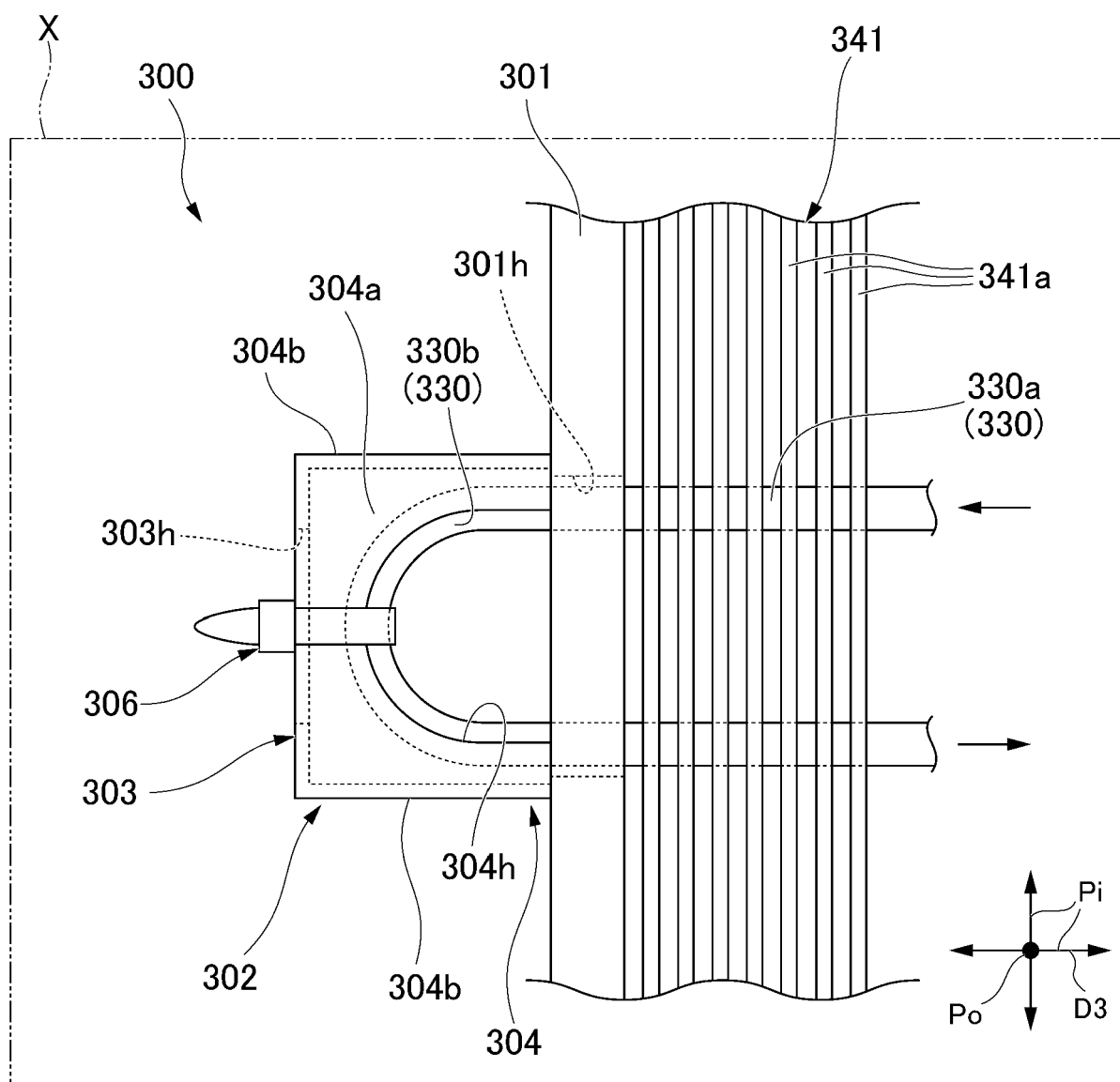


FIG. 3

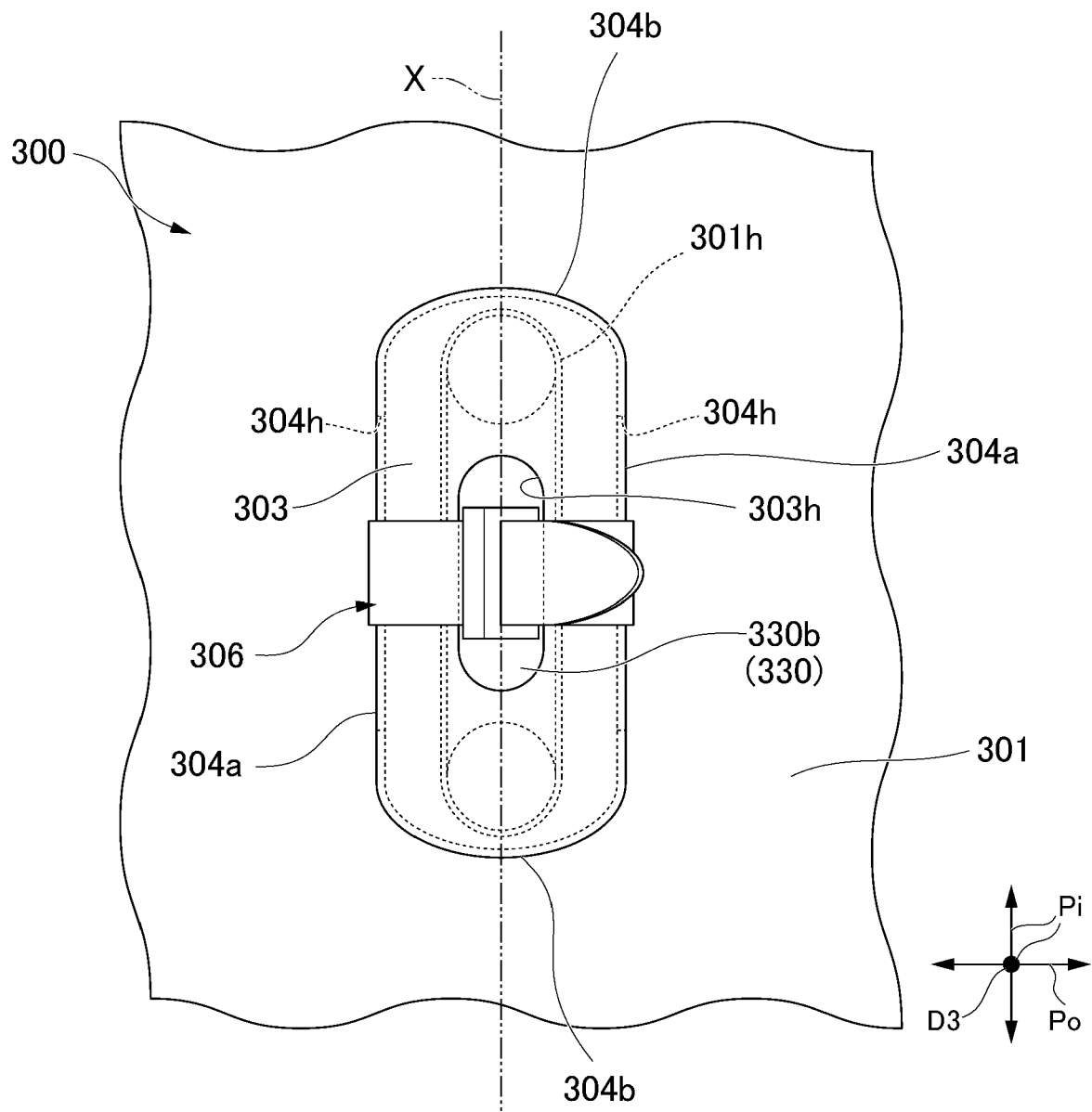
