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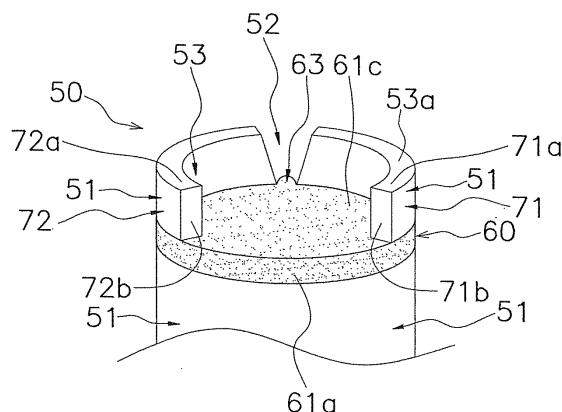
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(54) **HEAT EXCHANGER AND REFRIGERATION DEVICE**

(57) Provided are a heat exchanger and a refrigeration device, whereby it is possible to ensure good water drainage on cover members, while maintaining a good state of fastening between the cover members and a header collection pipe body. A heat exchanger (20) is provided with a header collection pip (22, 23) to which are connected flat multi-hole pipes (21b) having a plurality of heat transfer fins (21a) joined thereto. The header collection pipe (22,23) includes a header collection pipe body (50), and a baffle (60) as a partitioning plate. The

header collection pipe body (50) is provided so that the longitudinal direction thereof is vertically oriented. The baffle (60) serving as a cover member is furnished inside from the upper end of the header collection pipe body (50), and closes off the upper side of the header collection pipe body (50). The header collection pipe body (50) has a pipe end section (53) that extends upward past the baffle (60) serving as a cover member. A drainage slot (52) is formed in a part of the pipe end section (53).

FIG. 19



Description

TECHNICAL FIELD

[0001] The present invention relates to a heat exchanger and a refrigeration device.

BACKGROUND ART

[0002] A number of heat exchangers have been proposed to date, for example, a heat exchanger like that disclosed in Patent Document 1 (Japanese Laid-Open Patent Application 2010-112580), having a pair of header collection pipes, and a plurality of pipes through which the header collection pipes communicate with one another.

[0003] The heat exchanger disclosed in Patent Document 1 (Japanese Laid-Open Patent Application 2010-112580) comprises a partitioning plate for dividing the internal space of the header collection pipe into top and bottom parts, providing a configuration whereby the refrigerant flow can be shuttled between the pair of header collection pipes.

SUMMARY OF THE INVENTION

<Technical Problem>

[0004] In the heat exchanger disclosed in Patent Document 1 (Japanese Laid-Open Patent Application 2010-112580), there is some margin for improvement with regard to the shape of the upper section of the header collection pipe.

[0005] For example, as one conceivable example, a cover member could be fixed to the header collection pipe body at the upper end of the header collection pipe of the heat exchanger; however, in this case the joined sections would be limited to the circumference in the diametrical direction of the cover member, and the inner surface of the header collection pipe body, making it difficult to increase the joining strength.

[0006] In contrast to this, in order to ensure larger size of the joined section of the cover member and the header collection pipe body, it would be conceivable to form an opening to the inside of the end of the header collection pipe body, and to insert the cover member in through the opening and fasten the two together. However, a space in which the upper surface of the cover member is surrounded by the inner peripheral surface of the header collection pipe body would be produced in this case. In the event that condensation water, rainwater, or the like deposited onto the heat exchanger should enter this space, it would be extremely difficult to discharge the water from the space, posing the problem of corrosion of components situated nearby the water, or the problem of ice growth.

[0007] With the foregoing in view, it is an object of the present invention to provide a heat exchanger and a re-

frigeration device, whereby it is possible to ensure good water drainage on the cover member, while maintaining a good state of fastening between the cover member and the header collection pipe body.

<Solution to Problem>

[0008] A heat exchanger according to a first aspect of the present invention is a heat exchanger provided with a plurality of flattened pipes, a header collection pipe to which the flattened pipes are joined, and a plurality of fins joined to the flattened pipes, for heat exchange from a fluid flowing through the interior of the flattened pipes to air flowing outside the flattened pipes, wherein the header collection pipe is provided with a header collection pipe body and a cover member. The header collection pipe body is provided so that the longitudinal direction thereof is vertically oriented. The cover member is furnished inside from the upper end of the header collection pipe body, and closes off the upper side of the header collection pipe body. The header collection pipe body has a pipe end section that extends upward past the cover member. A drainage part is formed in a part of the pipe end section.

[0009] The plurality of flattened pipes may be arranged, for example, with their side surfaces facing, however, there is no particular limitation thereto.

[0010] According to this heat exchanger, condensation water, rainwater, or the like present on the cover member can be drained out through the drainage part furnished in the header collection pipe body. It is therefore possible to make it difficult for corrosion to occur in the vicinity of the upper end of the header collection pipe.

[0011] A heat exchanger according to a second aspect of the present invention is a heat exchanger according to the first aspect, wherein the drainage part is a slot formed by a downward receding of a part of the pipe end section.

[0012] According to this heat exchanger, the drainage part can be formed by a downward receding of a part of the pipe end section of the header collection pipe body to form a slot therein, and is therefore easy to manufacture.

[0013] A heat exchanger according to a third aspect of the present invention is a heat exchanger according to the second aspect, wherein the lower end of the drainage slot is situated below the upper end of the cover member.

[0014] According to this heat exchanger, the drainage slot has a section that is lower than the upper end of the cover member, whereby it is possible to drain out the entire amount of any water having pooled on top of the cover member.

[0015] A heat exchanger according to a fourth aspect of the present invention is a heat exchanger according to any of the first to third aspects, wherein at least a part of the outer peripheral part of the cover member is clamped from above and below between the pipe end section and a part of the header collection pipe other than

the pipe end section.

[0016] According to this heat exchanger, the top of the cover member has a part contacting the pipe end section, and the bottom of the cover member has a part contacting a section of the header collection pipe other than the pipe end section. Therefore, it is possible for the header collection pipe body and the cover member to be fixed more securely.

[0017] A refrigeration device according to a fifth aspect of the present invention is provided with a refrigerant circuit configured by connecting together a compressor, a first heat exchanger, an expansion valve, and a second heat exchanger that is the heat exchanger according to any of the first to fourth aspects. In the refrigerant circuit, the second heat exchanger is capable of functioning at least as an evaporator for the refrigerant.

[0018] According to this refrigeration device, it is possible for condensation water pooling in the upper end section of the header collection pipe during functioning of the second heat exchanger as an evaporator for the refrigerant to be drained out easily through the drainage part.

<Advantageous Effects of Invention>

[0019] With the heat exchanger according to the first aspect of the present invention, it is possible to largely eliminate the occurrence of corrosion in the vicinity of the upper end of the header collection pipe.

[0020] The heat exchanger according to the second aspect of the present invention affords ease of manufacture.

[0021] With the heat exchanger according to the third aspect of the present invention, it is possible to drain the entire amount of any water having pooled on top of the cover member.

[0022] With the heat exchanger according to the fourth aspect of the present invention, it is possible for the header collection pipe and the cover member to be fixed more securely.

[0023] With the refrigeration device according to the fifth aspect of the present invention, it is possible for condensation water having pooled in the upper end section of the header collection pipe to be drained out easily through the drainage part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a circuit diagram describing an overview of the configuration of an air conditioning apparatus according to an embodiment;

FIG. 2 is a perspective view showing the exterior of an air conditioning outdoor unit;

FIG. 3 is a schematic cross sectional view describing an overview of the arrangement of equipment in an air conditioning outdoor unit;

FIG. 4 is a simplified exterior perspective view showing gas refrigerant piping and liquid refrigerant piping of an outdoor heat exchanger;

FIG. 5 is a schematic rear view showing a simplified configuration of an outdoor heat exchanger;

FIG. 6 is a simplified rear view describing the configuration of an outdoor heat exchanger;

FIG. 7 is an enlarged fragmentary cross sectional view describing the configuration of a heat exchange part of an outdoor heat exchanger;

FIG. 8 is a simplified perspective view showing attached heat transfer fins in an outdoor heat exchanger;

FIG. 9 is an exterior perspective view showing the vicinity of the upper end section of a header collection pipe body;

FIG. 10 is a side view of a header collection pipe body, seen from the side to which flat multi-hole pipes will be connected;

FIG. 11 is a frontal side view of a header collection pipe body;

FIG. 12 is an exterior perspective view of a baffle;

FIG. 13 is a simplified plan view of a baffle;

FIG. 14 is a simplified side view of the baffle seen from the left side in FIG. 13;

FIG. 15 is a simplified side view showing a baffle in the inserted state immediately prior to elastic deformation thereof;

FIG. 16 is a simplified side view showing a completely inserted baffle in an elastically deformed state;

FIG. 17 is an exterior perspective view showing, from the inserted tip side, a state in which baffles have been fixed as partitioning plates inserted into a header collection pipe body;

FIG. 18 is an exterior perspective view showing, from the opposite side from the inserted tip, a state in which baffles have been fixed as partitioning plates inserted into a header collection pipe body;

FIG. 19 is an exterior perspective view showing the vicinity of the end of a header collection pipe body closed off by a baffle;

FIG. 20 is a side cross sectional view showing the vicinity of the end of a header collection pipe body closed off by a baffle;

FIG. 21 is an exterior perspective view showing the vicinity of the end of a header collection pipe body closed off by a baffle serving as a cover member in Modification

Example A; and

[0025] FIG. 22 is an exterior perspective view showing the vicinity of the end of a header collection pipe body closed off by a baffle serving as a cover member in Modification Example B.

