(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 209 721 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.07.2023 Bulletin 2023/28

(21) Application number: **23150738.5**

(22) Date of filing: **09.01.2023**

(51) International Patent Classification (IPC):
F24F 1/16 *(2011.01)* ***F28F 9/00*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24F 1/16; F28F 9/002; F28D 1/0471;
F28D 2021/0068; F28F 9/0243; F28F 2275/08

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **11.01.2022 JP 2022002349**

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

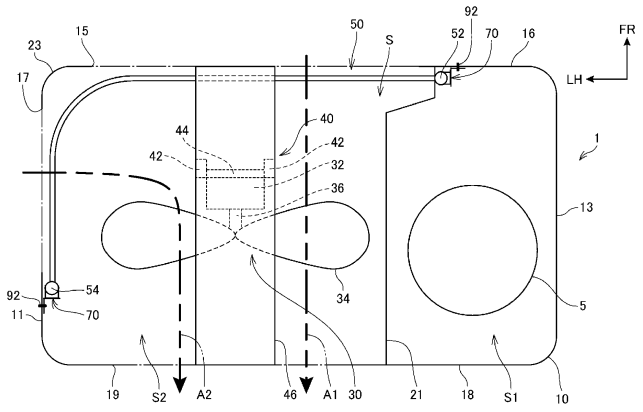
(72) Inventors:
- **KAWABATA, Ryuji**
  Osaka-shi, Osaka, 540-6207 (JP)
- **HAYASHI, Yoshimi**
  Osaka-shi, Osaka, 540-6207 (JP)
- **SHIMIZU, Shougo**
  Osaka-shi, Osaka, 540-6207 (JP)
- **MATSUI, Masaru**
  Osaka-shi, Osaka, 540-6207 (JP)
- **HIROTA, Masanobu**
  Osaka-shi, Osaka, 540-6207 (JP)

(74) Representative: **Eisenführ Speiser**
Patentanwälte Rechtsanwälte PartGmbB
Postfach 31 02 60
80102 München (DE)

(54) OUTDOOR UNIT OF AIR CONDITIONER

(57) An object of the present invention is to provide an outdoor unit of an air conditioner capable of preventing corrosion of a heat exchanger. The outdoor unit includes: a heat exchanger including header pipes 52 and 54 that respectively have side surfaces 51 and 53 to which flat tubes 62 are connected; a housing 10 that contains the heat exchanger; and fixing members 70 that fix the heat exchanger inside the housing 10. The fixing members 70 include: fixing portions 74 that are fixed inside the housing 10; and holding portions 72 that are in contact with the header pipes 52 and 54 at the side surfaces 51 and 53 except the connection surfaces 55 and 57 to which the flat tubes 62 are connected, and thereby holds the header pipes 52 and 54. The holding portions 72 include contact portions 80 that are in contact with predetermined sections of the side surfaces 51 and 53 of the header pipes 52 and 54. The side surfaces 51 and 53 of the header pipes 52 and 54 include exposed surfaces 59 exposed to the outside. The exposed surfaces 59 are at the same heights as the sections of the side surfaces 51 and 54 that are in contact with the contact portions 80, and the exposed surfaces 59 are not in contact with the contact portions 80 in a circumferential direction of the header pipes 52 and 54.

FIG.2



EP 4 209 721 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present disclosure relates to an outdoor unit of an air conditioner.

Description of the Related Art

[0002] Japanese Patent Laid-Open No. 2013-139930 discloses an outdoor unit that prevents corrosion of a bracket for mounting a heat exchanger. The outdoor unit has a mounting piece of the bracket made of aluminum fixed to a side plate made of steel plate on a side of a blower room. The side plate made of steel plate on a side of a blower room has an opening through which the mounting piece of the bracket made of aluminum passes. The mounting piece of the bracket made of aluminum is fixed through this opening. The bracket made of aluminum and the side plate made of steel plate on the side of the blower room has a resin cover interposed therebetween to form a predetermined interval therebetween.

[0003] The present disclosure provides an outdoor unit of an air conditioner that can prevent corrosion of heat exchangers.

SUMMARY OF THE INVENTION

[0004] An outdoor unit of an air conditioner includes: at least one heat exchanger including header pipes, the header pipes respectively having side surfaces to which at least one flat tube is connected; a housing that contains the heat exchanger; and at least one fixing member that fixes the heat exchanger inside the housing, wherein the fixing member includes: a fixing portion to be fixed to the housing; and at least one holding portion that is in contact with the header pipes at the side surfaces except a connection surface to which the flat tube is connected, and thereby holds the header pipes, the holding portion includes at least one contact portion that is in contact with a predetermined section of the side surface of the header pipe, and the side surface of the header pipe includes at least one exposed surface exposed to an outside, the exposed surface being at the same height as a section of the side surface that is in contact with the contact portion, the exposed surface having no contact with the contact portion in a circumferential direction of the header pipe.

[0005] According to the present disclosure, it is possible to prevent moisture from being stagnant on the fixing member and the side surface of the header pipe with which the fixing member is in contact. Therefore, corrosion of the heat exchanger can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a perspective view of an outdoor unit of an air conditioner according to Embodiment 1 of the present disclosure;
FIG. 2 is a plan view schematically showing an internal structure of the outdoor unit;
FIG. 3 is a perspective view showing a heat exchanger;
FIG. 4 is a side view showing the heat exchanger;
FIG. 5 is a plan view showing a header pipe fixed to a housing with a fixing member;
FIG. 6 is a side view showing a fixing member and a header pipe according to Embodiment 2 of the present disclosure;
FIG. 7 is a plan view showing a header pipe fixed to the housing with a fixing member according to Embodiment 3 of the present disclosure;
FIG. 8 is a plan view schematically showing an internal structure of an outdoor unit according to Embodiment 4 of the present disclosure; and
FIG. 9 is a plan view showing header pipes fixed to the housing with a fixing member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Knowledge on which the present disclosure is based)

[0007] When the inventors came up with the present disclosure, there was a technique for preventing corrosion of a bracket, which was a fixing member for attaching a heat exchanger to a housing, in an outdoor unit. The outdoor unit includes: a heat exchanger made of aluminum or an aluminum alloy; a bracket, made of aluminum or an aluminum alloy, to be attached to header pipes of a heat exchanger; a side plate of the housing, made of a non-aluminum metal, to which the bracket is fixed; and a non-metallic member forming a predetermined interval between the bracket and the side plate.

[0008] Thus, the non-metallic member prevents the bracket made of aluminum or the aluminum alloy from being in direct contact with the side plate made of the non-aluminum metal. This prevents corrosion of the bracket due to corrosion occurring between the non-aluminum metal and the aluminum metal.

[0009] However, in the conventional configuration, moisture such as rainwater and dew condensation water may be stagnant at the section where the header pipe is in contact with the fixing member. The inventors has discovered a problem in which the header pipe may be corroded due to oxidation-reduction reaction or the like caused by this stagnant moisture, and thus has composed the subject of the present disclosure to solve the problem.

[0010] Hereinafter, embodiments will be described in

detail with reference to the drawings. However, more detailed description than necessary may be omitted. For example, detailed description of well-known matters or redundant description of substantially the same configurations may be omitted. This is to avoid the following description from becoming longer than necessary and to facilitate understanding of those skilled in the art.

[0011] Note that the accompanying drawings and the following description are provided to allow those skilled in the art to sufficiently understand the present disclosure, and are not intended to limit the subject matter described in the claims.

(Embodiment 1)

[0012] Embodiment 1 will be described below with reference to FIGS. 1 to 4. A symbol FR shown in each figure denotes the front of an outdoor unit in a state in which the outdoor unit is installed on the installation surface and is normally used. In the state, a symbol UP denotes the upper side of the outdoor unit, and a symbol LH denotes the left of the outdoor unit. In the following description, directions represent these directions of the outdoor unit.

[1-1. Configuration]

[1-1-1. Configuration of outdoor unit]

[0013] FIG. 1 is a perspective view of an outdoor unit 1 of an air conditioner according to the present embodiment.

[0014] The air conditioner of the present embodiment includes: an indoor heat exchanger contained in an indoor unit; and a refrigeration circuit formed by a compressor 5, an expansion valve, an outdoor heat exchanger 50 and so on contained in the outdoor unit 1. The air conditioner circulates a refrigerant in this refrigeration circuit to air-condition a space to be conditioned in which the indoor unit is provided.

[0015] As shown in FIG. 1, the outdoor unit 1 of the present embodiment is an outdoor unit called a side flow type or a side-blowing type that sucks air into the inside through the outdoor heat exchanger 50 disposed on a side, causes the air to exchange heat with the refrigerant, and blows the air out from another side.

[0016] FIG. 2 is a plan view schematically showing the internal structure of the outdoor unit 1. In FIG. 2, for convenience of description, the edge of a bottom plate 12 forming the lower edges of a front air inlet 15 and a side air inlet 17, and a predetermined section of a rear plate 18 forming the edge of an air outlet 19 are indicated by alternate long and short dashed lines. In FIG. 2, airflow directions A1 and A2, which are directions of airflow, are indicated by chain double-dashed lines.

[0017] As shown in FIGS. 1 and 2, the outdoor unit 1 includes a box-shaped housing 10 whose longitudinal direction extends in the left-right direction. In the present embodiment, each part of housing 10 is made of a steel plate.

[0018] The housing 10 includes: a bottom plate 12 forming the bottom surface of the housing 10; a top plate 14 forming a top surface thereof; a front plate 16 forming a front surface thereof; a rear plate 18 forming a rear surface thereof; a left side plate 11 forming a left side surface thereof; and a right side plate 13 forming a right side surface thereof.

[0019] As shown in FIG. 1, the front plate 16 is provided with a front air inlet 15. The front air inlet 15 is a rectangular opening through which air is drawn from the outside of the housing 10 to the inside. In the front plate 16, the front air inlet 15 is provided at a position closer to the left side plate 11 than the right side plate 13.

[0020] The front plate 16 has a plurality of fastening holes 20 that are through holes at positions close to the edge of the front air inlet 15 on the side of the right side plate 13. These fastening holes 20 are arranged on the same straight line extending in the up-down direction of the housing 10. In the present embodiment, the front plate 16 is provided with three fastening holes 20.

[0021] The left side plate 11 has a side air inlet 17 provided thereon. The side air inlet 17 is a rectangular opening through which air is drawn into the housing 10. In the left side plate 11, the side air inlet 17 is provided at a position closer to the front plate 16 than the rear plate 18.

[0022] The left side plate 11 is provided with three fastening holes 20 at positions close to the edge of the side air inlet 17 on the rear plate 18 side, so as to be arranged on the same straight line extending in the up-down direction of the housing 10.

[0023] As shown in FIG. 2, the rear plate 18 is provided with an air outlet 19. The air outlet 19 is an opening through which the air sucked into the housing 10 is blown out of the housing 10.

[0024] In addition, the front air inlet 15, the side air inlet 17, or the air outlet 19 described above may be provided with a filter or a grid-like protective member.

[0025] The internal space S of the housing 10 is divided into two spaces by a partition plate 21. The partition plate 21 is a plate-like member that extends in the up-down direction of the housing 10 with a predetermined height dimension and extends in the front-rear direction of the housing 10. The partition plate 21 has the lower end connected to the bottom plate 12, and thereby is fixed to the housing 10. The partition plate 21 has an end, located on the front of the housing 10, connected to the front plate 16 and an end, located on the rear of the housing 10, connected to the rear plate 18.

[0026] As a result, the housing 10 internally has two spaces with the partition plate 21 interposed therebetween: a machine room S1 located near the right side surface of the housing 10; and the blower room S2 located near the left side surface of the housing 10.

[0027] The machine room S1 contains the compressor 5, an expansion valve, a header pipe 52 included in the outdoor heat exchanger 50, members composing the re-

frigeration circuit such as refrigerant pipes, various electric parts, and the like.

[0028] The blower room S2 contains a blower fan 30 and the outdoor heat exchanger 50 excluding the header pipe 52.

[0029] The blower fan 30 is an axial fan that rotates to introduce air from the outside of the housing 10 into the blower room S2, causes the air to exchange heat with the refrigerant flowing through the outdoor heat exchanger 50, and then discharges the air to the outside of the housing 10 again. This blower fan 30 includes a fan motor 32 and an impeller 34.

[0030] The fan motor 32 is a drive unit that rotates the impeller 34, and the fan motor 32 includes a drive shaft 36 to which the impeller 34 is mounted.

[0031] The impeller 34 is a rotating component that is rotated by the fan motor 32 to send out air in the axial direction.

[0032] The blower fan 30 is fixed by a fan support member 40 provided in the blower room S2. The fan support member 40 includes a pair of pillars 42, a motor mounting member 44, and a fixing plate 46.

[0033] Each pillar 42 is a columnar member that stands upright and extends upward from the upper surface of the bottom plate 12. The pair of pillars 42 are arranged side by side with a predetermined interval from each other in the left-right direction of the housing 10.

[0034] The motor mounting member 44 is a member that holds the fan motor 32. The motor mounting member 44 is mounted so as to be sandwiched between the pair of pillars 42. The motor mounting member 44 is mounted on the pair of pillars 42 at a position separated from the bottom plate 12 by a predetermined height dimension.