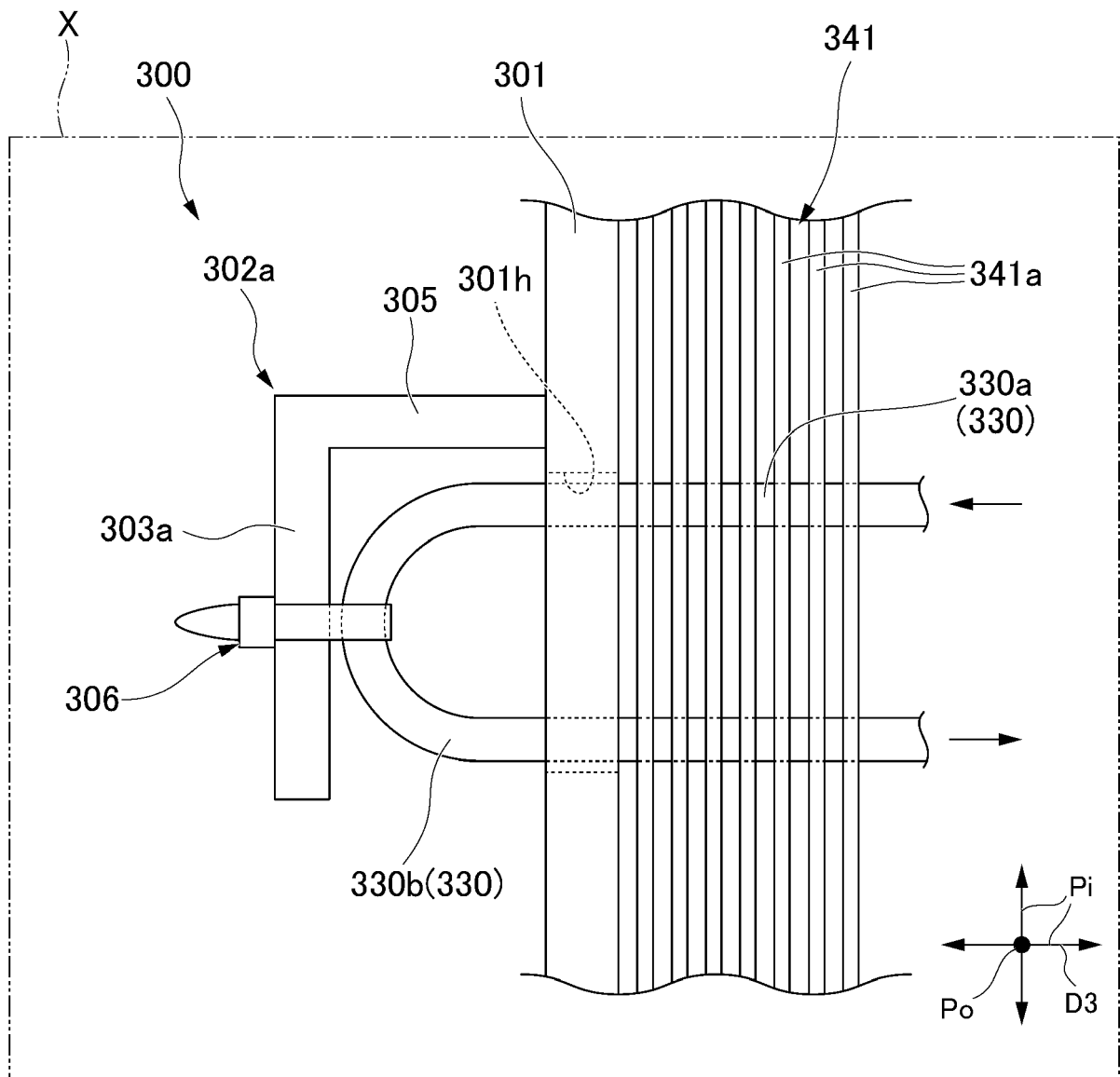


FIG. 4





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Application Number

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