DESCRIPTION OF EMBODIMENTS

(1) Overall configuration of air conditioning apparatus

[0026] FIG. 1 is a circuit diagram showing an overview of the configuration of an air conditioning apparatus according to an embodiment of the present invention.

[0027] An air conditioning apparatus 1 is a device used to cool or heat, through a vapor compression refrigeration cycle operation, the interior of a building in which an air conditioning indoor unit 3 is installed, and comprises an air conditioning outdoor unit 2 as the heat-source-side unit, and the air conditioning indoor unit 3 as the usage-side unit, these units being connected by refrigerant communication pipes 6, 7.

[0028] The refrigerant circuit configured from the connected air conditioning outdoor unit 2, air conditioning indoor unit 3, and refrigerant communication pipes 6, 7 has a configuration in which components such as a compressor 91, a four-way switching valve 92, an outdoor heat exchanger 20, an expansion valve 40, an indoor heat exchanger 4, and an accumulator 93 are connected by refrigerant piping. Refrigerant is sealed inside this refrigeration circuit, and a refrigeration cycle operation is performed in which the refrigerant is compressed, cooled, depressurized, heated, evaporated, and then compressed again. Possible options for the refrigerant include R410A, R407C, R22, R134a, carbon dioxide, and the like, for example.

(2) Detailed configuration of air conditioning apparatus

(2-1) Air conditioning indoor unit

[0029] The air conditioning indoor unit 3 is installed by being hung from an interior wall surface, or by being flush-mounted in or suspended from an interior ceiling of a building or the like. The air conditioning indoor unit 3 has an indoor heat exchanger 4 and an indoor fan 5. The indoor heat exchanger 4 is, for example, a fin-and-pipe heat exchanger of cross-fin type configured by heat transfer pipes and numerous fins. During cooling operation, the heat exchanger functions as an evaporator for the refrigerant, to cool the interior air, and during heating operation functions as a condenser for the refrigerant, to heat the interior air.

(2-2) Air conditioning outdoor unit

[0030] The air conditioning outdoor unit 2 is installed outside a building or the like, and is connected to the air conditioning indoor unit 3 by the refrigerant communication pipes 6, 7. As shown in FIGS. 2 and 3, the air conditioning outdoor unit 2 has a generally cuboid shaped unit casing 10.

[0031] As shown in FIG. 3, the air conditioning outdoor unit 2 has a structure in which a blower compartment S1 and machine compartment S2 are formed by the in-

ternal space of the unit casing 10 being divided in two by a vertically extending partitioning plate 18 ("trunk" structure). The air conditioning outdoor unit 2 has the outdoor heat exchanger 20 and an outdoor fan 95 which are arranged inside the blower compartment S1 of the unit casing 10; and has the compressor 91, the four-way switching valve 92, the accumulator 93, the expansion valve 40, a gas refrigerant line 31, and a liquid refrigerant line 32, which are arranged inside the machine compartment S2 of the unit casing 10.

[0032] The unit casing 10 is provided with a bottom plate 12, a top plate 11, a side panel 13 on the blower compartment side, a side panel 14 on the machine compartment side, a front plate 15 on the blower compartment side, and a front plate 16 on the machine compartment side, which constitutes the chassis.

[0033] The air conditioning outdoor unit 2 is configured to suck outside air into the blower compartment S1 inside the unit casing 10 through parts of the back and side surfaces of the unit casing 10, and to blow out the suctioned in outside air through the front surface of the unit casing 10. In specific terms, an intake port 10a and an intake port 10b for the blower compartment S1 inside the unit casing 10 are formed across the end at the back surface side of the side panel 13 on the blower compartment side and the end at the blower compartment S1 side of the side panel 14 on the machine compartment side. Another outlet port 10c is furnished to the blower compartment-side front plate 15, and the front side thereof is covered by a fan grill 15a.

[0034] The compressor 91 is a hermetic compressor driven, for example, by a compressor motor, and is configured such that the operating capacity is variable.

[0035] The four-way switching valve 92 is a mechanism for switching the direction of flow of the refrigerant. During the cooling operation, the four-way switching valve 92 connects a refrigerant line on the discharge side of the compressor 91 to the gas refrigerant line 31 extending from one end (the gas-side end) of the outdoor heat exchanger 20, as well as connecting, via the accumulator 93, the refrigerant communication pipe 7 for the gas refrigerant to the refrigerant line on the intake side of the compressor 91 (refer to the solid lines of the four-way switching valve 92 in FIG. 1). During the heating operation, the four-way switching valve 92 connects the refrigerant line on the discharge side of the compressor 91 to the refrigerant communication pipe 7 for the gas refrigerant, as well as connecting, via the accumulator 93, the intake side of the compressor 91 to the gas refrigerant line 31 extending from one end (the gas-side end) of the outdoor heat exchanger 20 (refer to the broken lines of the four-way switching valve 92 in FIG. 1).

[0036] The outdoor heat exchanger 20 is disposed upright (vertically) in the blower compartment S1, facing the intake ports 10a, 10b. The outdoor heat exchanger 20 is an aluminum heat exchanger; in the present embodiment, one having design pressure of about 3 MPa-4 MPa is used. The gas refrigerant line 31 extends from one end

(the gas-side end) of the outdoor heat exchanger 20, in such a way as to connect to the four-way switching valve 92. The liquid refrigerant line 32 extends from the other end (the liquid-side end) of the outdoor heat exchanger 20, in such a way as to connect to the expansion valve 40.

[0037] The accumulator 93 is connected between the four-way switching valve 92 and the compressor 91. The accumulator 93 is equipped with a gas-liquid separation function for separating the refrigerant into a gas phase and a liquid phase. Refrigerant flowing into the accumulator 93 is divided into a gas phase and a liquid phase, the gas phase refrigerant collecting in an upper space being supplied to the compressor 91.

[0038] The outdoor fan 95 supplies the outdoor heat exchanger 20 with outside air for the purpose of heat exchange with the refrigerant flowing through the outdoor heat exchanger 20.

[0039] The expansion valve 40 is a mechanism for decompressing the refrigerant in the refrigerant circuit, and is configured by an electrically operated valve having an adjustable aperture. In order to regulate the refrigerant pressure and/or the refrigerant flow rate, the expansion valve 40 is furnished between the outdoor heat exchanger 20 and the refrigerant communication pipe 6 for the liquid refrigerant, and has the function of causing the refrigerant to expand, both during cooling operation and heating operation.

[0040] The outdoor fan 95 is arranged facing the outdoor heat exchanger 20 in the blower compartment S1. The outdoor fan 95 draws outside air into the unit, causes heat exchange between refrigerant and the outside air in the outdoor heat exchanger 20, and then discharges the heat-exchanged air to the outside. The outdoor fan 95 is a fan capable of varying the airflow supplied to the outdoor heat exchanger 20; for example, a propeller fan or the like, driven by a motor composed of a DC fan motor or the like.

(3) Action of air conditioning apparatus

(3-1) Cooling operation

[0041] During a cooling operation, the four-way switching valve 92 is in the state depicted by the solid lines in FIG. 1, i.e., in a state in which the discharge side of the compressor 91 is connected to the gas side of the outdoor heat exchanger 20 via the gas refrigerant line 31, and the intake side of the compressor 91 is connected to the gas side of the indoor heat exchanger 4 via the accumulator 93 and the refrigerant communication pipe 7. The opening degree of the expansion valve 40 is adjusted so that the degree of superheat of the refrigerant in the outlet of the indoor heat exchanger 4 (i.e. the gas side of the indoor heat exchanger 4) remains constant. When the compressor 91, the outdoor fan 95, and the indoor fan 5 are operated with the refrigerant circuit in this state, low-pressure gas refrigerant is drawn into the compressor 91 and compressed to high-pressure gas refrigerant. This

high-pressure gas refrigerant is fed to the outdoor heat exchanger 20 through the four-way switching valve 92. Thereafter, the high-pressure gas refrigerant undergoes heat exchange in the outdoor heat exchanger 20 with outside air supplied by the outdoor fan 95, and is condensed to become high-pressure liquid refrigerant. The high-pressure liquid refrigerant which has reached a supercooled state is fed to the expansion valve 40 from the outdoor heat exchanger 20. The refrigerant is depressurized by the expansion valve 40 nearly to the intake pressure of the compressor 91, becoming a low-pressure gas-liquid two-phase refrigerant, which is sent to the indoor heat exchanger 4 and evaporated to a low-pressure gas refrigerant by heat exchange with indoor air in the indoor heat exchanger 4.

[0042] This low-pressure gas refrigerant is fed through the refrigerant communication pipe 7 to the air conditioning outdoor unit 2, and is drawn back into the compressor 91. Thus, in the cooling operation, the air conditioning apparatus 1 causes the outdoor heat exchanger 20 to function as a condenser of the refrigerant compressed in the compressor 91, and the indoor heat exchanger 4 to function as an evaporator of the refrigerant condensed in the outdoor heat exchanger 20.

(3-2) Heating operation

[0043] During the heating operation, the four-way switching valve 92 is in the state depicted by the broken lines in FIG. 1, i.e., in a state in which the discharge side of the compressor 91 is connected to the gas side of the indoor heat exchanger 4 via the refrigerant communication pipe 7, and the intake side of the compressor 91 is connected to the gas side of the outdoor heat exchanger 20 via the gas refrigerant line 31. The opening degree of the expansion valve 40 is adjusted so that the degree of supercooling of the refrigerant at the outlet of the indoor heat exchanger 4 remains constant at a degree of supercooling target value. When the compressor 91, the outdoor fan 95, and the indoor fan 5 are operated with the refrigerant circuit in this state, low-pressure gas refrigerant is drawn into the compressor 91 and compressed to high-pressure gas refrigerant, and then fed through the four-way switching valve 92 and the refrigerant communication pipe 7 to the air conditioning indoor unit 3.