[0035] The fixing plate 46 is a member that fixes the upper ends of the pair of pillars 42. The fixing plate 46 is a plate-like member and arranged so as to have a flat surface facing the bottom surface of the housing 10 and have the longitudinal direction extending in the front-rear direction of the housing

[0036] 10. The fixing plate 46 has ends, in the longitudinal direction, respectively connected to the front plate 16 and the rear plate 18 by, for example, screw fastening, and is thereby fixed to the housing 10. The fixing plate 46 fixed to the housing 10 is arranged above the upper end of the outdoor heat exchanger 50.

[0037] Note that the fixing plate 46 may be fixed by having the end, located near the front plate 16, engaged with the upper end of the outdoor heat exchanger 50.

[0038] The upper end of each pillar 42 is connected to the flat surface of the fixing plate 46 facing the bottom surface of the housing 10. Thereby, the pair of pillars 42 are fixed to the housing 10 via the fixing plate 46.

[0039] The fixing plate 46 of the present embodiment is made of sheet metal.

[0040] The fan support member 40 supports the blower fan 30 with the fan motor 32 mounted on the motor mounting member 44. The blower fan 30 fixed to the fan support member 40 is arranged at a position where the impeller 34 faces the air outlet 19 and the end of the drive shaft 36 is directed to the air outlet 19.

[1-1-2. Configuration of outdoor heat exchanger]

[0041] FIG. 3 is a perspective view showing the outdoor heat exchanger 50. FIG. 4 is a side view showing the outdoor heat exchanger 50.

[0042] The outdoor heat exchanger 50 is a heat exchanger that functions as an evaporator that evaporates the refrigerant supplied from the indoor unit or a condenser that condenses the refrigerant.

[0043] As shown in FIGS. 2, 3, and 4, the outdoor heat exchanger 50 of the present embodiment is formed in a substantially L-shape in a plan view as a whole.

[0044] The outdoor heat exchanger 50 includes a pair of header pipes 52 and 54, a first refrigerant pipe 66, a second refrigerant pipe 68, a partition wall 60, a plurality of flat tubes 62, and a plurality of fins 64.

[0045] In the present embodiment, these members included in the outdoor heat exchanger 50 are all made of aluminum or an aluminum alloy.

[0046] Both of the header pipes 52 and 54 are hollow columnar members extending in the up-down direction of the housing 10. In the present embodiment, the header pipes 52 and 54 are both cylindrical. These header pipes 52 and 54 are provided at opposite ends of the outdoor heat exchanger 50.

[0047] The header pipe 52 has the first refrigerant pipe 66 and the second refrigerant pipe 68 connected thereto. The first refrigerant pipe 66 and the second refrigerant pipe 68 function as a refrigerant inlet or outlet in the outdoor heat exchanger 50.

[0048] The first refrigerant pipe 66 is connected to an upper part of a side surface 51 included in the header pipe 52. The second refrigerant pipe 68 is connected to a lower part of the side surface 51 included in the header pipe 52.

[0049] In the present embodiment, the first refrigerant pipe 66 and the second refrigerant pipe 68 are connected to substantially the same section in the circumferential direction of the header pipe 52 in a plan view.

[0050] The header pipe 52 has a partition wall 60 inside that separates the internal space SP of the header pipe 52 into an upper space SP1 located above and a lower space SP2 located below. The partition wall 60 is disposed at a position substantially midway between the first refrigerant pipe 66 and the second refrigerant pipe 68 in the height direction of the header pipe 52.

[0051] The header pipe 54 is provided with an internal space SQ.

[0052] Each of the plurality of flat tubes 62 is a long flat member having a channel for refrigerant flow inside.

[0053] The flat tubes 62 are arranged with their longitudinal directions parallel to each other, in the longitudinal direction of the header pipes 52 and 54. Each flat tube 62 has ends respectively connected to a side surface 51 of the header pipe 52 and a side surface 53 of the header

pipe 54.

[0054] In other words, the header pipe 52 has predetermined sections of the side surface 51 to which one ends of flat tubes 62 are connected in a row in the longitudinal direction of the header pipe 52, at predetermined intervals from each other. Similarly, the header pipe 54 has predetermined sections of the side surface 53 to which the other ends of flat tubes 62 are connected in a row in the longitudinal direction of the header pipe 54, at predetermined intervals from each other.

[0055] Thus, the longitudinal direction of flat tubes 62 matches the longitudinal direction of the outdoor heat exchanger 50.

[0056] The flat tubes 62 are connected to the header pipes 52 and 54, respectively, so that the width directions of the flat tubes 62 are parallel to each other.

[0057] Hereinafter, the predetermined sections of the side surfaces 51 and 53 of the header pipes 52 and 54 to which the flat tubes 62 are connected are referred to as connection surfaces 55 and 57.

[0058] Each of the fins 64 is a flat plate member whose flat surface is provided with a plurality of through holes through which flat tubes 62 can be inserted. The flat tubes 62 are inserted into the fins 64, and connected to header pipes 52 and 54. In other words, each fin 64 is arranged with its longitudinal direction and width direction orthogonal to the flat tubes 62. The longitudinal direction of each fin 64 arranged in this manner matches the longitudinal direction of each header pipe 52 and 54.

[0059] In the present embodiment, the pair of header pipes 52 and 54, the partition wall 60, the first refrigerant pipe 66, the second refrigerant pipe 68, the plurality of flat tubes 62, and the plurality of fins 64 are fixed to each other by brazing.

[0060] In the blower room S2, the outdoor heat exchanger 50 is disposed with the longitudinal direction along the front plate 16 and the left side plate 11. Specifically, the header pipe 52 is disposed at a position close to the edge of the front air inlet 15 near the right side plate 13, and the header pipe 54 is disposed at a position close to the edge of the side air inlet 17 near the rear plate 18. The outdoor heat exchanger 50 is disposed such that it is curved toward the corner 23 of the housing 10 formed with the front plate 16 and the left side plate 11.

[0061] As shown in FIG. 1, the outdoor heat exchanger 50 disposed in this way has most of flat tubes 62 and the plurality of fins 64 exposed from the housing 10 through the front air inlet 15 and the side air inlet 17. In contrast, the header pipe 52 is shielded by the front plate 16 and the header pipe 54 is shielded by the left side plate 11.

[0062] The partition plate 21 is provided so as to be located between the header pipe 52 and the plurality of fins 64.

[0063] Accordingly, the header pipe 52 is disposed in the machine room S1, and the plurality of flat tubes 62, fins 64, and the header pipe 54 are disposed in the blower room S2. Therefore, the partition plate 21 shields the header pipe 52 from the air flowing into the blower room S2 through the front air inlet 15 and the side air inlet 17, and the moisture and salt contained in the air, leading to corrosion prevention.

[1-1-3. Configuration of fixing member]

[0064] As shown in FIG. 2, the outdoor unit 1 includes at least one fixing member 70 that fixes the outdoor heat exchanger 50 to the housing 10.

[0065] Specifically, the header pipe 52 is fixed to the front plate 16 with a plurality of the fixing members 70, and the header pipe 54 is fixed to the left side plate 11 with the plurality of fixing members 70. In the present embodiment, each of the header pipes 52 and 54 is fixed with three fixing members 70.

[0066] Each of the header pipes 52 and 54 fixed to the housing 10 in this manner is disposed with its longitudinal direction along the up-down direction of the housing 10. The longitudinal direction of each header pipe 52 and 54 is substantially the vertical direction.

[0067] The fixing structure of the header pipe 52 will be described below, but the fixing structure of the header pipe 54 has the same configuration, so the description thereof will be omitted.

[0068] FIG. 5 is a plan view showing the header pipe 52 fixed to the housing 10 with the fixing member 70.

[0069] As shown in FIG. 5, each fixing member 70 includes a holding portion 72 and a fixing portion 74.

[0070] The fixing portion 74 is a member that fixes the fixing member 70 to the housing 10. This fixing portion 74 is provided at a position separated from the header pipe 52. For this reason, the fixing portion 74 is formed of a material having high rigidity and a higher longitudinal elastic modulus and yield point than the holding portion 72 regardless of the ionization tendency. Such materials include, for example, steel plates.

[0071] This prevents the fixing member 70 from being detached from the housing 10 or deformed, if vibration or the like occurs due to the driving of the compressor 5, for example. Therefore, the header pipe 52 and the outdoor heat exchanger 50 are prevented from deviating from their positions to be disposed.

[0072] The fixing portion 74 is formed by bending a flat plate member such as a sheet metal so as to have an L-shape in a plan view. The fixing portion 74 thus formed has a flat surface of a contact base 75, which is on one side of the bent portion, provided with a fastening hole 77 that is a through hole.

[0073] The fixing portion 74 is attached to the front plate 16 in such a way that the fastening member 92 is inserted into a fastening hole 77 and the fastening hole 20 in a state in which a flat surface of the contact base 75 is in contact with the flat surface of the front plate 16 facing the internal space S. Thereby, the fixing member 70 is attached to the housing 10.

[0074] The fixing portion 74 has a flat surface of a contact base 71, which is on the other side of the bent portion, provided with a connecting hole 73 that is a through hole.

[0075] The holding portion 72 is a member that is in contact with the header pipe 52 at the side surface 51 except the connection surface 55, and thereby holds the header pipe 52.

[0076] The entire holding portion 72 is made of a metal material with an ionization tendency equivalent to or higher than that of aluminum forming the outdoor heat exchanger 50 including the header pipes 52 and the flat tubes 62, that is, a metal material with a potential equal to or lower than that of aluminum. Such metal materials include, for example, zinc (Zn).

[0077] In this way, the holding portion 72 is made of a metal material with a potential equal to or lower than that of the metal material forming the outdoor heat exchanger 50. This makes it possible to prevent the progress of corrosion of the header pipe 52 due to contact of dissimilar metals promoted by stagnant moisture such as dew condensation water and rainwater at the section where the holding portion 72 holds the header pipe 52.

[0078] The holding portion 72 includes a connecting portion 86. The connecting portion 86 is a flat plate having a flat surface facing an exposed surface 59. The connecting portion 86 is provided with a connecting hole 87, which is a through hole, substantially in the center thereof.

[0079] The holding portion 72 is connected with the fixing portion 74 in such a way that a fastening member 90 is inserted into the connecting hole 87 and the connecting hole 73 in a state in which the flat surface of the connecting portion 86 is in contact with the flat surface of the contact base 71.

[0080] The connecting portion 86 has an extending portion 84 at each end in the horizontal direction. As shown in FIG. 4, each extending portion 84 is a flat plate having a rectangular surface shape in a side view of the outdoor heat exchanger 50. Each extending portion 84 extends from the connecting portion 86 by a predetermined length dimension toward the direction opposite to the fixing portion 74. In other words, the pair of extending portions 84 are connected by the connecting portion 86.

[0081] These extending portions 84 are provided on the holding portion 72, so that the fixing portion 74 is disposed apart from the exposed surface 59 of the header pipe 52 when the holding portion 72 holds the header pipe 52.

[0082] As shown in FIG. 5, each extending portion 84 is provided with a contact portion 80 at an end thereof. As shown in FIG. 4, the pair of contact portions 80 are formed so as to have a rectangular surface shape in a side view of the outdoor heat exchanger 50. As shown in FIG. 5, these contact portions 80 are formed so as to be curved to have substantially the same curvature as the side surface 51 of the header pipe 52 in a plan view.

[0083] As shown in FIG. 5, the pair of contact portions 80 are disposed so as to be located opposite to each other across the header pipe 52, at positions off the connection surfaces 55. Each of the curved surfaces included in the pair of contact portions 80 is in contact with the side surface 51. In other words, the pair of contact portions 80 are in surface contact with the side surface 51 so as to sandwich the header pipe 52. Thereby, the fixing member 70 can fix the header pipe 52 more reliably. Hereinafter, each curved surface of the contact portion 80 in contact with the side surface 51 is referred to as a contacting surface 83, and the section of the side surface 51 with which the contacting surface 83 is in contact is referred to as a contacted surface 58.

[0084] The pair of contact portions 80 are disposed apart from each other with a predetermined interval in the circumferential direction of the side surface 51, on the opposite side of the connection surface 55 across the header pipe 52. Therefore, when the header pipe 52 is held by the holding portion 72, the exposed surface 59 that is exposed without any contact with the contact portions 80 is formed at a section between the pair of contacted surfaces 58 of the side surface 51. The exposed surface 59 is formed so that the length in the up-down direction of the header pipe 52 is the same as the length of each contact portion 80. In other words, the exposed surface 59 is provided from the upper end to the lower end of each contact portion 80 and holding portion 72. The exposed surface 59 is provided at the same height as the contacted surface 58 in the up-down direction of the header pipe 52.

[0085] Thus, the holding portion 72 holds the header pipe 52 in surface contact such that the exposed surface 59 is provided, thereby reducing the area in which the holding portion 72 is in contact with the header pipe 52. This makes it possible to reduce stagnant moisture such as dew condensation water and rainwater in the holding portion 72 and the contact section between the holding portion 72 and the header pipe 52, and thereby prevent corrosion of the header pipe 52 and the holding portion 72 due to the moisture.

[0086] The exposed surface 59 functions as a drainage channel, along which stagnant moisture in the fixing member 70 is drained down the header pipe 52. This makes it possible to reduce stagnant moisture such as dew condensation water and rainwater in the holding portion 72, and thereby prevent corrosion of the header pipe 52 and the holding portion 72 due to the moisture.

[0087] On the side surface 51 of the header pipe 52, the exposed surface 59 is located on the opposite side of the connection surface 55. This allows stagnant moisture such as dew condensation water and rainwater in the fixing member 70 and the contact section between the holding portion 72 and the header pipe 52 to be drained down the header pipe 52 by gravity, along the exposed surface 59 located away from the connection surface 55. Therefore, in the outdoor heat exchanger 50, the moisture is prevented from flowing in and being stagnant on the connection surface 55, the surfaces of the flat tubes 62, and the like.

[0088] As shown in FIG. 5, the length L1 of each exposed surface 59 in the circumferential direction of the side surface 51 of the header pipe 52 is formed to be

longer than the length L2 of each contact portion 80 in the circumferential direction of the side surface 51 or each contacted surface 58.

[0089] This reduces the area in which the holding portion 72 is in contact with the header pipe 52. Therefore, if a small amount of moisture, which is not likely to be affected by gravity and is likely to be held at the contact section between the holding portion 72 and the header pipe 52 due to surface tension, adheres to the holding portion 72, the section where the moisture adheres is reduced.

[0090] In addition, the exposed surface 59 has a length longer than the section where the holding portion 72 is in contact with the header pipe 52, so that a larger drainage channel is formed and the outdoor unit 1 can drain more moisture adhering to the holding portion 72. This makes it possible to reduce stagnant moisture in the holding portion 72 and prevent the corrosion of the header pipe 52 and the holding portion 72 due to the moisture.

[0091] As shown in FIG. 3, three fixing members 70 are attached to the header pipe 52 in the longitudinal direction of the header pipe 52. The exposed surfaces 59 provided on the side surface 51 by these fixing members 70 are disposed so as to overlap each other at least partially in the circumferential direction of the header pipe 52 in a plan view of the header pipe 52. In the present embodiment, these exposed surfaces 59 are located on the same straight line, extending in the longitudinal direction of the header pipe 52, on the side surface 51.

[0092] This allows the moisture drained along the exposed surfaces 59 from the upper fixing members 70 of the three fixing members 70 to be drained further down the header pipe 52 along the exposed surfaces 59 provided by the lower fixing members 70. In other words, if the header pipe 52 is fixed by a plurality of fixing members 70, moisture drained from the upper fixing members 70 is not stagnant in the lower fixing member 70.

[0093] Therefore, in the present embodiment, if the header pipe 52 is fixed by a plurality of fixing members 70, the stagnant moisture in the fixing members 70 can be drained down through all the fixing members 70. This then makes it possible to more reliably fix the header pipe 52 with the plurality of fixing members 70, and prevent the stagnant moisture in fixing members 70.

[1-2. Operation]

[0094] The operation of the outdoor unit 1 configured as above will be described below.

[0095] First, the flow of the refrigerant in the air conditioner will be described.

[0096] In the case of heating operation of the air conditioner, when the outdoor unit 1 starts operating, the compressor 5 is driven. The compressor 5 compresses the refrigerant enclosed in the refrigeration circuit and sends out gas refrigerant through refrigerant pipes.

[0097] This gas refrigerant releases heat in the indoor heat exchanger and condenses, flows into the expansion valve through the pipes, is decompressed by the expansion valve, and flows into the lower space SP2 of the outdoor heat exchanger 50 through the second refrigerant pipe 68. The refrigerant that has flowed into the lower space SP2 flows into the internal space SQ through the flat tubes 62 located lower than the partition wall 60. After that, the refrigerant flows toward the header pipe 52 through the flat tubes 62 located higher than the partition wall 60. The refrigerant flowing through the outdoor heat exchanger 50 exchanges heat with the air sent out by the blower fan 30, and thereby absorbs heat and evaporates in the flat tubes 62. The refrigerant evaporated in the flat tubes 62 flows into the upper space SP1 and then returns to the compressor 5 through the first refrigerant pipe 66.

[0098] Next, the airflow directions that are directions of air flow in the outdoor unit 1 will be described.

[0099] When the outdoor unit 1 starts operating, the blower fan 30 starts rotating prior to the compressor 5. The rotating blower fan 30 causes air to flow from the outside of the outdoor unit 1 into the inside of the housing 10, that is, the blower room S2, in the airflow directions A1 and A2 as shown in FIG. 2. Specifically, the air mainly flows into the blower room S2 through the front air inlet 15 and the side air inlet 17. The air flowing into the blower room S2 passes between the flat tubes 62 and the fins 64 in a direction orthogonal to the longitudinal direction of the outdoor heat exchanger 50 in the up-down direction, in other words, in the width direction of the flat tubes 62.

[0100] This promotes heat exchange between the refrigerant flowing inside the plurality of flat tubes 62 and the air flowing between the plurality of fins 64.

[0101] The air having exchanged heat with the refrigerant is discharged through the air outlet 19 to the outside of the housing 10 by the blower fan 30.

[0102] The outdoor unit 1 repeats the operation described above, and thereby absorbs heat from the outdoor air into the refrigeration circuit and sends it indoors.

[0103] Note that, when the air conditioner performs cooling operation, the direction of refrigerant circulation in the refrigeration circuit is opposite to that in heating operation, and the outdoor heat exchanger 50 functions as a condenser.

[0104] In the outdoor unit 1 that operates as described above, rainwater and moisture in the atmosphere may enter from the outside of the housing 10 along with the airflow generated by the blower fan 30. In addition, the outdoor heat exchanger 50 may have moisture such as dew condensation water that occurs on the surface thereof due to the heat exchange of the refrigerant. The outdoor unit 1 may have the moisture adhering to the upper surfaces of the holding portions 72 of the fixing members 70, each holding header pipes 52 and 54, and to the side surfaces 51 and 53 of the header pipes 52 and 54 adjacent to the upper surfaces.

[0105] The fixing members 70 of the present embodiment is in contact with the side surfaces 51 and 53 so as

to form exposed surfaces 59 except the sections where the contact portions 80 is in contact, and thereby hold the header pipes 52 and 54. Therefore, if various types of moisture adheres to the upper surfaces of the holding portions 72, the outdoor unit 1 can cause the moisture to flow down the header pipes 52 and 54 by gravity through the exposed surfaces 59.

[0106] In other words, the outdoor unit 1 prevents the moisture from being stagnant on the upper surfaces of the holding portions 72. This then allows the outdoor unit 1 to prevent corrosion of the header pipes 52 and 54 at sections where the holding portions 72 of the fixing members 70 hold the header pipes 52 and 54.

[1-3. Effects]

[0107] As described above, the outdoor unit 1 in the present embodiment includes: the outdoor heat exchanger 50 including header pipes 52 and 54 to which the flat tubes 62 are connected at the side surfaces 51; the housing 10 that contains the outdoor heat exchanger 50; and the fixing members 70 that fix the outdoor heat exchanger 50 inside the housing 10. Each fixing member 70 includes: the fixing portion 74 fixed inside the housing 10; and the holding portion 72 that is in contact with either the header pipes 52 and 54 at the side surfaces 51 and 53 except connection surfaces 55 and 57 to which the flat tubes 62 are connected, and thereby hold the header pipes 52 and 54. The side surfaces 51 and 53 of the header pipes 52 and 54 include the exposed surfaces 59 that are exposed to the outside without being in contact with the contact portions 80 in the circumferential direction of the header pipes 52 and 54, at the same height as the sections in contact with the contact portions 80.

[0108] As a result, in the outdoor unit 1, the exposed surfaces 59 function as drainage channels for moisture adhering to the upper surfaces of the holding portions 72, and can prevent moisture from being stagnant in the holding portions 72. This allows the outdoor unit 1 to prevent corrosion of the header pipes 52 and 54 at sections where the holding portions 72 of the fixing members 70 hold the header pipes 52 and 54.

[0109] As in the present embodiment, each length L1 of the exposed surfaces 59 in the circumferential directions of the side surfaces 51 and 53 of the header pipes 52 and 54 may be longer than the length L2 of the contact portions 80 in the circumferential directions of the side surfaces of the header pipes 52 and 54.

[0110] As a result, the area in which each holding portion 72 is in contact with the header pipe 52 is reduced. This makes it possible to prevent the moisture from being stagnant if a small amount of moisture, which is not likely to be affected by gravity and is likely to be held at the contact section between the holding portion 72 and the header pipe 52 due to surface tension, adheres to the holding portion 72, for example, during cooling and heating low-load operation with little condensed water, or during times of low rainfall.

[0111] In addition, a larger drainage channel is formed in the holding portion 72. Therefore, the outdoor unit 1 can prevent the stagnant moisture in the holding portions 72, and prevent the corrosion of the header pipe 52 and the holding portions 72 due to the moisture.

[0112] As in the present embodiment, each contact portion 80 has the contacting surface 83 in contact with the side surface 51 of the header pipe 52 or the side surface 53 of the header pipe 54. The holding portions 72 each have a plurality of the contact portions 80, and the contacting surfaces 83 of the contact portions 80 may be in contact with the side surfaces 51 and 53 of the header pipes 52 and 54 to hold the header pipes 52 and 54.

[0113] Thus, the fixing members 70 provide the side surfaces 51 and 53 of the header pipes 52 and 54 with the exposed surfaces 59, and sandwiches the header pipes 52 and 54 with the contact portions 80 that are in surface contact with the side surfaces 51 and 53, and thereby holds the header pipes 52 and 54. Therefore, the fixing members 70 can drain the adhering moisture through the drainage channels, and can fix the header pipes 52 and 54 more reliably.

[0114] As in the present embodiment, the header pipes 52 and 54 are provided so that their longitudinal directions are in the up-down direction of the housing 10. A plurality of the fixing members 70 are provided in the longitudinal direction of the header pipes 52 and 54. The exposed surfaces 59 provided by the fixing members 70 holding either the header pipe 52 or 54 may be disposed so as to overlap each other at least partially in the circumferential direction in the header pipe 52 and 54 in a plan view of the header pipe 52 or 54.

[0115] As a result, the moisture drained from the upper fixing members 70 successively travel along the exposed surfaces 59 provided by the lower fixing members 70, and is drained further in the downward direction of the header pipes 52 and 54. Therefore, if the header pipe 52 is fixed by a plurality of fixing members 70, the outdoor unit 1 can drain the stagnant moisture in the fixing members 70 up to below all the fixing members 70, and prevent the moisture from being stagnant in the fixing members 70.

[0116] As in the present embodiment, the contact portions 80 may be made of a metal material having a potential equal to or lower than those of the header pipes 52 and 54.

[0117] For this reason, the contact portions 80 are made of a metal that is baser than aluminum or a metal that is as base as aluminum. This makes it possible to prevent the progress of corrosion of the header pipes 52 and 54 due to contact of dissimilar metals promoted by stagnant moisture such as dew condensation water and rainwater at the sections where the holding portions 72 hold the header pipes 52 and 54.

[0118] As in the present embodiment, the fixing portions 74 may be made of a material having a greater longitudinal elastic modulus and yield point than those

of the contact portion 80.

[0119] This prevents the fixing members 70 from being detached from the housing 10 or deformed, if vibration or the like occurs due to the driving of the compressor 5, for example. Therefore, the header pipes 52 and 54 are prevented from moving from the positions covered by the front plate 16 and the left side plate 11 to the positions exposed from the front air inlet 15 and the side air inlet 17.

(Embodiment 2)

[0120] Embodiment 2 will be described below with reference to FIG. 6.

[2-1. Configuration of fixing member]

[0121] FIG. 6 is a side view showing a fixing member 170 and the header pipe 52 according to Embodiment 2 of the present disclosure. In FIG. 6, the same parts as those in FIGS. 3 to 5 are denoted by the same reference numerals, and description thereof are omitted.

[0122] The outdoor unit 1 according to Embodiment 2 differs from the outdoor unit 1 according to Embodiment 1 at least in that the fixing member 170 is used instead of the fixing member 70. The fixing structure of the header pipe 52 will be described below, but the fixing structure of the header pipe 54 has the same configuration, so the description thereof will be omitted.

[0123] The fixing member 170 includes a holding portion 172 and a fixing portion 74.

[0124] The holding portion 172 is made of the same material as the holding portion 72 of Embodiment 1 and includes a pair of contact portions 180. These contact portions 180 are formed so as to be curved to have substantially the same curvature as the side surface 51 of the header pipe 52 in a plan view. The length of each contact portion 180 in the circumferential direction of the side surface 51 is substantially the same as the length L2 of each contact portion 80 in the circumferential direction of the side surface 51 and each contacted surface 58 in Embodiment 1.

[0125] As shown in FIG. 6, each contact portions 180 is formed to have a substantially trapezoidal surface shape in a side view of the outdoor heat exchanger 50. The upper surface 185 of each contact portion 180 is formed so as to incline downward from the connection surface 55 toward the extending portion 84 in a state of being in contact with the side surface 51 of the header pipe 52. In other words, the upper surface 185 has a shape that inclines downward toward the exposed surface 59.