[0044] The high-pressure gas refrigerant sent to the air conditioning indoor unit 3 undergoes heat exchange with indoor air in the indoor heat exchanger 4, and the refrigerant condenses to high-pressure liquid refrigerant, which during subsequent passage through the expansion valve 40 is depressurized according to the opening degree of the expansion valve 40. The refrigerant having passed through the expansion valve 40 inflows to the outdoor heat exchanger 20. The low-pressure gas-liquid two-phase refrigerant flowing into the outdoor heat exchanger 20 undergoes heat exchange with outside air supplied by the outside fan 95, evaporating to become

low-pressure gas refrigerant, which again flows into the compressor 91 through the four-way switching valve 92. Thus, in the heating operation, the air conditioning apparatus 1 causes the indoor heat exchanger 4 to function as a condenser of the refrigerant compressed in the compressor 91, and the outdoor heat exchanger 20 to function as an evaporator of the refrigerant condensed in the indoor heat exchanger 4.

(4) Detailed configuration of outdoor heat exchanger

(4-1) Overall configuration of outdoor heat exchanger

[0045] Next, the configuration of the outdoor heat exchanger 20 is described in detail, making reference to FIG. 4 which shows a simplified exterior perspective view of the outdoor heat exchanger 20, FIG. 5 which shows a schematic rear view of an outdoor heat exchanger, and FIG. 6 which shows simplified rear view.

[0046] The outdoor heat exchanger 20 comprises a heat exchange part 21 for performing heat exchange between the outside air and the refrigerant, this heat exchange part 21 being configured from numerous heat transfer fins 21a and numerous flat multi-hole pipes 21b. The heat transfer fins 21a and the flat multi-hole pipes 21b are all made of aluminum or aluminum alloy. The flat multi-hole pipes 21b function as heat transfer pipes through which heat moving between the heat transfer fins 21a and the outside air is transmitted to the refrigerant flowing through the interior.

[0047] One header collection pipe 22, 23 made of aluminum is provided at each end of the heat exchange part 21 of the outdoor heat exchanger 20.

[0048] The header collection pipe 22 has internal spaces 22a, 22b divided in a vertical direction by a first baffle 22c. The gas refrigerant line 31 is connected to the upper internal space 22a, and the liquid refrigerant line 32 is connected to the lower internal space 22b.

[0049] The interior of the header collection pipe 23 is divided in a vertical direction by a second baffle 23f, a third baffle 23g, a fourth baffle 23h, and a fifth baffle 23i, forming internal spaces 23a, 23b, 23c, 23d, and 23e. The numerous flat multi-hole pipes 21b connecting to the internal space 22a in the upper part of the header collection pipe 22 connect to three of the internal spaces 23a, 23b, 23c of the header collection pipe 23. Numerous flat multi-hole pipes 21b connecting to the internal space 22b in the lower part of the header collection pipe 22 connect to three of the internal spaces 23c, 23d, 23e of the header collection pipe 23.

[0050] In the present embodiment, the baffles are employed not only as partitioning plates for a header collection pipe body 50, but also as components employed to serve as cover members; when describing the shape common to these components, a representative baffle 60 will be described as follows.

[0051] The internal space 23a of the uppermost tier and the internal space 23e of the lowermost tier of the

header collection pipe 23 are connected by a communication line 24. The internal space 23b of the second tier from the top and the internal space 23d of the second tier from the bottom are connected by a communication line 25. The middle internal space 23c also functions to connect part of the upper part (the section connecting to the internal space 22a of the uppermost tier) and part of the lower part (the section connecting to the internal space 22b of the lowermost tier) of the heat exchange part 21. Due to this configuration, during cooling operation for example, as shown by arrows in FIG. 5, gas refrigerant supplied to the internal space 23a of the upper part of the header collection pipe 23 by the gas refrigerant line 31 is liquefied in the course of heat exchange in the upper part of the heat exchange part 21, and is returned by the header collection pipe 23, passing through the lower part of the heat exchange part 21 to exit from the liquid refrigerant line 32. During heating operation, the refrigerant flows in the opposite direction from the flow shown by the arrows in FIG. 5.

(4-2) Configuration of heat exchange part

[0052] FIG. 7 is a partial enlarged view showing a cross sectional structure in a plane perpendicular to the direction of flattening of the flat multi-hole pipes 21b of the heat exchange part 21 of the outdoor heat exchanger 20. FIG. 8 is a simplified perspective view showing the attached heat transfer fins 21a in the outdoor heat exchanger 20.

[0053] The heat transfer fins 21a are flat panels made of thin aluminum or aluminum alloy, in each of which heat transfer fins 21a are formed a plurality of notches 21aa for insertion of the flattened pipes, which extend horizontally and which are aligned vertically. The heat transfer fins 21a are attached in such a way as to have innumerable sections that project towards the upstream side of the air flow.

[0054] The flat multi-hole pipes 21b have top and bottom flat surface parts serving as heat transfer surfaces, and a plurality of internal flow passages 21ba through which the refrigerant flows. The flat multi-hole pipes 21b, which are slightly thicker than the vertical width of the notches 21aa, are arrayed in multiple tiers with gaps therebetween and with the flat surface sections thereof facing up and down, and are temporarily fixed by being fitted in place into the notches 21aa. With the flat multi-hole pipes 21b temporarily fixed by being fitted in place into the notches 21aa of the heat transfer fins 21 in this way, the heat transfer fins 21 and the flat multi-hole pipes 21b are soldered together. The flat multi-hole pipes 21b are fitted at both ends into the respective header collection pipes 22, 23 and soldered. Therefore, the internal spaces 22a, 22b of the header collection pipe 22 and/or the internal spaces 23a, 23b, 23c, 23d, 23e of the header collection pipe 23 are linked to the internal flow passages 21ba of the flat multi-hole pipes 21b.

[0055] As shown in FIG. 7, the heat transfer fins 21a

are vertically linked, whereby condensation forming on the heat transfer fins 21a and/or the flat multi-hole pipes 21b drips downward along the heat transfer fins 21a, and is discharged to the outside through a passage formed in the bottom plate 12.

(4-3) Configuration of header collection pipes

[0056] The configuration of the header collection pipes 22, 23, primarily in the vicinity of the ends thereof, is described below, and since there are no differences between the header collection pipes 22, 23 in terms of the configuration at their ends, the header collection pipe 22 will be described as representative, omitting discussion of the header collection pipe 23.

[0057] The header collection pipe 22 has the header collection pipe body 50, a baffle 60 serving as the cover member, and a baffle 60 serving as the partitioning plate.

(4-3-1) Header collection pipe body

[0058] FIG. 9 shows an exterior perspective view showing the vicinity of the upper end section of the header collection pipe body 50. FIG. 10 shows a side view of a header collection pipe body, seen from the side to which flat multi-hole pipes will be connected. FIG. 11 shows a frontal side view of a header collection pipe body.

[0059] The header collection pipe body 50 is a member of generally round cylindrical shape, open respectively at the top and bottom ends.

[0060] A solder material 51 is applied to the surface of an outer peripheral surface 51a at the radially outside of the header collection pipe body 50. While the solder material 51 is not limited to any particular type, for example, aluminum solder, which is a solder material containing material in common with both the material of the header collection pipe body 50 and the material of the baffles 60, is preferred. From a materials cost standpoint, it is preferable that no solder material be applied to an inner peripheral surface 51b at the radially inside of the header collection pipe body 50 and/or to the upper and lower end surfaces thereof.

[0061] In the header collection pipe body 50, there are formed a plurality of flat pipe insertion openings 59, a plurality of baffle insertion openings 56, a plurality of baffle distal end openings 54, and an opening 55.

[0062] The flat pipe insertion openings 59 are openings into which is inserted one end of the flat multi-hole pipes 21b, and which open in diametrical directions in sections of the header collection pipe body 50 other than the ends. A plurality of the flat pipe insertion openings 59 are furnished so as to line up in a vertical direction which is the longitudinal direction of the header collection pipe body 50. The flat pipe insertion openings 59 are formed by removing arcuate sections equivalent to a 90-120 degree center angle of the header collection pipe body 50.

[0063] The baffle insertion openings 56 are openings for insertion of the baffles 60 serving as partitioning

plates, discussed later, which open in diametrical directions in sections of the header collection pipe body 50 other than the ends, to the opposite side from the flat pipe insertion openings 59. A plurality of the baffle insertion openings 56 are furnished so as to line up in a vertical direction which is the longitudinal direction of the header collection pipe body 50. The baffle insertion openings 56 are formed by removing arcuate sections equivalent to an approximately 160-200 degree center angle of the header collection pipe body 50. In the diametrical thickness section of the header collection pipe body 50, each of the baffle insertion openings 56 has a thickness upper surface 56d, a thickness lower surface 56e, and a thickness abutting surface 56b. The thickness abutting surfaces 56b are surfaces which extend in a diametrical direction and in a vertical direction of the header collection pipe body 50, and which come into respective surface contact with a first insertion direction surface 64b of a first engaged part 64 of the baffles 60, and with a second insertion direction surface 65b of a second engaged part 65 of the baffles 60, discussed below.

[0064] The baffle distal end openings 54 are openings which are formed to the opposite side from the direction of the main openings of the baffle insertion openings 56, i.e., on the same side as the flat pipe insertion openings 59, and open to circular shape in diametrical view. In the diametrical thickness section of the header collection pipe body 50, each of the baffle distal end openings 54 has a cylindrical inner surface 54b whose axial direction coincides with the diametrical direction of the header collection pipe body 50. In the header collection pipe body 50, the baffle distal end openings 54 are formed at locations comparable in height to the baffle insertion openings 56.