[0126] Accordingly, if moisture adheres to the upper surface of the holding portion 172, the moisture flows in the direction in which the upper surface 185 of each contact portion 180 inclines and is guided to the exposed surface 59. Then, the moisture is caused to flow from the exposed surface 59 in the downward direction of the fixing member 170.

[0127] This makes it possible to prevent the moisture from being stagnant in the outdoor unit 1 if a small amount of moisture, which is not likely to be affected by gravity and is likely to be held at the contact section between the holding portions 172 and the header pipe 52 due to surface tension, adheres to the holding portions 172, for example, during cooling and heating low-load operation with little condensed water, or during times of low rainfall.

[2-2. Effects]

[0128] As described above, in the present embodiment, the upper surface 185 of each contact portion 180 has a shape that inclines downward toward the exposed surface 59.

[0129] As a result, the moisture adhering to the upper surface of the holding portion 172 flows toward the exposed surface 59 along the inclination of the upper surfaces 185 due to gravity. Therefore, the outdoor unit 1 can prevent the stagnant moisture in the holding portions 72, and prevent the corrosion of the header pipe 52 or the holding portions 72 due to the moisture.

(Embodiment 3)

[0130] Embodiment 3 will be described below with reference to FIG. 7.

[3-1. Configuration of fixing member]

[0131] FIG. 7 is a side view showing the header pipe 52 fixed to the housing 10 with a fixing member 270 according to Embodiment 3 of the present disclosure. In FIG. 7, the same parts as those in FIG. 5 are denoted by the same reference numerals, and description thereof are omitted.

[0132] The outdoor unit 1 according to Embodiment 3 differs from the outdoor unit 1 according to Embodiment 1 at least in that the fixing member 270 is used instead of the fixing member 70. The fixing structure of the header pipe 52 will be described below, but the fixing structure of the header pipe 54 has the same configuration, so the description thereof will be omitted.

[0133] As shown in FIG. 7, each fixing member 270 includes a holding portion 272 and a fixing portion 74.

[0134] The holding portion 272 is a member that is in contact with the header pipe 52 at the side surface 51 except the connection surface 55, and thereby holds the header pipe 52. The holding portion 272 is entirely made of the same material as holding portion 72 in Embodiment 1.

[0135] The holding portion 272 includes a connecting portion 286. The connecting portion 286 is formed to be substantially the same as the connecting portion 86 of Embodiment 1. The holding portion 272 is connected with the fixing portion 74 in such a way that a fastening member 290 is inserted into the connecting hole 287 provided in the connecting portion 286 and the connecting hole 73

in a state in which the flat surface of the connecting portion 286 is in contact with the flat surface of the contact base 71.

[0136] The fastening member 290 is a rod-shaped fastening member having a predetermined length. The fastening member 290 is entirely made of the same material as the holding portion 272. The fastening member 290 has a protruding end 292 that is one end thereof protruding toward the surrounding portions 282. The protruding end 292 has a flat contacting surface 293 provided at the end thereof.

[0137] The connecting portion 286 has an extending portion 284 at each end in the horizontal direction. Each extending portion 284 is formed to be substantially the same as that of the extending portion 84 of Embodiment 1, and stands upright from the connecting portion 286 toward the opposite sides of the fixing portion 74.

[0138] The connecting portion 286 each has ends provided with a pair of surrounding portions 282. Each surrounding portion 282 is formed to have a rectangular surface shape in a side view of the outdoor heat exchanger 50. These surrounding portions 282 are formed by being curved so as to have substantially the same curvature as the side surface 51 of the header pipe 52 in a plan view.

[0139] The pair of surrounding portions 282 are disposed so as to be located opposite to each other across the header pipe 52, at positions off the connection surface 55. The pair of surrounding portions 282 are disposed apart from each other with a predetermined interval, on the opposite sides of the connection surface 55 across the header pipe 52.

[0140] These surrounding portions 282 each are provided with a contact portion 280. Each of these contact portions 280 has a projecting shape protruding by a predetermined width dimension from a facing surface 285 that is included in the surrounding portion 282 and faces the side surface 51. In the present embodiment, each contact portion 280 is provided at an end portion of the surrounding portion 282 facing the connection surface 55. The contact portion 280 is also provided substantially in the center of the surrounding portion 282 in the up-down direction.

[0141] Each of these contact portion 280 has a flat contacting surface 283 at the end thereof.

[0142] The holding portion 272 holds the header pipe 52 with the contacting surfaces 283 of these contact portions 280 in contact with the side surface 51. Therefore, when the holding portion 272 holds the header pipe 52, the surrounding portions 282 are disposed apart from the side surface 51.

[0143] Furthermore, when the holding portion 272 holds the header pipe 52, the contacting surface 293 of the protruding end 292 is in contact with the side surface 51. The protruding end 292 has substantially the same function as the contact portion 280.

[0144] In other words, the holding portion 272 holds the header pipe 52 with the contacting surfaces 283 of contact portions 280 and the contacting surface 293 of the protruding end 292 in contact with the side surface 51. Hereinafter, the sections of the side surface 51, with which the contacting surfaces 283 and the contacting surface 293 are in contact, are referred to as contacted surfaces 258.

[0145] This configuration forms exposed surfaces 259 that are exposed without being in contact with the contacting surfaces 283 and the contacting surface 293 at sections located between the contacted surfaces 258 on the side surface 51, when the header pipe 52 is held by the holding portion 272.

[0146] In this way, the outdoor unit 1 has the holding portions 272 holding the header pipe 52, which is in contact with only the contact portions 280 each having a projecting shape and the protruding end 292. This provides outdoor unit 1 with the exposed surfaces 259, and reduces the areas in which the holding portions 272 are in contact with the header pipe 52.

[0147] Therefore, the outdoor unit 1 can prevent the stagnant moisture, such as dew condensation water or rainwater, in the holding portions 272, and prevent the corrosion of the header pipe 52 and the holding portions 272 due to the moisture. In addition, the header pipe 52 has a larger drainage channel formed on the side surface 51 thereof, and thereby can drain more moisture adhering to the contact sections between the holding portions 272 and the header pipe 52.

[3-2. Effects]

[0148] As described above, in the present embodiment, the contact portions 280 and the protruding ends 292 each have a projecting shape protruding toward the side surfaces 51 and 53 of the header pipes 52 and 54. The holding portions 272 hold the header pipes 52 and 54 whose side surfaces 51 and 53 are in contact with the contacting surfaces 283 and 293, which are the ends of the projecting shapes of the contact portions 280 and the protruding ends 292.

[0149] As a result, each holding portion 272 is in contact with the side surface 51 only at the contacting surfaces 283 and the contacting surface 293, so that the areas in contact with the header pipe 52 are reduced. Accordingly, the header pipe 52 has a larger drainage channel formed on the side surface 51 thereof. This makes it possible to prevent the moisture from being stagnant in the outdoor unit 1 if a small amount of moisture, which is not likely to be affected by gravity and is likely to be held at the contact section between the holding portions 272 and the header pipe 52 due to surface tension, adheres to the holding portions 272, for example, during cooling and heating low-load operation with little condensed water, or during times of low rainfall.

(Embodiment 4)

[0150] Embodiment 4 will be described below with reference to FIGS. 8 and 9.

[4-1. Configuration]

[4-1-1. Configuration of outdoor unit]

[0151] FIG. 8 is a plan view schematically showing the internal structure of an outdoor unit 300 according to Embodiment 4 of the present disclosure. In FIG. 8, the same parts as in FIG. 2 are denoted by the same reference numerals, and the description thereof will be omitted.

[0152] The outdoor unit 300 according to Embodiment 4 includes at least a plurality of outdoor heat exchangers 50, and differs from the outdoor unit 1 according to Embodiment 1 in that at least one fixing member 370 is used instead of the fixing member 70.

[0153] As shown in FIG. 8, the outdoor unit 300 includes a plurality of outdoor heat exchangers 50. These outdoor heat exchangers 50 are disposed at substantially the same locations as the outdoor heat exchanger 50 of Embodiment 1. These outdoor heat exchangers 50 are disposed side by side in the direction from the outside to the inside of the housing 10. Therefore, the header pipes 52 included in the outdoor heat exchangers 50 are arranged in the direction from the front plate 16 toward the inside of the housing 10. Similarly, the header pipes 54 included in the outdoor heat exchangers 50 are arranged in the direction from the side plate 11 toward the inside of the housing 10. In other words, a plurality of the header pipes 52 and 54 are arranged in a direction crossing the longitudinal direction of the header pipes 52 and 54, respectively.

[4-1-2. Configuration of fixing member]

[0154] The header pipes 52 and 54 are fixed to the housing 10 with a plurality of the fixing members 370.

[0155] The fixing structure of each header pipe 52 will be described below, but the fixing structure of each header pipe 54 has the same configuration, so the description thereof will be omitted.

[0156] FIG. 9 is a plan view showing a plurality of header pipes 52 fixed to the housing 10 with the fixing member 370 according to Embodiment 4 of the present disclosure. In FIG. 8, the same parts as those in FIG. 7 are denoted by the same reference numerals, and the description thereof will be omitted.

[0157] As shown in FIG. 9, each fixing member 370 includes a pair of holding portions 372 and a fixing portion 374.

[0158] The fixing portion 374 is a member that fixes the fixing member 370 to the housing 10. The fixing portion 374 is made of the same material as the fixing portion 74 of Embodiment 1, and is formed by bending a flat plate member into an L-shape. The fixing portion 374 has a contact base 371 that is on one side of the bent portion, and the contact base 371 has a flat surface provided with two connecting holes 373 side by side in the longitudinal direction of the contact base 371. The contact base 371 is formed to be longer than the contact base 71 in the longitudinal direction.

[0159] The fixing portion 374 includes a contact base 375 that is on the other side of the bent portion. The fixing portion 374 is attached to the front plate 16 with the fastening member 92 inserted through the fastening hole 77 provided in the contact base 375 and the fastening hole 20.

[0160] Each holding portion 372 is a member that is in contact with the header pipe 52 at the side surface 51 except the connection surface 55, and thereby holds the header pipe 52. Each holding portion 372 is entirely made of the same material as the holding portion 72 of Embodiment 1.

[0161] Each holding portion 372 includes a connecting portion 386 and extending portions 384 standing upright from the respective ends of the connecting portion 386. The connecting portion 386 is substantially the same as the connecting portion 286 of Embodiment 3, and the extending portions 384 are substantially the same as the extending portions 284 of Embodiment 3. The connecting portion 386 is provided with a connecting hole 387.

[0162] Each extending portion 384 is provided with a surrounding portion 382 at the end. The surrounding portion 382 has the same shape as the surrounding portion 282 of Embodiment 3.

[0163] One of the two surrounding portions 382 of each holding portion 372 is provided with a contact portion 380. The contact portion 380 is formed in substantially the same shape as in Embodiment 3, and protrudes by a predetermined width dimension from a facing surface 385 that is included in the surrounding portion 382 and faces the side surface 51. The contact portion 380 is provided with a flat contacting surface 383 at the end. In the present embodiment, the contact portion 380 is provided at the end of the surrounding portion 382 located on the side facing the connection surface 55.

[0164] The other of the two surrounding portions 382 is provided with a connecting hole 389 that is a through hole.

[0165] The holding portions 372 are attached to the contact base 371 of the fixing portion 374. Specifically, the holding portions 372 are disposed side by side in the longitudinal direction of the contact base 371 so that the surrounding portions 382 provided with the connecting holes 389 are adjacent to each other.

[0166] Each of the holding portions 372 is connected with the fixing portion 374 in such a way that a fastening member 390 is inserted into a connecting hole 387 provided in the connecting portion 386 and a one of the two connecting holes 373 in a state in which the flat surface of the connecting portion 386 is in contact with the flat surface of the contact base 371.

[0167] These fastening members 390 are substantially the same members as the fastening members 290 of Embodiment 3. Each fastening member 390 includes a protruding end 392 and the protruding end 392 has a flat contacting surface 393 at the end.

[0168] A fastening member 394 is inserted through the

connecting hole 389 made in each of the two holding portions 372, the holes disposed adjacent to each other. Thereby, the pair of holding portions 372 are connected to each other.

[0169] The fastening member 394 is a rod-shaped fastening member having a predetermined length. The fastening member 394 is entirely made of a metal that is baser than or as base as aluminum. When the fastening member 394 is inserted through the connecting holes 389, both ends of the fastening member 394 protrude from the facing surfaces 385 by a predetermined width dimension. The fastening member 394 has a flat contacting surface 395 at each end thereof.

[0170] When each fixing member 370 is fixed to the front plate 16, the holding portions 372 are disposed side by side in a direction crossing the longitudinal direction of the header pipes 52. Therefore, the holding portions 372 can hold a plurality of the header pipes 52 disposed side by side.

[0171] Each holding portion 372 holds the header pipe 52 with the contacting surface 383 of the contact portion 380, the contacting surface 395 of the fastening member 394, and the contacting surface 393 of the protruding end 392 in contact with the side surface 51. In other words, the protruding end 392 and the fastening member 394 have substantially the same function as the contact portion 380.