[0065] The header collection pipe body 50 is furnished at the ends thereof with pipe end sections 53 for attaching the baffles 60 as the cover members, discussed later.

[0066] The pipe end section 53 is a section formed by extending an arcuate section, equivalent to an approximately 160-250 degree center angle of the header collection pipe body 50, further out in the longitudinal direction of the header collection pipe body 50. The pipe end section 53 may be formed by extending any arcuate section of the header collection pipe body 50, and may be formed, for example, through lengthwise extension of the lengthwise end on the flat pipe insertion opening 59 side in an arcuate section of the header collection pipe body 50, as in the present embodiment, or through lengthwise extension of the lengthwise end on the baffle insertion opening 56 side. The pipe end section 53 has a drainage slot 52 and engaging parts 70.

[0067] The shape of the drainage slot 52 is one created by notching a portion of the upper end surface 53a of the pipe end section 53, doing so towards the opposite side from the lengthwise end from the lengthwise end of the header collection pipe body 50. The slot depth of the drainage slot 52 (the location of the lower end 52a) is formed so as to be located at the same height, in the lon-

itudinal direction of the header collection pipe body 50, as the upper end surface 51c of the header collection pipe body 50, in sections thereof other than the pipe end section 53 and the drainage slot 52. There is afforded thereby a configuration allowing water present on the upper surface of the baffle 60 in sections surrounded by the pipe end section 53 to drain towards the outside in a diametrical direction through the drainage slot 52.

[0068] The engaging parts 70 have at the upper end of the pipe end section 53 a first engaging part 71 extending away towards one side in the circumferential direction from the section where the drainage slot 52 is formed, and a second engaging part 72 extending away towards the other side in the circumferential direction from the section where the drainage slot 52 is formed. The engaging parts 70 are configured to have short width in the vertical direction, about equal to the width of the baffles 60 in the thickness direction.

[0069] The first engaging part 71 has an upper surface 71a configured to be coplanar with the upper end surface 53a of the pipe end section 53; a downward-facing lower surface 71c; and a circumferential surface 71b facing to the circumferential direction. The lower surface 71c of the first engaging part 71 is located above the upper end surface 51c of the header collection pipe body 50 and below the upper surface 71a of the first engaging part 71. The circumferential surface 71b of the first engaging part 71 is configured by a surface facing to the circumferential direction and extending in contiguous fashion from the upper end surface 51c of the header collection pipe body 50 to the upper surface 71a of the first engaging part 71. In relation to a circumferential surface 53b constituting the surface that faces to the circumferential direction in a section of the lower side of the first engaging part 71 of the pipe end section 53 (the surface closer to the first engaging part 71 than to the second engaging part 72), this circumferential surface 71b of the first engaging part 71 is disposed further away in the direction towards which the circumferential surface 53b of the pipe end section 53 faces. A distance that is slightly larger than the width of the baffle 60, discussed below, in the thickness direction (a distance equal to the width of the baffle insertion openings 56 in the vertical direction) is thereby ensured between the lower surface 71c of the first engaging part 71 and the upper surface 51c of the header collection pipe body 50.

[0070] The second engaging part 72 is similar in shape to the first engaging part 71, and is disposed in an axially symmetric relationship to the first engaging part 71. Specifically, the second engaging part 72 has an upper surface 72a configured to be coplanar with the upper end surface 53a of the pipe end section 53; a downward-facing lower surface 72c; and a circumferential surface 72b facing to the circumferential direction. The lower surface 72c of the second engaging part 72 is located above the upper end surface 51c of the header collection pipe body 50 and below the upper surface 72a of the second engaging part 72. The circumferential surface 72b of the

second engaging part 72 is configured by a surface facing towards a circumferential direction and extending vertically in contiguous fashion from the upper end surface 51c of the header collection pipe body 50 to the upper surface 72a of the second engaging part 72. In relation to a circumferential surface 53c constituting the surface that faces towards a circumferential direction in a section of the pipe end section 53 to the lower side of the second engaging part 72 (the surface closer to the second engaging part 72 than to the first engaging part 71), this circumferential surface 72b of the second engaging part 72 is disposed further away in the direction towards which the circumferential surface 53c of the pipe end section 53 faces. A distance that is slightly larger than the width of the baffle 60, discussed below, in the thickness direction (a distance equal to the width of the baffle insertion openings 56 in the vertical direction) is thereby ensured between the lower surface 72c of the second engaging part 72 and the upper surface 51c of the header collection pipe body 50.

(4-3-2) Baffles

[0071] FIG. 12 shows an exterior perspective view of the baffle 60. FIG. 13 shows a simplified plan view of the baffle 60. FIG. 14 shows a simplified side view of the baffle 60, seen from the left side in FIG. 13.

[0072] The baffles 60 are employed as partitioning plates and as cover members. In the present embodiment, the baffles 60 serving as partitioning plates and the baffles 60 serving as cover members all share a common shape, dimensions, and material, and are manufactured as identical components. By adopting a common shape and the like, fewer types of components are needed, and manufacturing costs can be minimized.

[0073] The baffle 60 has a baffle body 61, a protruding part 63, a first engaged part 64, and a second engaged part 65. It is possible for this baffle 60 both to be employed to split the flow channel through insertion, with the side thereof at which the protruding part 63 is disposed oriented to the insertion side, into the baffle distal end opening 54 of the header collection pipe body 50, and to be employed as members for blocking off the ends of the header collection pipe body 50.

[0074] The baffle body 61 is a generally circular member of plate shape made of aluminum or aluminum alloy, preferably of the same material as the material of the header collection pipe body 50 so as to maintain a good soldered state. The baffle body 61 has a semicircular section about equal in size to the contours of the header collection pipe body 50, and a semicircular section about equal in size to the inside diameter of the header collection pipe body 50. The semicircular section about equal in size to the contours of the header collection pipe body 50 has a counter-insertion direction outer peripheral surface 61a positioned along the outer peripheral surface 51a of the header collection pipe body 50 when attached to the header collection pipe body 50. The semicircular

section about equal in size to the inside diameter of the header collection pipe body 50 has a first insertion direction outer peripheral surface 61b and a second insertion direction outer peripheral surface 61c which are positioned facing the inner peripheral surface 51b of the header collection pipe body 50 when attached to the header collection pipe body 50. The baffle body 61 additionally has a generally circular first surface 61d, and a generally circular second surface 61e facing to the opposite side from the first surface 61d.

[0075] The protruding part 63 has a shape that protrudes in a diametrical direction from a circumferential section of the baffle body 61, between the first insertion direction outer peripheral surface 61b and the second insertion direction outer peripheral surface 61c of the baffle body 61. At its distal end, the protruding part 63 has a distal end surface 63a facing towards the direction of protrusion. The first surface 61d of the baffle body 61 extends out over the top of the protruding part 63, and the bottom of the protruding part 63 has a section that is coplanar to the second surface 61e of the baffle body 61. The width of the protruding part 63 in the circumferential direction is generally about equal to the thickness of the baffle body 61. The protruding part 63 has the distal end surface 63a constituting the outside of the baffle 60, and a first protruding part side surface 63b and a second protruding part side surface 63c which constitute side faces of the protruding part 63 in the circumferential direction. The first protruding part side surface 63b links up with the first insertion direction outer peripheral surface 61b. The second protruding part side surface 63c links up with the second insertion direction outer peripheral surface 61c. The distal end surface 63a of the protruding part 63, in a section thereof bordering the first protruding part side surface 63b, in a section thereof bordering the second protruding part side surface 63c, in a section thereof bordering the first surface 61d of the baffle body 61, and in a section thereof bordering the second surface 61e of the baffle body 61, respectively, is machined to a rounded shape. Because the protruding part 63 has been machined round, during insertion thereof into the baffle distal end opening 54 of the header collection pipe body 50, smooth insertion is possible with minimal likelihood that getting stuck will occur.

[0076] The first engaged part 64 is configured by a radially outside end of the baffle body 61, which end is situated in the semicircular section thereof about equal in size to the contours of the header collection pipe body 50 and located to one side of the section bordering the semicircular section about equal in size to the inside diameter of the header collection pipe body 50, and the second engaged part 65 is located to the other side of this border section. The first engaged part 64, on the surface thereof to the second surface 61e side of the baffle 60, has a first lower engaged surface 64a formed to arch up towards the second surface 61e side of the baffle 60, as one moves in the counter-insertion direction from the insertion direction. The first engaged part 64,

on the surface thereof to the first surface 61d side of the baffle 60, has a first upper engaged surface 64c formed to arch up towards the second surface 61e side of the baffle 60, as one moves in the counter-insertion direction from the insertion direction. The first engaged part 64 has a first insertion direction surface 64b facing towards the insertion direction that links up in the thickness direction with the first lower engaged surface 64a and the first upper engaged surface 64c.

[0077] The second engaged part 65 is similar to the first engaged part 64 and has a shape axial symmetric with respect to the first engaged part 64. Specifically, the second engaged part 65, on the surface thereof to the second surface 61e side of the baffle 60, has a second lower engaged surface 65a formed to arch up towards the second surface 61e side of the baffle 60, as one moves in the counter-insertion direction from the insertion direction. The second engaged part 65, on the surface thereof to the first surface 61d side of the baffle 60, has a second upper engaged surface 65c formed to arch up towards the second surface 61e side of the baffle 60, as one moves in the counter-insertion direction from the insertion direction. The second engaged part 65 has a second insertion direction surface 65b facing towards the insertion direction that links up in the thickness direction with the second lower engaged surface 65a and the second upper engaged surface 65c.

(4-4) Joined closure by baffle in sections in the vicinity of header collection pipe body ends

[0078] FIG. 15 shows a simplified side view showing the baffle 60 in the inserted state immediately prior to elastic deformation thereof. FIG. 16 shows a simplified side view showing a completely inserted baffle 60 in an elastically deformed state. FIG. 17 shows an exterior perspective view showing, from the inserted tip side, a state in which the baffles 60 have been fixed as partitioning plates inserted into the header collection pipe body 50. FIG. 18 shows an exterior perspective view showing, from the opposite side from the inserted tip, a state in which the baffles 60 have been fixed as partitioning plates inserted into the header collection pipe body 50. In FIGS. 17 and 18, to facilitate understanding, the baffles 60 are depicted by hatching, to distinguish them from the header collection pipe body 50.

[0079] The baffle 60 being deployed as a partitioning plate is oriented to position the protruding part 63 at the leading edge in the insertion direction, and is inserted through the baffle insertion opening 56 of the header collection pipe body 50 until the first lower engaged surface 64a and the second lower engaged surface 65a reach a state immediately prior to elastic deformation (see the abutting section P of the baffle 60 and the header collection pipe body 50 in FIG. 15). Then, as insertion of the baffle 60 being deployed as a partitioning plate advances to the point of insertion as far as the back of the baffle insertion opening 56, with the first lower engaged surface

64a and the second lower engaged surface 65a being in an elastically deformed state facing the surface on the first surface 61 d side of the baffle 60 (see the abutting section P' of the baffle 60 and the header collection pipe body 50 in FIG. 16), insertion is completed to produce a temporary joint through planar contact of the first insertion direction outer peripheral surface 61b and the second insertion direction outer peripheral surface 61c in a diametrical direction against the inner peripheral surface 51b at the radially inside of the header collection pipe body 50, and simultaneous planar contact of the thickness abutting surface 56b against the first insertion direction surface 64b of the first engaged part 64 and the second insertion direction surface 65b of the second engaged part 65, respectively, of the baffle 60 (see the abutting section Q in FIG. 16).

[0080] In the process of inserting the baffle 60 being deployed as a partitioning plate into the baffle insertion opening 56 of the header collection pipe body 50, the first engaged part 64 and the second engaged part 65 of the baffle 60 reach an outer peripheral section of the baffle insertion opening 56 and enter a state of engagement in a state that precedes full insertion to the back, in which state the baffle 60 is clamped in a vertical direction by the upper surface and the lower surface of the baffle insertion opening 56 (in which state the first engaged part 64, the second engaged part 65 of the baffle 60, and/or the thickness upper surface 56d and the thickness lower surface 56e of the baffle insertion opening 56 of the header collection pipe body 50, undergo plastic deformation through force interaction, with some residual stress remaining). In this state, the baffle 60 is stably fixed; however, by pushing the baffle 60 deeper towards the back into the baffle insertion opening 56, the first insertion direction outer peripheral surface 61 b and the second insertion direction outer peripheral surface 61 c of the protruding part 63 come into planar contact in a diametrical direction against the inner peripheral surface 51b at the radially inside of the header collection pipe body 50, while simultaneously the first insertion direction surface 64b of the first engaged part 64 of the baffle 60 comes into planar contact against the thickness abutting surface 56b of the header collection pipe body 50. By inserting the baffle 60 until such a state of planar contact is achieved, the protruding part 63 of the baffle 60 is positioned at a location at which it is covered from the vertical direction and the circumferential direction by the cylindrical inner surface 54b of the baffle distal end opening 54 of the header collection pipe body 50. The first protruding part side surface 63b, the second protruding part side surface 63c, the first surface 61d, and the second surface 61e, as well as the bordering sections thereof in the protruding part 63 of the baffle 60, reach a state of abutment against the surface of the cylindrical inner surface 54b of the baffle distal end opening 54 of the header collection pipe body 50, producing a state in which the baffle 60 is supported by the header collection pipe body 50, at both the end on the counter-insertion side and the end on the insertion

side. Therefore, as compared with a structure of support at only one or the other of the end on the counter-insertion side and the distal end on the insertion side (a backlash structure), a state of stable retention in which the baffle 60 is unlikely to become dislodged can be achieved. The distal end surface 63a of the protruding part 63 is positioned to be generally coplanar in relation to the outer peripheral surface 51a at the radially outside of the header collection pipe body 50. The distal end surface 63a of the protruding part 63 may have dimensions and shape such that it is positioned diametrically toward the outside from the outer peripheral surface 51 a at the radially outside of the header collection pipe body 50, or dimensions and shape such that it is positioned midway along the wall width of the header collection pipe body 50, in the inside of the baffle distal end opening 54. In cases in which dimensions and shape such that it is positioned diametrically to the outside have been adopted, the solder material 51 furnished to the outer peripheral face of the header collection pipe body 50 is easily drawn into the joining site between the baffle distal end opening 54 and the protruding part 63.

[0081] Moreover, the baffle 60, in the vicinity of the outer peripheral surface thereof on the opposite side from the direction of insertion, is clamped in a vertical direction by the thickness upper surface 56d and the thickness lower surface 56e of the baffle insertion opening 56 of the header collection pipe body 50. The counter-insertion direction outer peripheral surface 61 a of the baffle 60 is then positioned approximately coplanar to the outer peripheral surface 51a of the header collection pipe body 50 in a diametrical direction.

[0082] The header collection pipe body 50 to which the baffles 60 have been temporarily fixed in the above manner is placed in an oven for oven soldering.

[0083] Even if the header collection pipe body 50 to which the baffles 60 have been temporarily fixed in the above manner is subjected to shock or the like during transport while being moved into the oven, it is possible to avoid dislodging the baffles 60 from the temporarily fixed state. It is possible for such a temporarily fixed state to be achieved simply by furnishing the first engaged part 64 and/or the second engaged part 65 to the baffle 60, and the shape and dimensions of the baffles 60 need not be so accurate as to exactly conform to the shape of the baffle insertion openings 56, and therefore manufacturing costs can be lower.

[0084] Thus, at the protruding part 63 of the baffle 60, the solder material 51 furnished to the outer peripheral surface of the header collection pipe body 50 can be attracted into the joint sections between the baffle distal end opening 54 and the protruding part 63. The solder material 51 can then be drawn, as the direction of attraction, from various directions including the upward, downward, and circumferential directions with respect to the distal end surface 63a of the protruding part 63, on the outer peripheral surface 51a of the header collection pipe body 50. Therefore, as compared with a mode not fur-

nished with the protruding part 63 and/or the baffle distal end openings 54, the solder material 51 can be drawn into proximity to the distal end in the insertion direction of the baffle 60 over pathways that are shorter in length, and the solder material 51 can be drawn in amounts sufficient for joining, into the joint sections in the vicinity of the distal end in the insertion direction, so that soldering strength can be increased. Moreover, it is possible for the state of joining (i.e., whether or not the solder material 51 has been drawn in to a sufficient extent, forming fillets of the solder material 51 in the vicinity of the joining site) in the vicinity of the distal end in the insertion direction of the baffle 60, which in a mode not furnished with the protruding part 63 and/or the baffle distal end openings 54 was difficult to visually check from the outer perimeter of the header collection pipe body 50, to be easily visually checked from the outer perimeter of the header collection pipe body 50. Moreover, the solder material 51 in surrounding sections of the header collection pipe body 50 is readily drawn into the joint sections between the counter-insertion direction outer peripheral surface 61a of the baffle 60 and the outer peripheral surface 51a of the header collection pipe body 50 as well.

[0085] A comparable temporarily fixed state can be produced even in cases in which the baffle 60 has been inserted into the baffle insertion opening 56 while oriented upside down in relation to the orientation discussed above.

(4-5) Joined closure by baffles as cover members in sections in the vicinity of header collection pipe body ends

[0086] FIG. 19 shows an exterior perspective view showing the vicinity of an end of the header collection pipe body 50 closed off by the baffle 60 as a cover member. FIG. 20 shows a side cross sectional view thereof, respectively. In FIGS. 19 and 20, to facilitate understanding, the baffles 60 are depicted by hatching, to distinguish them from the header collection pipe body 50.

[0087] The baffle 60 deployed as a cover member, oriented to position the protruding part 63 at the leading edge in the insertion direction, is inserted in a horizontal direction between the upper end surface 51c of the header collection pipe body 50 and the lower surfaces 71c, 72c of the engaging parts 70, to produce a temporarily fixed state.

[0088] In the process of inserting the baffle 60 deployed as the cover member between the upper end surface 51c of the header collection pipe body 50 and the lower surfaces 71c, 72c of the engaging parts 70, the first engaged part 64 and the second engaged part 65 of the baffle 60 reach the engaging parts 70 and enter a state of engagement in a state that precedes full insertion to the back, in which state the parts are clamped in a vertical direction by the upper end surface 51c of the header collection pipe body 50 and by the lower surfaces 71c, 72c of the engaging parts 70 (in which state the first engaged part 64, the second engaged part 65 of the baffle

60, and/or the upper end surface 51c of the header collection pipe body 50 and the lower surfaces 71c, 72c of the engaging parts 70, undergo plastic deformation through force interaction, with some residual stress remaining). In this state, the baffle 60 is stably fixed; however, by pushing the baffle 60 deeper towards the back, the first insertion direction outer peripheral surface 61b and the second insertion direction outer peripheral surface 61c of the baffle 60 come into planar contact in a diametrical direction against the inner peripheral surface 51b at the radially inside of the header collection pipe body 50, and simultaneously, the first insertion direction surface 64b of the first engaged part 64 of the baffle 60 comes into planar contact against the circumferential surface 53b of the pipe end section 53. By inserting the baffle 60 until such a state of planar contact is achieved, the protruding part 63 of the baffle 60 is positioned above the lower end 52a of the drainage slot 52 furnished to the pipe end section 53. Here, the bottom of the protruding part 63 of the baffle 60 may be supported by the upper surface of the lower end 52a of the drainage slot 52 of the pipe end section 53, in which case the baffle 60 is supported by the header collection pipe body 50, at both the end on the counter-insertion side and the distal end on the insertion side. In this case, as compared with a structure of support at only one or the other of the end on the counter-insertion side and the distal end on the insertion side (a backlash structure), a state of stable retention in which the baffle 60 is unlikely to become dislodged can be achieved. The distal end surface 63a of the protruding part 63 is positioned to be generally coplanar in relation to the outer peripheral surface 51a at the radially outside of the header collection pipe body 50. The distal end surface 63a of the protruding part 63 may have dimensions and shape such that it is positioned diametrically to the outside from the outer peripheral surface 51a at the radially outside of the header collection pipe body 50, or dimensions and shape such that it is positioned midway along the wall width of the pipe end section 53 on the upper surface of the lower end 52a of the drainage slot 52. In cases in which dimensions and shape such that it is positioned diametrically to the outside have been adopted, the solder material 51 furnished to the outer peripheral face of the header collection pipe body 50 is easily drawn into the joining site between the drainage slot 52 and the protruding part 63.