[0172] Thereby, when each holding portion 372 holds the header pipe 52, the surrounding portions 382 are disposed apart from the side surface 51. In addition, when the header pipe 52 is held by the holding portion 372, the side surface 51 has an exposed surface 359 thereon that is exposed without contact with the contacting surface 383 and the contacting surface 393.

[0173] Thus, the holding portion 372 holds the header pipe 52 so as to provide the exposed surface 359, so that the area of the holding portion 372 in contact with the header pipe 52 is reduced. This makes it possible to prevent the stagnant moisture, such as dew condensation water or rainwater, in the holding portion 372, and prevent the corrosion of the header pipe 52 and the holding portion 372 due to the moisture.

[0174] In addition, the header pipe 52 has the exposed surface 359 thereon that functions as a drainage channel. This makes it possible to drain more moisture adhering to the contact section between the holding portion 372 and the header pipe 52.

[4-2. Effects]

[0175] As described above, in the present embodiment, a plurality of holding portions 372 are arranged in the fixing portion 374 in the direction crossing the longitudinal direction of the header pipes 52 and 54.

[0176] Thereby, the outdoor unit 300 can fix a plurality of the header pipes 52 and 54 disposed side by side in the direction crossing the longitudinal direction of the outdoor unit 300 with the one fixing member 370. Therefore, the outdoor unit 300 can reduce the number of parts, and can easily fix a plurality of the outdoor heat exchangers 50.

[0177] The fastening member 394 is inserted as in the present embodiment. Thereby, two holding portions 372 are connected to each other with the fastening member 394. The fastening member 394 has a contacting surface 395 at each end. The pair of holding portions 372 may hold the header pipes 52 or 54 with the contacting surfaces 395 in contact with the side surfaces 51 or 53.

[0178] Thereby, the fastening member 394 can fasten the plurality of holding portions 372 and support the header pipe 52 and 54.

[0179] Although the fixing member 370 has two holding portions 372 in the present embodiment, the number of the fixing members 370 is not limited to this and may be three or more.

[0180] Also, for example, in the present embodiment, the fastening member 394 has a contacting surface 395 at each end, but the fastening member 394 may have a contacting surface 395 only at either end.

[0181] Further, for example, the holding portion 372 does not always has the contact portion 280 having a projecting shape as in Embodiment 3. Instead, the holding portion 372 may have a contact portion having a shape that holds the header pipe 52 in surface contact, like the contact portion 80 of Embodiment 1.

(Other embodiments)

[0182] As described above, Embodiments 1 to 4 have been described as examples of the techniques disclosed in the present application. However, the techniques in the present disclosure are not limited to this, and can also be applied to embodiments with modifications, replacements, additions, omissions, and the like. Also, it is possible to combine components described in the Embodiments 1 and 2 to form a new embodiment.

[0183] Therefore, other embodiments will be exemplified below.

[0184] In the above-described Embodiments 3 and 4, the fixing members 270 and 370 are in contact with the header pipes 52 and 54 at three points per header pipe with the contact portions 280 and 380, the protruding ends 292 and 392, and the fastening members 394, and thereby hold the header pipes 52 and 54. However, any number of such points may be used for the holding, and the fixing members 270 and 370 may be in contact with the header pipes 52 and 54 at two points per header pipe or four points or more per header pipe, to hold the header pipes 52 and 54.

[0185] In the embodiments described above, the contacting surfaces 83, 283, 293, 383, 393, and 395 included in the fixing members 70, 170, 270, and 370 may be provided with grooves that extend in the longitudinal direction of the header pipes 52 and 54. This forms channels that allow moisture to flow between the contact portions 80, 180, 280 and 380, and the side surfaces 51 and

53 of the header pipes 52 and 54. Therefore, the fixing members 70, 170, 270, and 370 can drain stagnant moisture such as dew condensation water and rainwater through the grooves to help prevent corrosion of the header pipes 52 and 54 while holding the header pipes 52 and 54.

[0186] In the embodiments described above, the fixing members 70, 170, 270, and 370 may hold the header pipes 52 and 54 at positions off the partition walls 60. This prevents load, which is involved with fixing members 70, 170, 270, and 370 holding the header pipes 52 and 54, from being applied to the partition walls 60.

[0187] In each of the embodiments described above, at least part of the contacting surfaces 83, 283, 383, and 395 may be disposed at a position that is in contact with or overlaps an edge of the connection surface 55 or 57. In other words, as shown in FIG. 5, the contact portions 80, 180, 280, and 380 each may be disposed to have an end in contact with an edge of the connection surfaces 55 or 57, or flat tubes 62.

[0188] The moisture such as condensed water generated on the flat tubes 62 in the heat exchanger 50 may flow down along the side surfaces of the flat tubes 62 and the connection surfaces 55 and 57 with the above configuration. If such moisture is in contact with some ends of the contact portions 80, 180, 280 and 380, the moisture is attracted to the contact portions 80, 180, 280 and 380 by surface tension. This allows the heat exchanger 50 to drain the moisture adhering to the flat tubes 62, and prevent the moisture from being stagnant on the flat tubes 62.

[0189] In embodiments described above, a plurality of fixing members 70, 170, 270, and 370 are provided in the longitudinal direction of header pipes 52 and 54.

[0190] Here, generally in the header pipes 52 and 54, dew condensation water is more likely to occur in the lower part than in the upper part.

[0191] In this case, the fixing members 70, 170, 270, and 370, provided in the lower part of the header pipes 52 and 54, may have contacting surfaces 83, 283, 293, 383, and 393, and 395 that are shorter in the circumferential direction of the header pipes 52 and 54 than those of the fixing members 70, 170, 270, and 370 provided in the upper part of the header pipes 52 and 54.

[0192] This allows the outdoor units 1 and 300 to have the larger contacting surfaces 83, 283, 293, 383, 393 and 395 in the fixing members 70, 170, 270, and 370, provided in the upper part of the header pipes 52 and 54. In addition, this makes it possible to have the larger exposed surfaces 59, 259, and 359 formed by the fixing members 70, 170, 270, and 370 provided in the lower part of the header pipes 52 and 54.

[0193] When the fixing members 70, 170, 270, and 370, located in the upper part where dew condensation water is less likely to occur, have the larger contacting surfaces 83, 283, 293, 383, 393, and 395, the header pipes 52 and 54 can be supported more reliably. In contrast, the fixing members 70, 170, 270, and 370, located in the lower part, can have the larger exposed surfaces 59, 259, and 359 to drain the stagnant moisture more reliably.

[0194] Note that, any manner can be applied for the supporting and draining, and the header pipes 52 and 54 may be provided with, for example, the fixing members 70 in the upper part and the fixing members 270 in the lower part.

[0195] Furthermore, for example, the fixing members 370 may be formed so that the contacting surfaces 383 of the holding portions 372 located in the windward is smaller than the contacting surfaces 383 thereof located in the leeward.

[0196] In the embodiments described above, the fixing members 70, 170, 270, and 370 are fixed to the housing 10 via the fixing portions 74, and 374. However, any manner can be applied for the fixing, and a manner may be such that: the extending portions 84, 284, and 384 are provided with fastening holes on the side surfaces; the extending portions 84, 284, and 384 are fixed to the left side plate 11 or the front plate 16 with the fastening members; and thereby the fixing members 70, 170, 270, and 370 are fixed to the housing 10. In this case, the fixing members 70, 170, 270, and 370 may have no fixing portions 74, and 374.

[0197] In the embodiments described above, the holding portions 72, 172, 272 and 372, the fastening members 290 and 390, and the protruding ends 392 are all made of a metal material that has a potential equal to or lower than that of the materials forming the header pipes 52 and 54.

[0198] However, the materials are not limited to this, and the materials may be such that: only the contact portions 80, 280, and 380 and the contacting surfaces 293, 393, and 395 are made of a metal material having a potential equal to or lower than that of the material forming the header pipes 52 and 54.

[0199] Furthermore, the contact portions 80, 280, and 380, and the contacting surfaces 293, 393, and 395 do not always have to be made of a metal material that has a potential equal to or lower than that of the material forming the header pipes 52 and 54, and may be made of, for example, a non-metallic material such as a ceramic material or a resin material.

[0200] This makes it possible to prevent the progress of corrosion due to contact of dissimilar metals, which is promoted by stagnant moisture such as dew condensation water and rainwater, at the sections where the holding portions 72, 172, 272, and 372 hold the header pipes 52 and 54.

[0201] Alternatively, for example, the contact portions 80, 280, and 380 and contacting surfaces 293, 393, and 395 may have a passivation film formed thereon, may be plated with a metal having a potential equal to or lower than that of the material forming the header pipes 52 and 54, or may be coated with a resin. In this case, the contact portions 80, 280, and 380 and the contacting surfaces 293, 393, and 395 may be made of a metal material hav-

ing a potential equal to or higher than that of the material forming the header pipes 52 and 54.

[0202] Also, these processes may be applied to the fixing portions 74 and 374.

[0203] In embodiments described above, the fixing members 70, 170, 270, and 370 are attached to the front plate 16. However, the fixing members 70, 170, 270, and 370 are not limited to this, and may be other members provided inside the housing 10, such as the partition plate 21.

[0204] In the embodiments described above, the outdoor units 1 and 300 are heat exchange units of side-blowing type. However, the type is not limited to this, and the outdoor unit 1 and 300 may be, for example, what is called heat exchange units of upward blowing type in which air is sucked from the side surface of the housing 10 and the air is blown upward from the top of the housing 10.

[0205] Note that the above-described embodiments are for illustrating the techniques in the present disclosure, and various modifications, replacements, additions, omissions, etc., can be made within the scope of the claims or equivalents thereof.

[0206] The present disclosure is applicable to outdoor units in which header pipes are fixed to a housing with fixing members. Specifically, the present disclosure is applicable to an outdoor unit or the like including a flat tube heat exchanger.

Reference Signs List

[0207]

1, 300 outdoor unit
10 housing
50 outdoor heat exchanger
51, 53 side surface
52, 54 header pipe
55, 57 connection surface
59, 259, 359 exposed surface
62 flat tube
70, 170, 270, 370 fixing member
72, 172, 272, 372 holding portion
74, 374 fixing portion
80, 180, 280, 380 contact portion
83, 283, 293, 383, 393, 395 contacting surface
292, 392 protruding end (contact portion)
394 fastening member (contact portion)

Claims

1. An outdoor unit of an air conditioner **characterized by** comprising:

   at least one heat exchanger (50) including header pipes (52 and 54), the header pipes respectively having side surfaces (51 and 53) to which at least one flat tube (62) is connected;
   a housing (10) that contains the heat exchanger; and
   at least one fixing member (70) that fixes the heat exchanger inside the housing, wherein
   the fixing member includes:

      a fixing portion (74) to be fixed to the housing; and
      at least one holding portion (72) that is in contact with the header pipes at the side surfaces except a connection surface (55) to which the flat tube is connected, and thereby holds the header pipes; wherein:

         the holding portion includes at least one contact portion (80) that is in contact with a predetermined section of the side surface of the header pipe; and
         the side surface of the header pipe includes at least one exposed surface (59) exposed to an outside, the exposed surface being at the same height as a section of the side surface that is in contact with the contact portion, the exposed surface having no contact with the contact portion in a circumferential direction of the header pipe.

2. The outdoor unit of the air conditioner according to claim 1, wherein

   in the side surface of the header pipe held by the holding portion,
   a length of the exposed surface in a circumferential direction of the side surface of the header pipe is longer than a length of the contact portion in the circumferential direction of the side surface of the header pipe.

3. The outdoor unit of the air conditioner according to claim 1 or 2, wherein
   the exposed surface is provided on an opposite side of the connection surface in the side surface of the header pipe.

4. The outdoor unit of the air conditioner according to any one of claims 1 to 3, wherein
   the contact portion is provided in contact with an edge of the connection surface.

5. The outdoor unit of the air conditioner according to any one of claims 1 to 4, wherein

   the contact portion includes a contacting surface (83) in contact with the side surface of the header pipe, and
   the holding portion includes a plurality of the con-

tact portions, and the contacting surface (83) of each contact portion is in contact with the side surface of the header pipe and thereby holds the header pipe.

6. The outdoor unit of the air conditioner according to any one of claims 1 to 5, wherein

the contact portion includes a projecting shape that protrudes toward the side surface of the header pipe, and
the holding portion includes a plurality of the contact portions, and an end of the projecting shape of each contact portion is in contact with the side surface of the header pipe and thereby holds the header pipe.

7. The outdoor unit of the air conditioner according to any one of claims 1 to 6, wherein

the housing is provided with a plurality of the heat exchangers arranged side by side in a direction crossing a longitudinal direction of the header pipes, and
a plurality of the holding portions are arranged in the direction crossing the longitudinal direction of the header pipes, and are provided on the fixing portion.

8. The outdoor unit of the air conditioner according to claim 7, wherein

a plurality of the holding portions are fastened together with a fastening member (290), and
the fastening member is provided with a contact portion (280) in contact with a predetermined section of the side surface of the header pipe, the header pipe being held by at least any one of the holding portions.

9. The outdoor unit of the air conditioner according to claim 7, wherein

a plurality of the holding portions are fastened together with a fastening member (390), and
the fastening member is provided with a plurality of contact portions each in contact with a predetermined section of the side surface of the header pipe, the header pipe being held by each holding portion.

10. The outdoor unit of the air conditioner according to any one of claims 1 to 9, wherein

the header pipe is provided having a longitudinal direction in an up-down direction of the housing,
a plurality of the fixing members are provided in a longitudinal direction of the header pipe, and
a plurality of the exposed surfaces each exposed by the fixing member are provided so that at least part of the exposed surfaces overlap each other in a plan view of the header pipe.

11. The outdoor unit of the air conditioner according to any one of claims 1 to 10, wherein
an upper surface of each contact portion has a shape that inclines downward toward the exposed surface.

12. The outdoor unit of the air conditioner according to any one of claims 1 to 11, wherein
each contact portion has a shape that inclines downward toward the exposed surface.

13. The outdoor unit of the air conditioner according to any one of claims 1 to 12, wherein
each contact portion is provided with a groove extending in a longitudinal direction of the header pipe.

14. The outdoor unit of the air conditioner according to any one of claims 1 to 13, wherein

at least one of the header pipes is provided with a partition wall (60) that partitions a space inside the header pipe, and
each holding portion holds the header pipe at a position off the partition wall.

15. The outdoor unit of the air conditioner according to any one of claims 1 to 14, wherein
the contact portion is made of a metallic material or a non-metallic material, the metallic material having a potential equal to or lower than that of the header pipe.

16. The outdoor unit of the air conditioner according to claim 15, wherein
the fixing portion is made of a material having a greater longitudinal elastic modulus and yield point than the contact portion.