[0089] Moreover, the baffle 60, in the vicinity of the outer peripheral surface thereof on the opposite side from the direction of insertion, is supported from below by the upper end surface 51c of the header collection pipe body 50. The counter-insertion direction outer peripheral surface 61a of the baffle 60 is then positioned approximately coplanar to the outer peripheral surface 51a of the header collection pipe body 50 in a diametrical direction.

[0090] The header collection pipe body 50 to which the baffles 60 have been temporarily fixed as cover members in the above manner is placed in an oven for oven soldering. In specific terms, both the baffles 60 deployed as

partitioning plates, and the baffles 60 deployed as cover members, after being temporarily fixed, are placed in an oven.

[0091] Even if the temporarily fixed baffles 60 are subjected to shock or the like during transport while being moved into the oven, it is possible to prevent dislodgement of the baffles 60 from the temporarily fixed state. It is possible for such a temporarily fixed state to be achieved simply by furnishing the first engaged part 64 and/or the second engaged part 65 to the baffle 60, and the shape and dimensions of the baffles 60 need not be so accurate as to exactly conform to the shapes between the upper end surface 51 c of the header collection pipe body 50 and the lower surfaces 71c, 72c of the engaging parts 70, and therefore manufacturing costs can be lower.

[0092] In sections in which the baffles 60 deployed as cover members are fixed by soldering to the header collection pipe body 50 through the aforescribed configuration, at the protruding part 63 of the baffle 60, the solder material 51 furnished to the outer peripheral surface of the header collection pipe body 50 can be attracted into the joint sections between the drainage slot 52 and the protruding part 63. When soldering in the vicinity of the protruding part 63 of the baffle 60, not only the solder material 51 on the outer peripheral surface 51a of the header collection pipe body 50, in the section thereof below the distal end surface 63a of the protruding part 63, but also the solder material 51 at locations adjacent to the pipe end section 53 in the circumferential direction and/or further thereabove, can be drawn in, making it possible to ensure sufficient soldering strength and higher reliability. Here, a fillet F having formed on the baffle 60 upper surface at a location along the inner peripheral surface 51b of the header collection pipe body 50 by the solder material 51 which has been placed on the outer peripheral surface 51a of the header collection pipe body 50 and which has liquefied inside the oven and passed through a gap between the header collection pipe body 50 and the baffle 60 due to surface tension, can be readily visually checked from above, making it possible to readily ensure that the solder material 51 has been drawn in sufficiently, and to increase reliability.

[0093] Furthermore, the fastening parts 70 of the pipe end section 53 are configured integrally with the header collection pipe body 50, and therefore movement tending to detach the baffles 60 deployed as cover members can be minimized. Moreover, even in the event of attempted detachment of the baffles 60 deployed as cover members from the header collection pipe body 50 due to a soldering defect, it is possible to prevent the baffles 60 from flying off.

(5) Features of outdoor heat exchanger 20 of air conditioning apparatus 1

[0094] In the outdoor heat exchanger 20 of the present embodiment, in a state with the baffle 60 having been

attached as a cover member to the header collection pipe body 50, the pipe end section 53 is positioned along at least a portion of the upper surface of the baffle 60. Therefore, the joined sections of the baffle 60 and the header collection pipe body 50 are not limited to only on the baffle bottom surface as in the prior art example, but have a joined section on the upper face side as well. In so doing, the joining strength of the header collection pipe body 50 and the baffle 60 deployed as a cover member can be increased.

[0095] Moreover, rather than an arrangement in which the baffle 60 deployed as the cover member is covered by the pipe end section 53 of the header collection pipe body 50 in such a way as to be bordered thereby along the entire upper surface at the outside in a diametrical direction, instead, the drainage slot 52 which links the inner peripheral surface 51b and the outer peripheral surface 51a of the header collection pipe body 50 up in a diametrical direction is formed in at least a portion thereof. Therefore, it is possible for dew condensation water and/or rainwater to present the inside of the pipe end section 53, at the upper surface side of the baffle 60 deployed as a cover member to drain out rapidly. For this reason, corrosion of the header collection pipe body 50 and the baffles 60 deployed as cover members, which are made of metal, can be inhibited. Additionally, ice-up caused by freezing of the water can be inhibited.

[0096] In particular, in cases in which the outdoor heat exchanger 20 in which the aforescribed drainage slot 52 has been adopted functions as the evaporator for the refrigerant during the refrigeration cycle, condensation tends to form, but it is possible in such cases as well to efficiently drain the condensation which has formed.

(6) Modification examples

[0097] Whereas the aforescribed embodiment describes one example of embodiment of the present invention, the aforescribed embodiment should in no way be construed as limiting the invention of the present application, and there is no limitation to the aforescribed embodiment. The invention of the present application would reasonably include various appropriate modifications of the invention of the present application, made without departing from the scope and spirit thereof.

(6-1) Modification example A

[0098] In the aforescribed embodiment there was described an example in which, in the header collection pipe body 50 of the outdoor heat exchanger 20, the engagement parts 70 respectively have mutually separate sections, namely, the first engagement part 71 and the second engagement part 72.

[0099] However, the present invention is not limited to this arrangement, and it would be acceptable, for example, to adopt a mode like that of a header collection pipe body 250 furnished with an engagement part 270 as

shown in FIG. 21, in which the first engagement part 71 and the second engagement part 72 of the aforescribed embodiment extend to connect in a circumferential direction. The engagement part 270 may be furnished with a drainage hole 72x passing therethrough in a diametrical direction so as to connect the inner peripheral surface 51b and the outer peripheral surface 51a.

[0100] Additionally, it would be acceptable to form the drainage hole 72x only, in place of the drainage slot 52 of the aforescribed embodiment.

[0101] In this case as well, it is possible to ensure drainage of water from a space inside the pipe end section 53, and above the baffle 60 deployed as the cover member.

(6-2) Modification example B

[0102] In the aforescribed embodiment there was described an example in which the lower end 52a of the drainage slot 52, and the upper end surface 51 c of the header collection pipe body 50 in sections thereof other than the pipe end section 53, are at identical heightwise positions in the longitudinal direction of the header collection pipe body 50.

[0103] However, the present invention is not limited to this arrangement, and it would be acceptable to constitute as the drainage structure one employing, for example, a baffle 360 deployed as a cover member, lacking a shape that corresponds to the protruding part 63 of the aforescribed embodiment, and a header collection pipe body 350 provided with a pipe end section 353 having a drainage slot 352 notched into the top of a portion of the radially outside end of the baffle 360 deployed as a cover member, as shown FIG. 22. Ample drainage can be ensured in this case as well.

REFERENCE SIGNS LIST

[0104]

1	Air conditioning apparatus (refrigeration device)	
2	Air conditioning outdoor unit	
3	Air conditioning indoor unit	
10	Unit casing	
20	Outdoor heat exchanger (heat exchanger)	
21	Heat exchange part	
21a	Heat transfer fin (fin)	
21b	Flat multi-hole pipe (flattened pipe)	
22, 23	Header collection pipe	
31	Gas refrigerant line	
32	Liquid refrigerant line	
40	Expansion valve	
50	Header collection pipe body	
52	Drainage slot (drainage part, slot)	
52a	Lower end	
53	Pipe end section	
60	Baffle (cover member)	

CITATION LIST

PATENT LITERATURE

- 5 **[0105]** [Patent Literature 1] Japanese Laid-Open Patent Application 2010-112580

Claims

- 10
1. A heat exchanger (20) comprising:
- 15 a plurality of flattened pipes (21 b);
a header collection pipe (22, 23) to which the flattened pipes are joined; and
a plurality of fins (21 a) joined to the flattened pipes,
a fluid flowing through the interior of the flattened pipes exchanging heat with air flowing outside the flattened pipes,
wherein
the header collection pipe (22, 23) is provided with:
- 25 a header collection pipe body (50) provided so that the longitudinal direction thereof is vertically oriented; and
a cover member (60) furnished inside from an upper end of the header collection pipe body (50), and closing off the upper side of the header collection pipe body (50);
the header collection pipe body (50) has a pipe end section (53) that extends upward past the cover member (60), and
a drainage part (52) is formed in a part of the pipe end section (53).
- 30
2. The heat exchanger according to claim 1, wherein the drainage part is a slot (52) formed by a downward receding of a part of the pipe end section (53).
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3. The heat exchanger according to claim 2, wherein a lower end (52a) of the drainage slot (52) is situated below an upper end of the cover member (60).
- 45
4. The heat exchanger according to any of claims 1 to 3, wherein
at least a part of an outer peripheral part of the cover member is clamped from above and below between the pipe end section and a part of the header collection pipe other than the pipe end section (53).
- 50
5. A refrigeration device (1), comprising a refrigerant circuit configured by connecting together a compressor, a first heat exchanger, an expansion valve, and a second heat exchanger that is the heat exchanger according to any of claims 1 to 4, the second heat exchanger being capable of functioning at least as
- 55

an evaporator for the refrigerant.