FIG.1

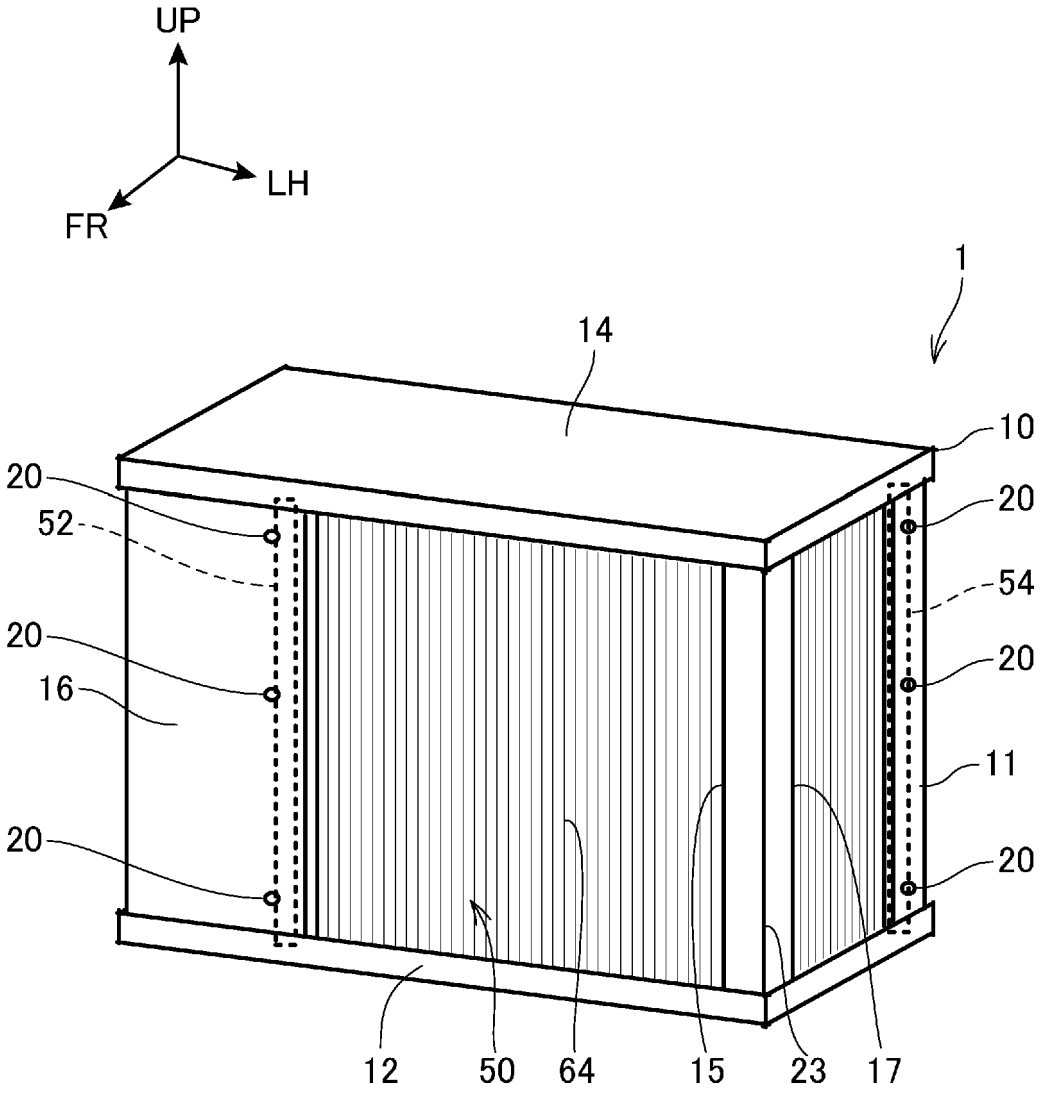


FIG.2

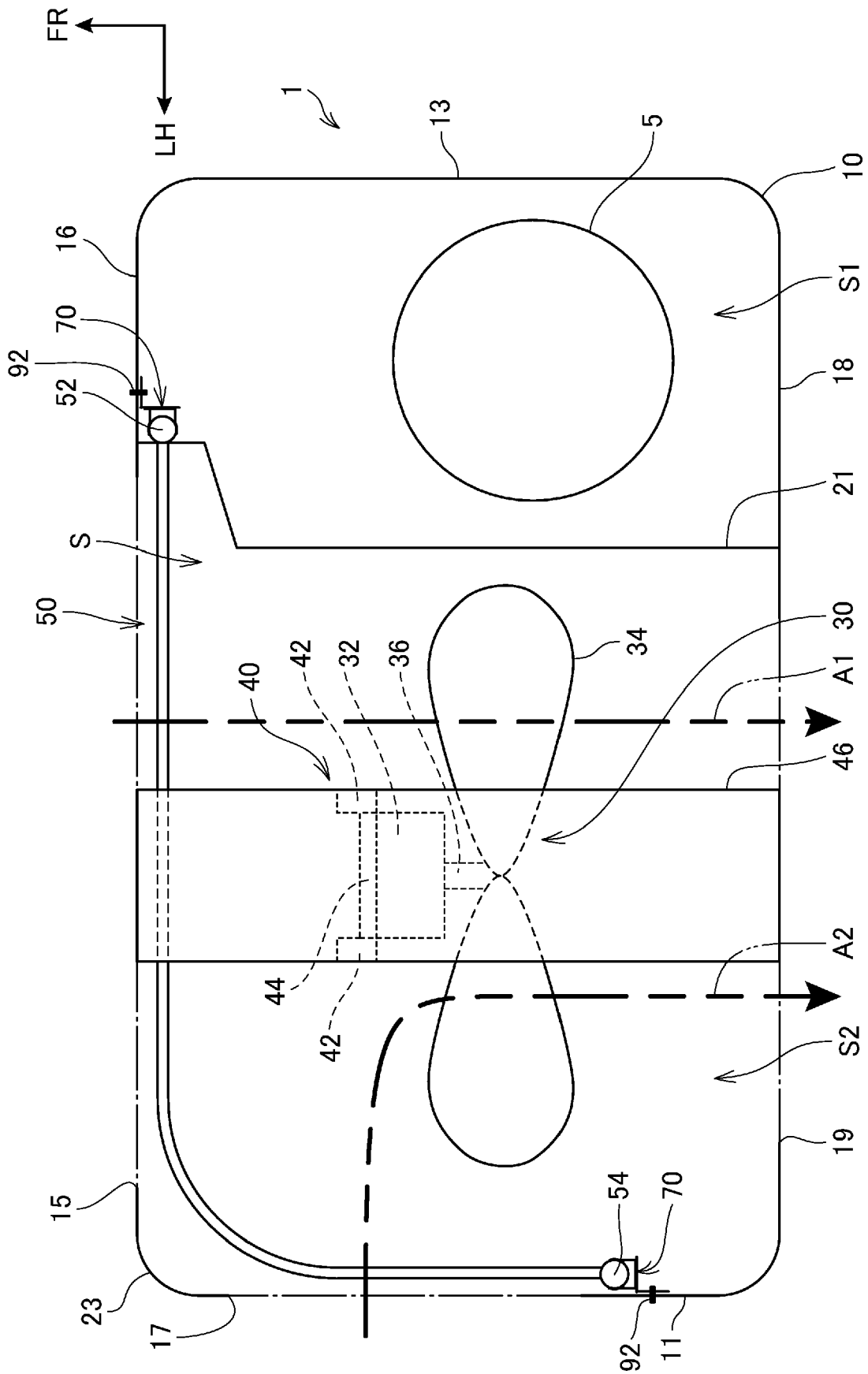

FR
LH
1
13
5
10
16
70
92
52
S1
18
21
S
50
30
34
42
32
36
40
A1
46
44
42
A2
S2
19
15
54
70
23
17
92
11

FIG.3

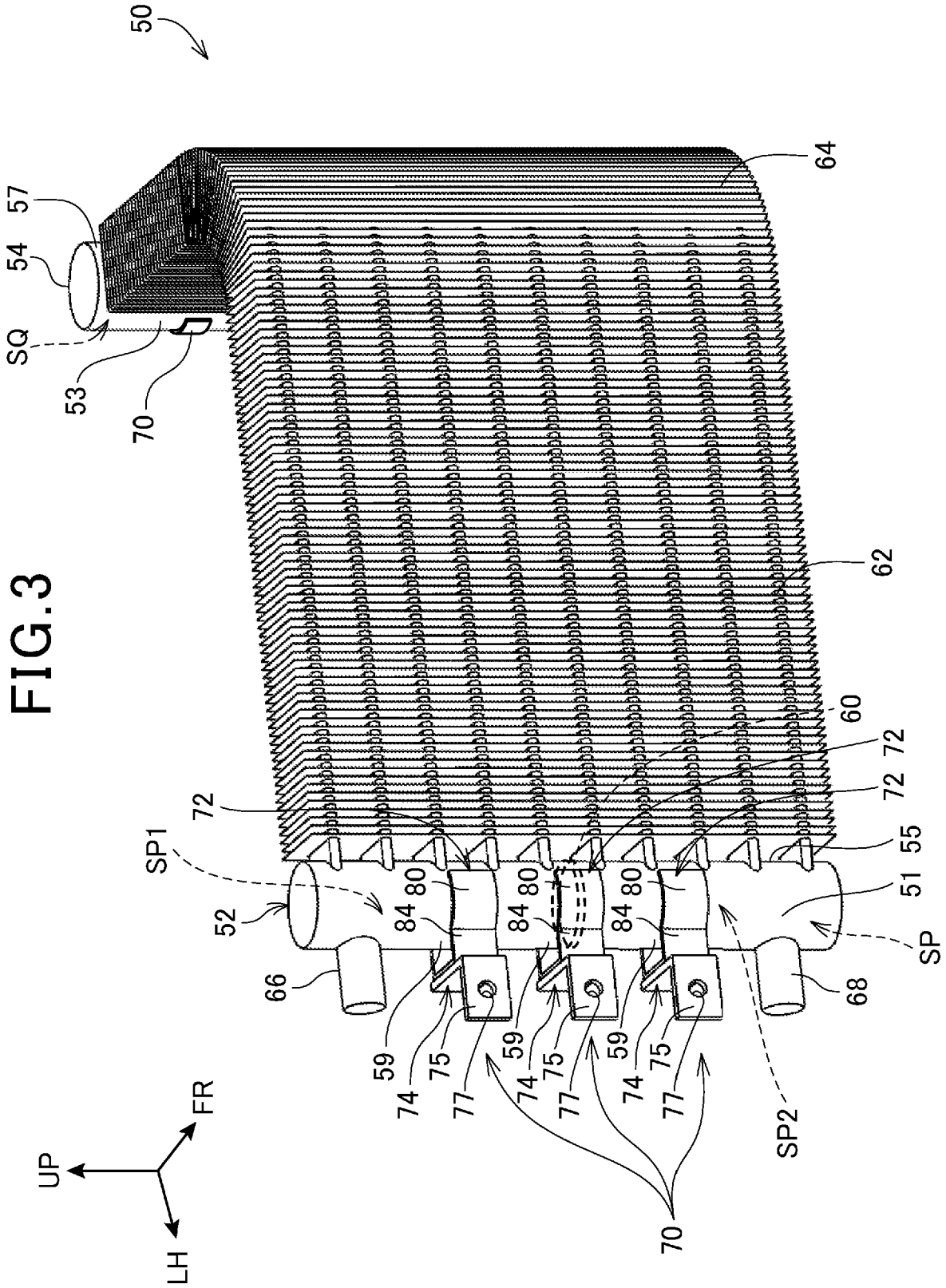

50
57
54
SQ
53
70
64
62
60
72
72
72
SP1
52
55
51
SP
66
68
80
84
59
74
75
77
SP2
UP
FR
LH

FIG.4

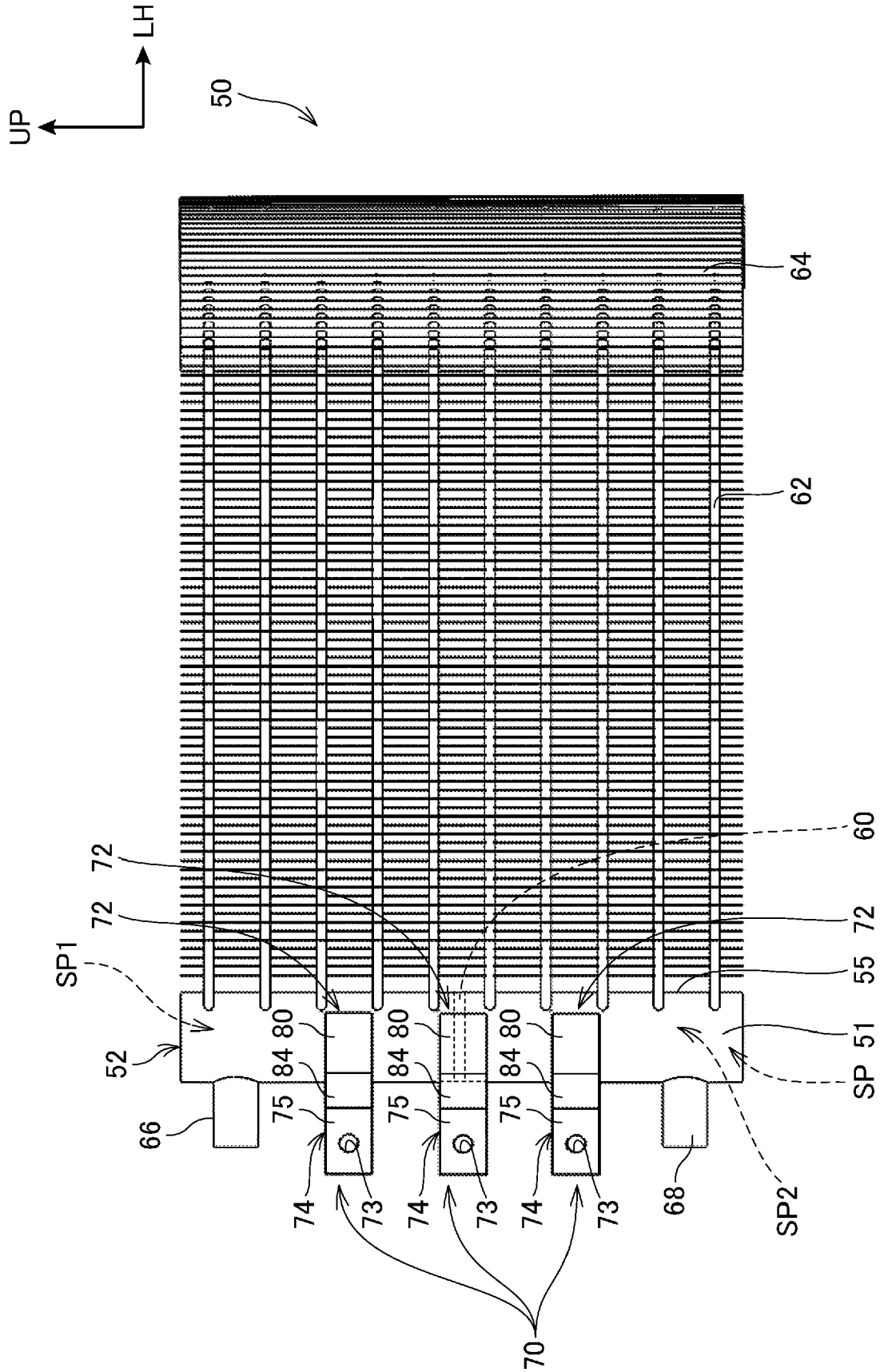


FIG.5

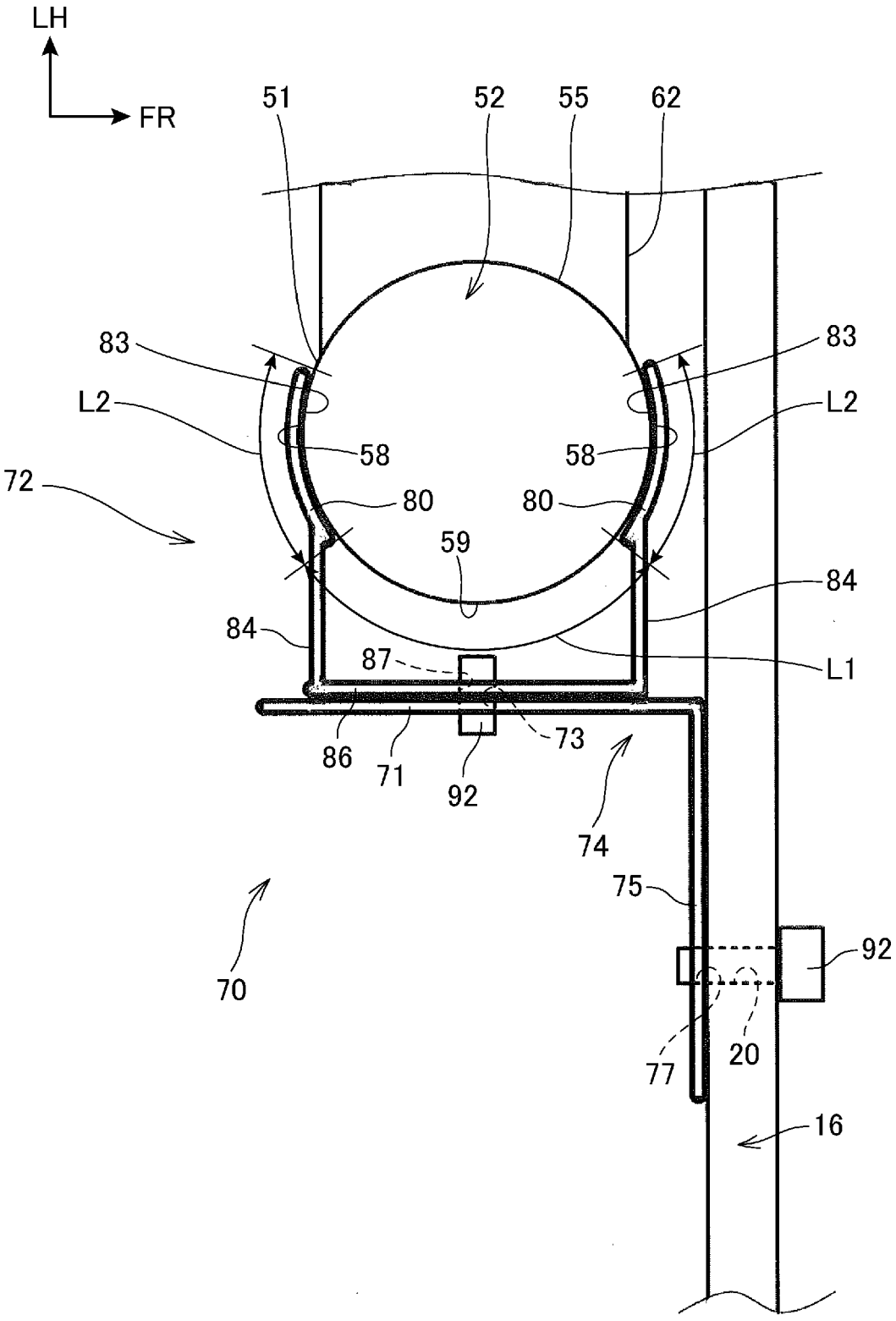

LH
FR
51
52
55
62
83
83
L2
L2
58
58
72
80
80
59
84
84
87
L1
86
71
92
73
74
75
92
70
77
20
16

FIG.6

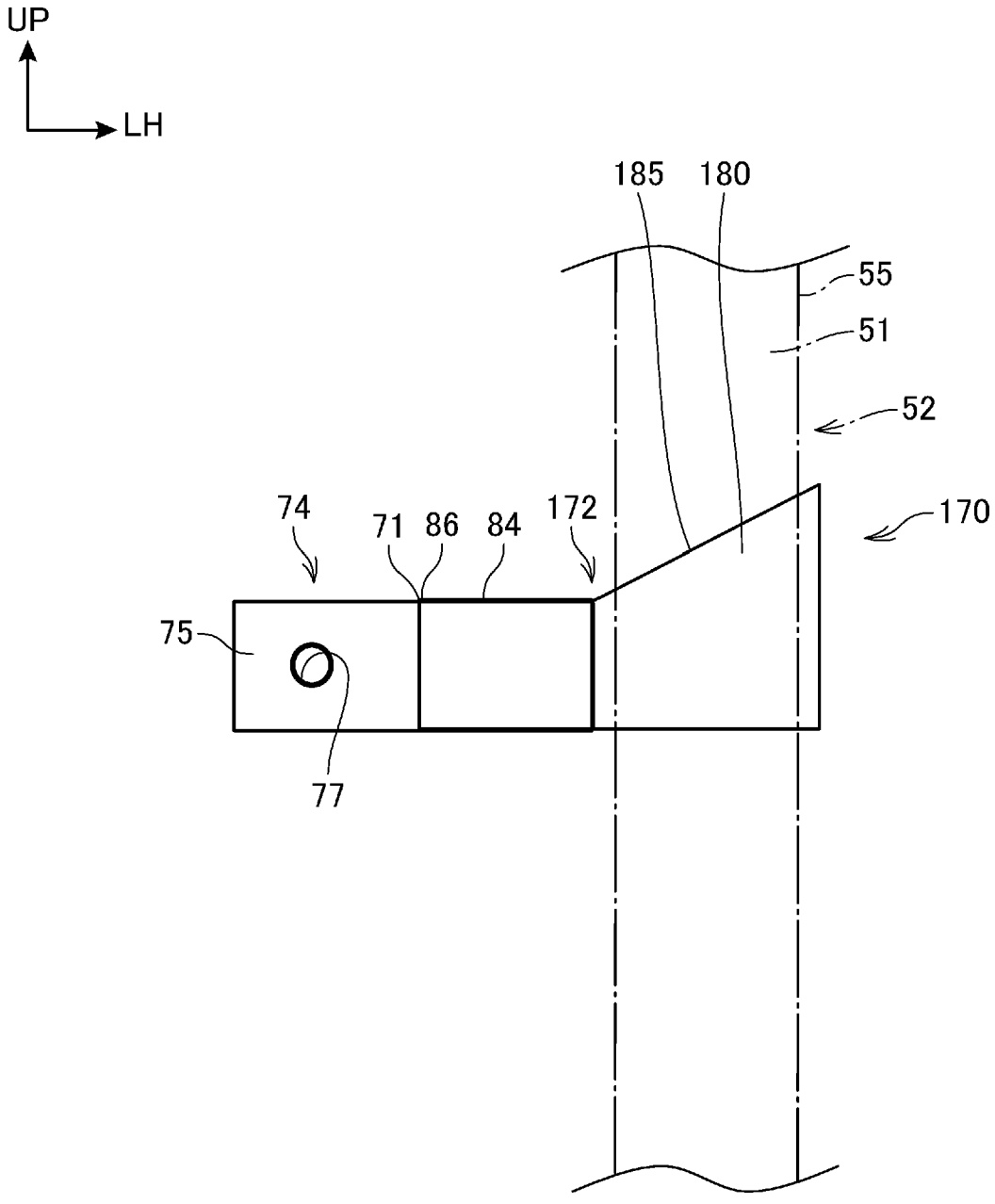


FIG.7

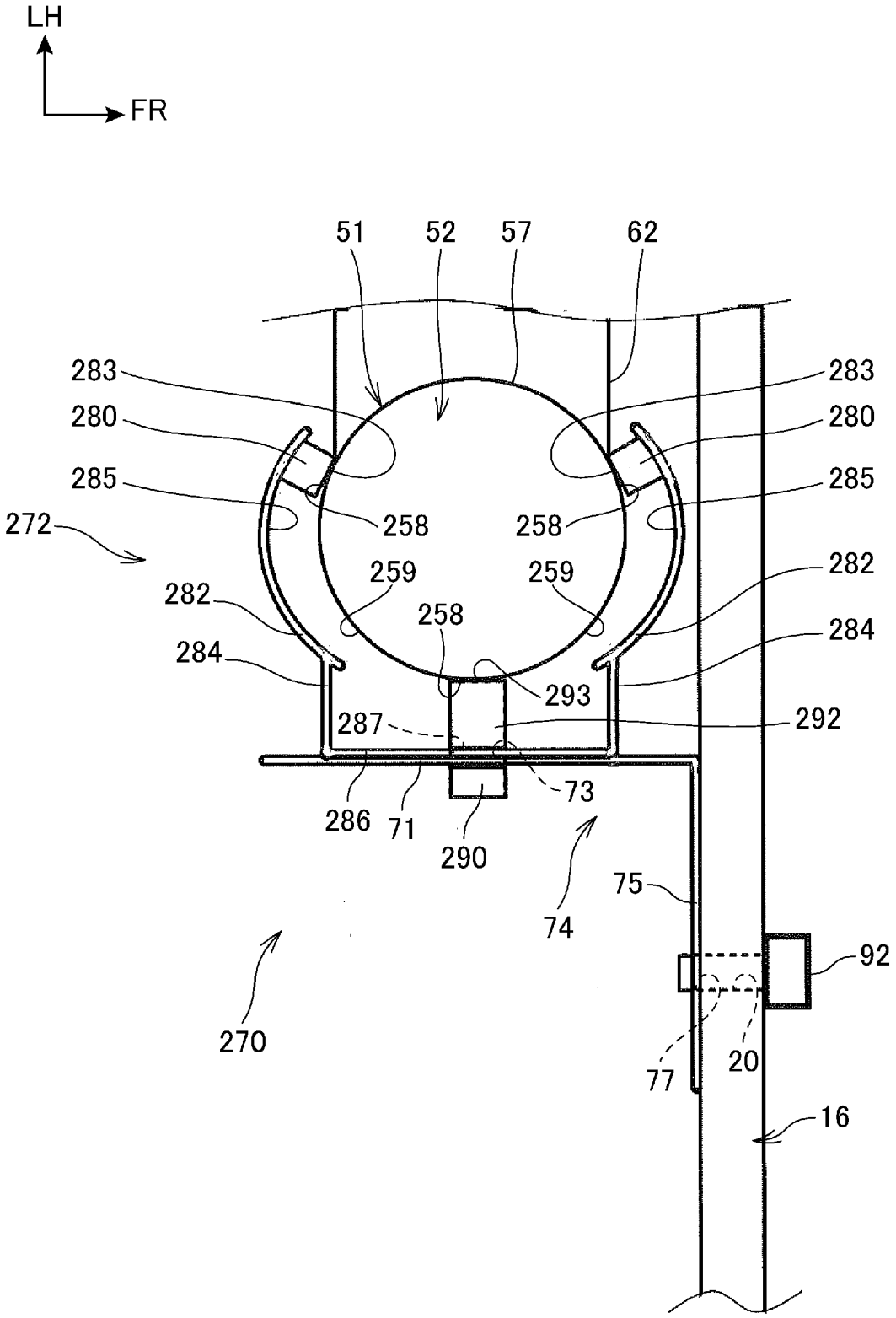

LH
FR
51
52
57
62
283
280
285
272
258
259
282
284
287
292
293
73
286
71
290
74
75
92
270
77
20
16

FIG.8

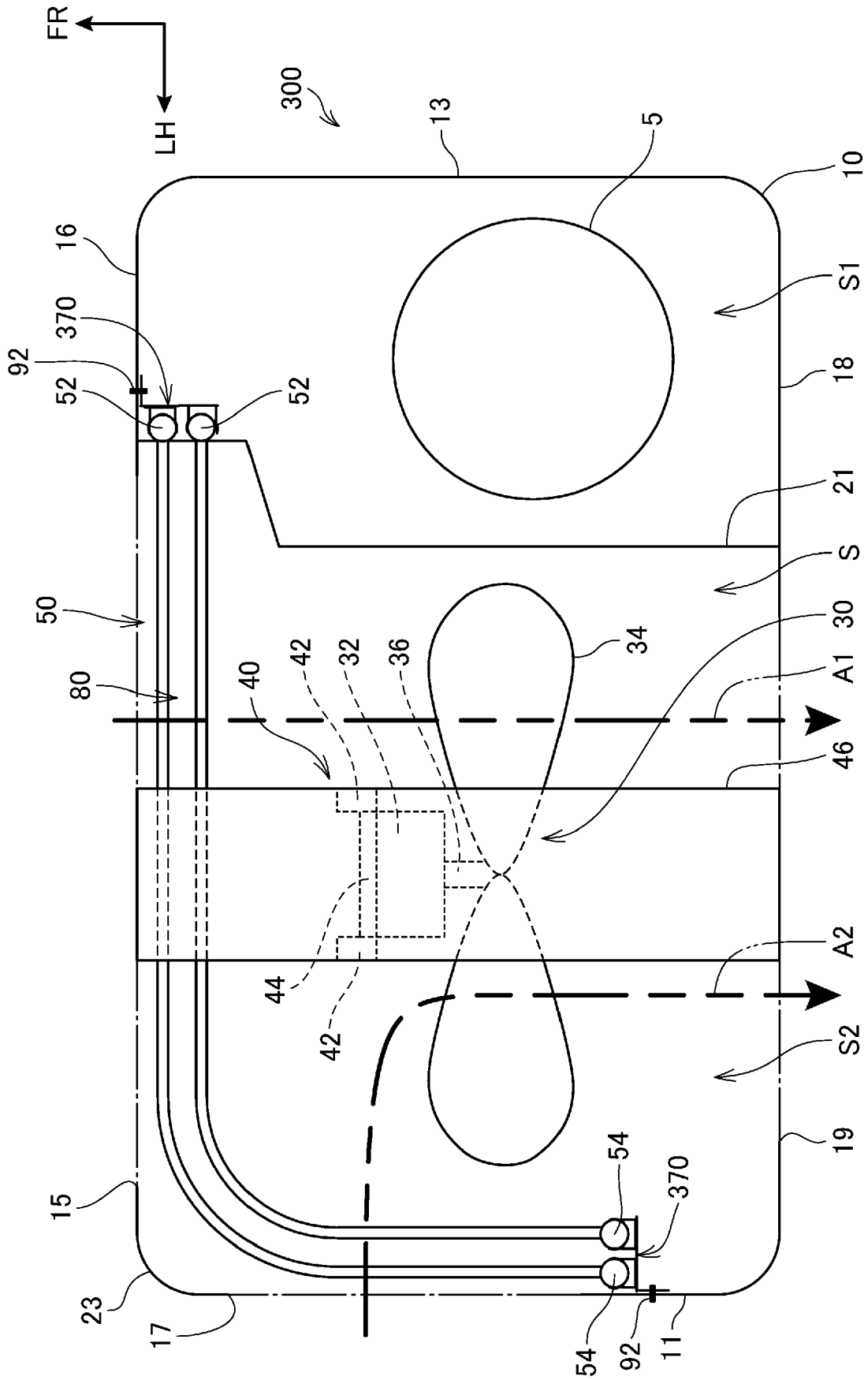
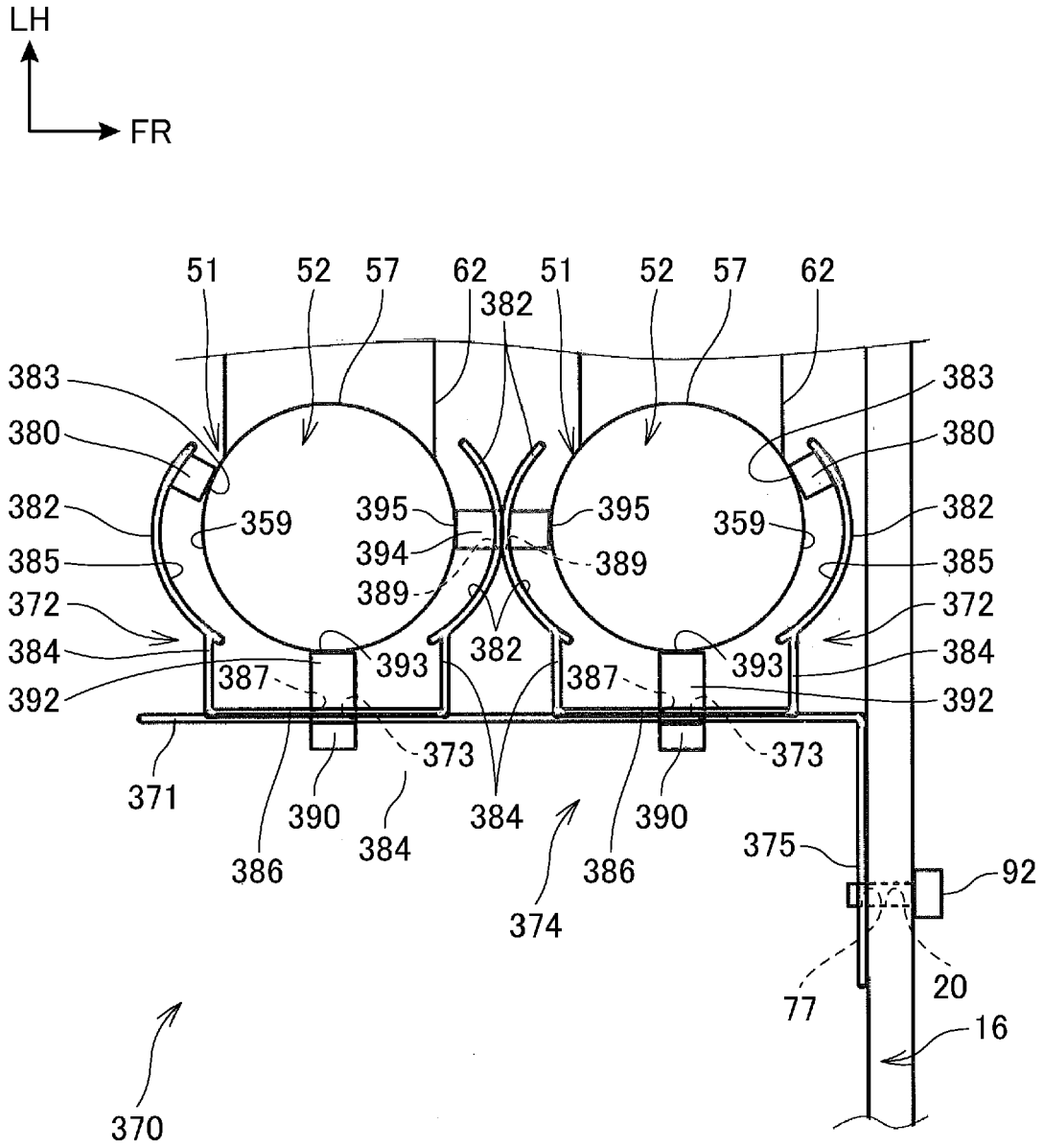

FR
LH
300
13
5
10
16
370
92
52
52
18
S1
21
S
50
80
40
42
32
36
34
30
A1
46
44
42
A2
S2
19
54
370
15
23
17
54
92
11

FIG.9


LH
FR
51
52
57
62
382
383
380
359
395
394
389
385
372
384
387
393
392
373
371
390
386
374
375
92
77
20
16
370

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 15 0738

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 42 17 062 A1 (ZEXEL CORP [JP]) 26 November 1992 (1992-11-26) * column 3, line 1 - column 10, line 32; figures *	1-16	INV. F24F1/16 F28F9/00
X	WO 2013/099908 A1 (DAIKIN IND LTD [JP]) 4 July 2013 (2013-07-04) * the whole document *	1-5,7-16	