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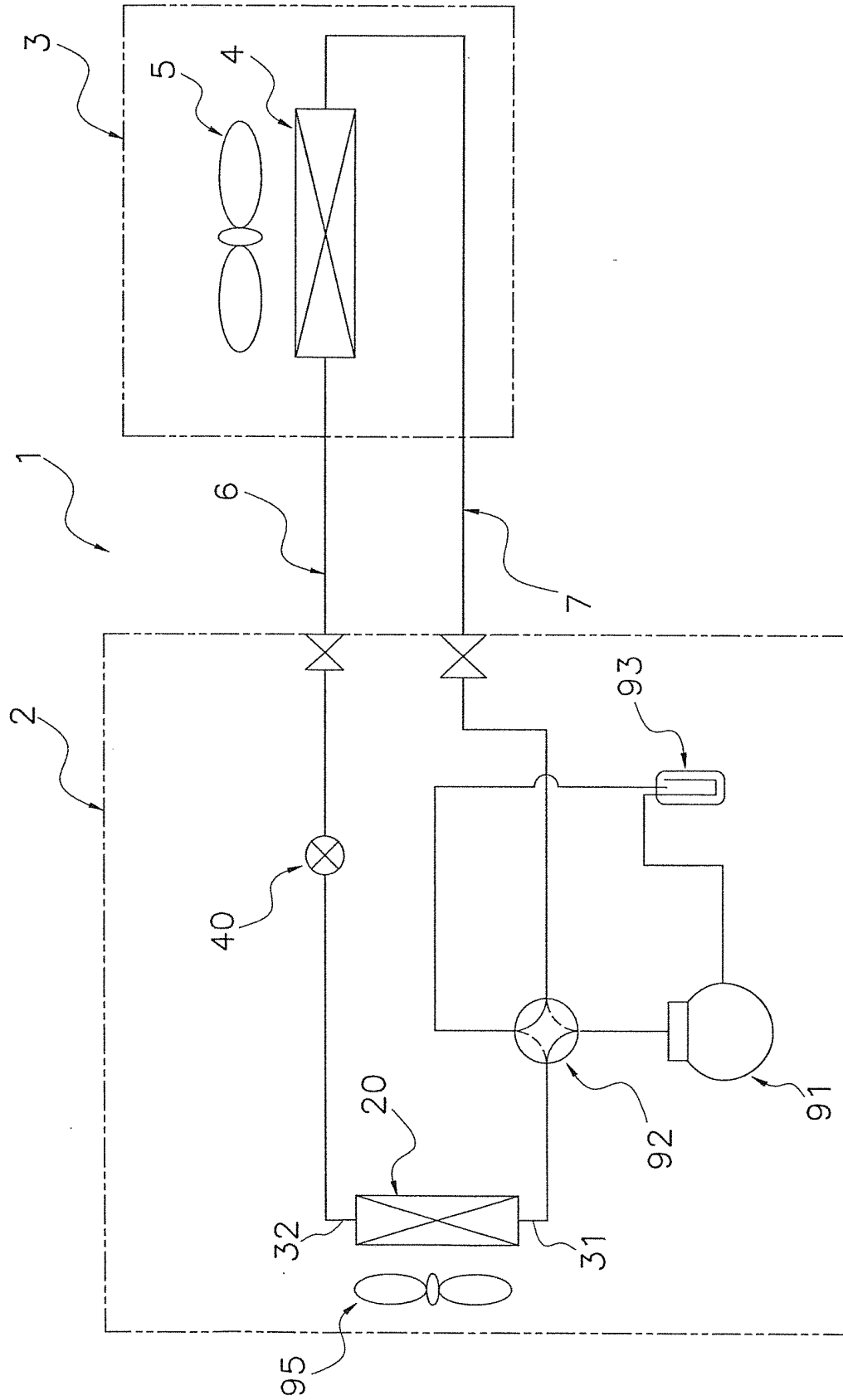