X	KR 200 436 611 Y1 (.) 11 September 2007 (2007-09-11) * the whole document *	1-5,10	
A	JP H05 96786 U (.) 27 December 1993 (1993-12-27) * figure 4 *	2	
A	JP 3 133376 B2 (SHOWA ALUMINUM CORP) 5 February 2001 (2001-02-05) * figure 1 *	13	
A	JP 2000 146480 A (CALSONIC CORP) 26 May 2000 (2000-05-26) * figures 1, 6a, 6b *	6,13	TECHNICAL FIELDS SEARCHED (IPC) F24F F28F
A	JP H04 115276 U (.) 13 October 1992 (1992-10-13) * paragraph [0017]; figure 1 *	11,12	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 May 2023	Arndt, Markus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 0738

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-05-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4217062 A1	26-11-1992	DE 4217062 A1	26-11-1992
		JP 2546505 Y2	03-09-1997
		JP H04138579 U	25-12-1992
		US 5205349 A	27-04-1993
WO 2013099908 A1	04-07-2013	AU 2012361651 A1	14-08-2014
		BR 112014016010 A2	13-06-2017
		CN 104024745 A	03-09-2014
		EP 2799788 A1	05-11-2014
		ES 2641692 T3	13-11-2017
		JP 5263381 B2	14-08-2013
		JP 2013139927 A	18-07-2013
		KR 20140100582 A	14-08-2014
		US 2015041101 A1	12-02-2015
		WO 2013099908 A1	04-07-2013
KR 200436611 Y1	11-09-2007	NONE	
JP H0596786 U	27-12-1993	NONE	
JP 3133376 B2	05-02-2001	JP 3133376 B2	05-02-2001
		JP H04366397 A	18-12-1992
JP 2000146480 A	26-05-2000	JP 4169407 B2	22-10-2008
		JP 2000146480 A	26-05-2000
JP H04115276 U	13-10-1992	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2013139930 A **[0002]**