FIG. 1

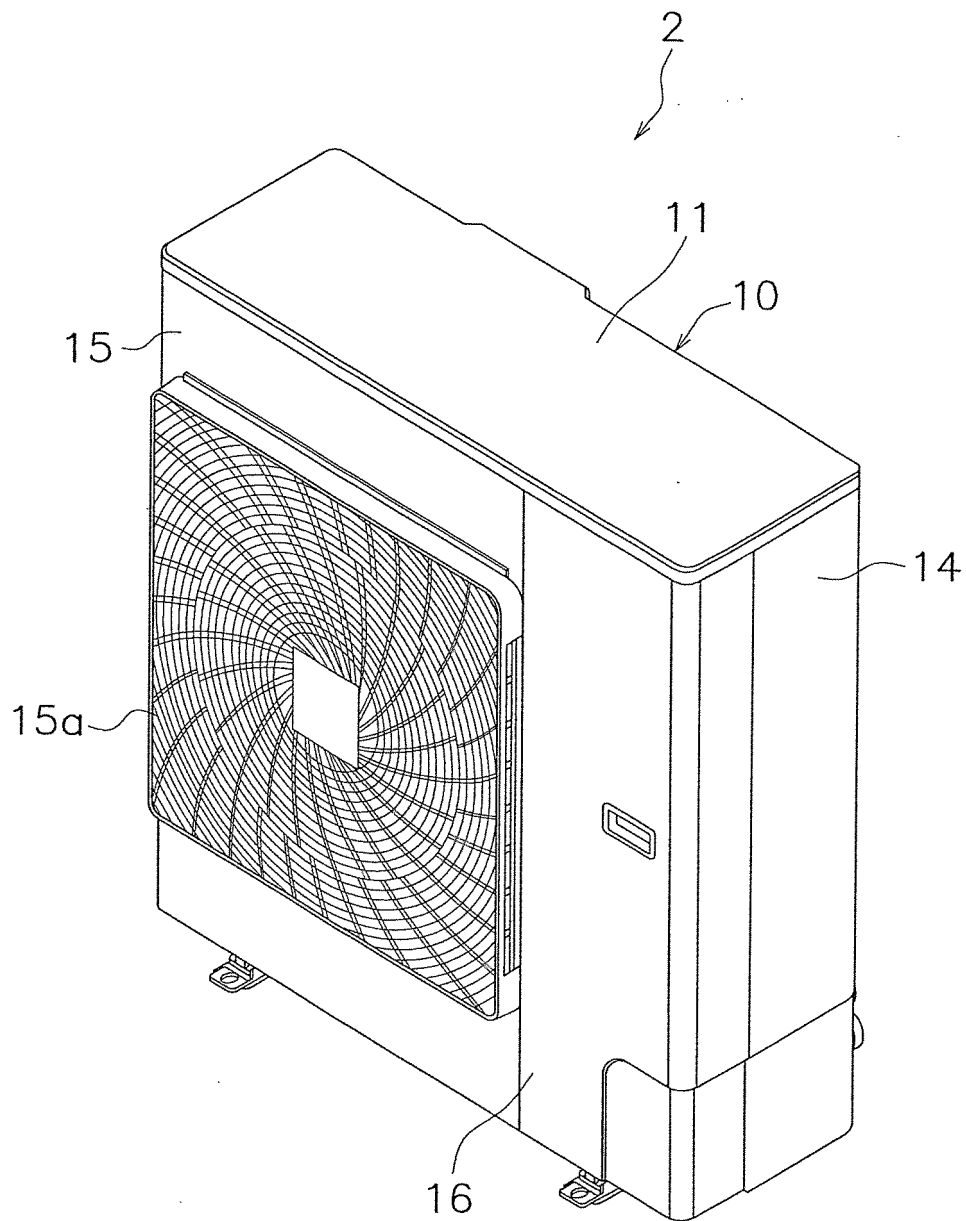


FIG. 2

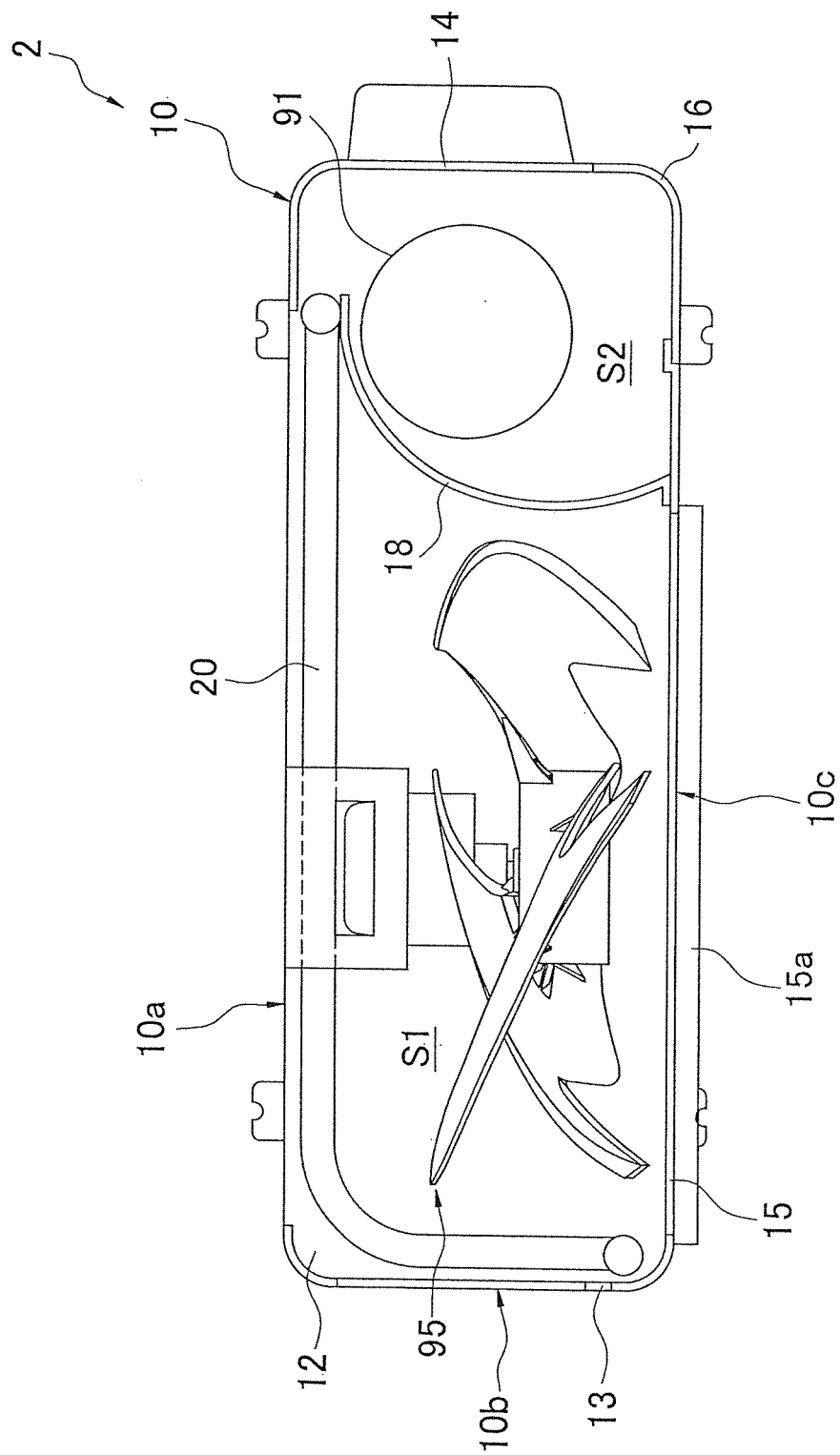


FIG. 3

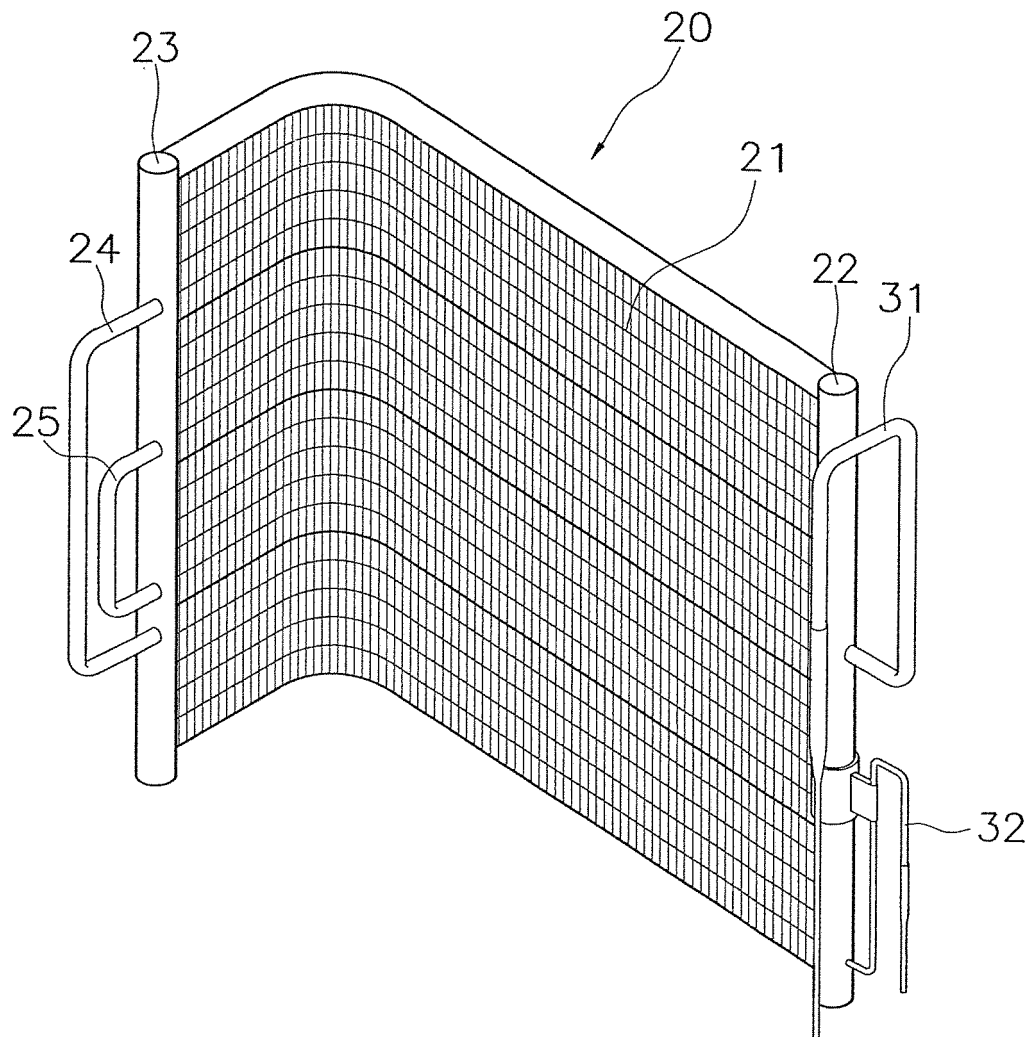


FIG. 4

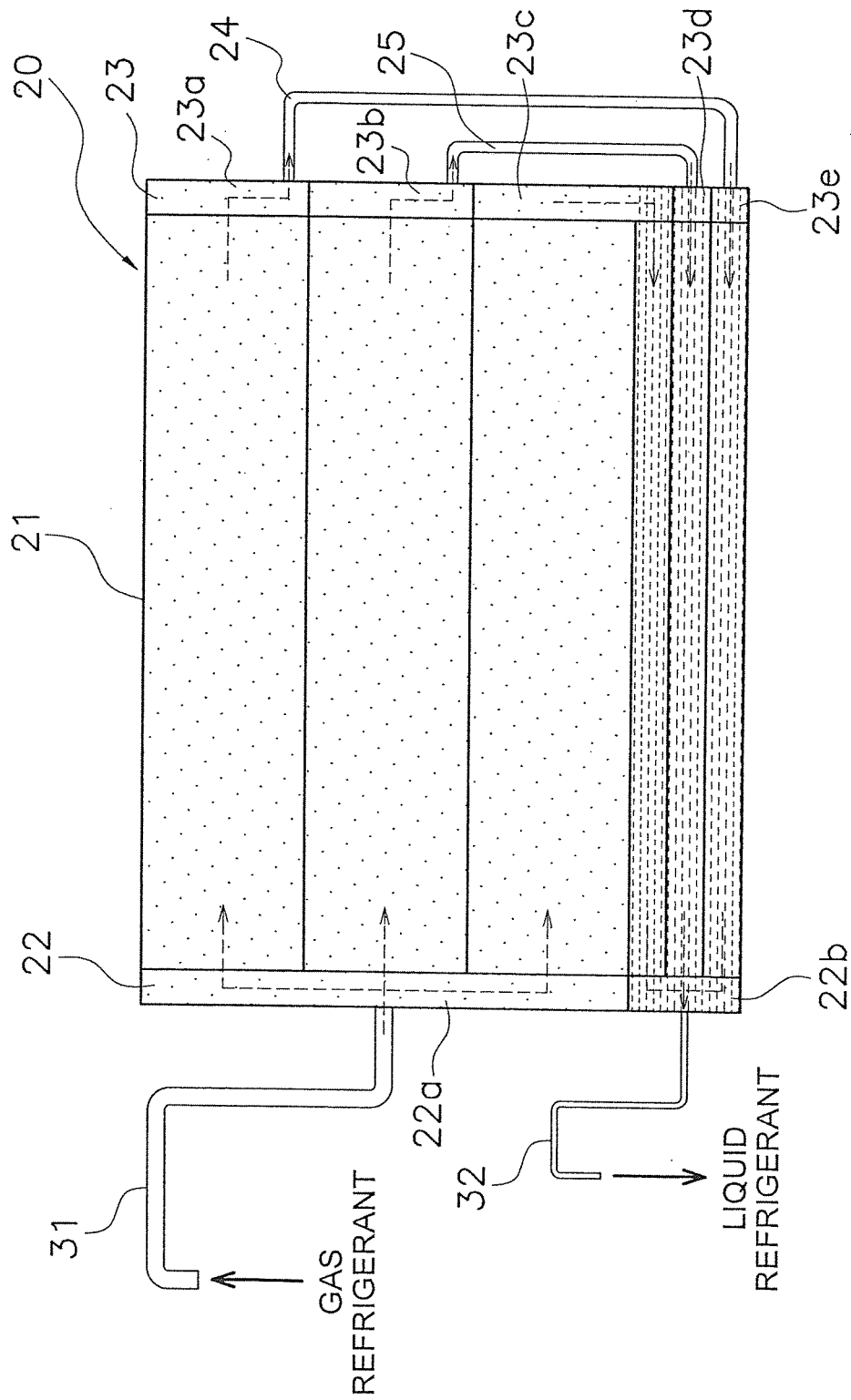


FIG. 5

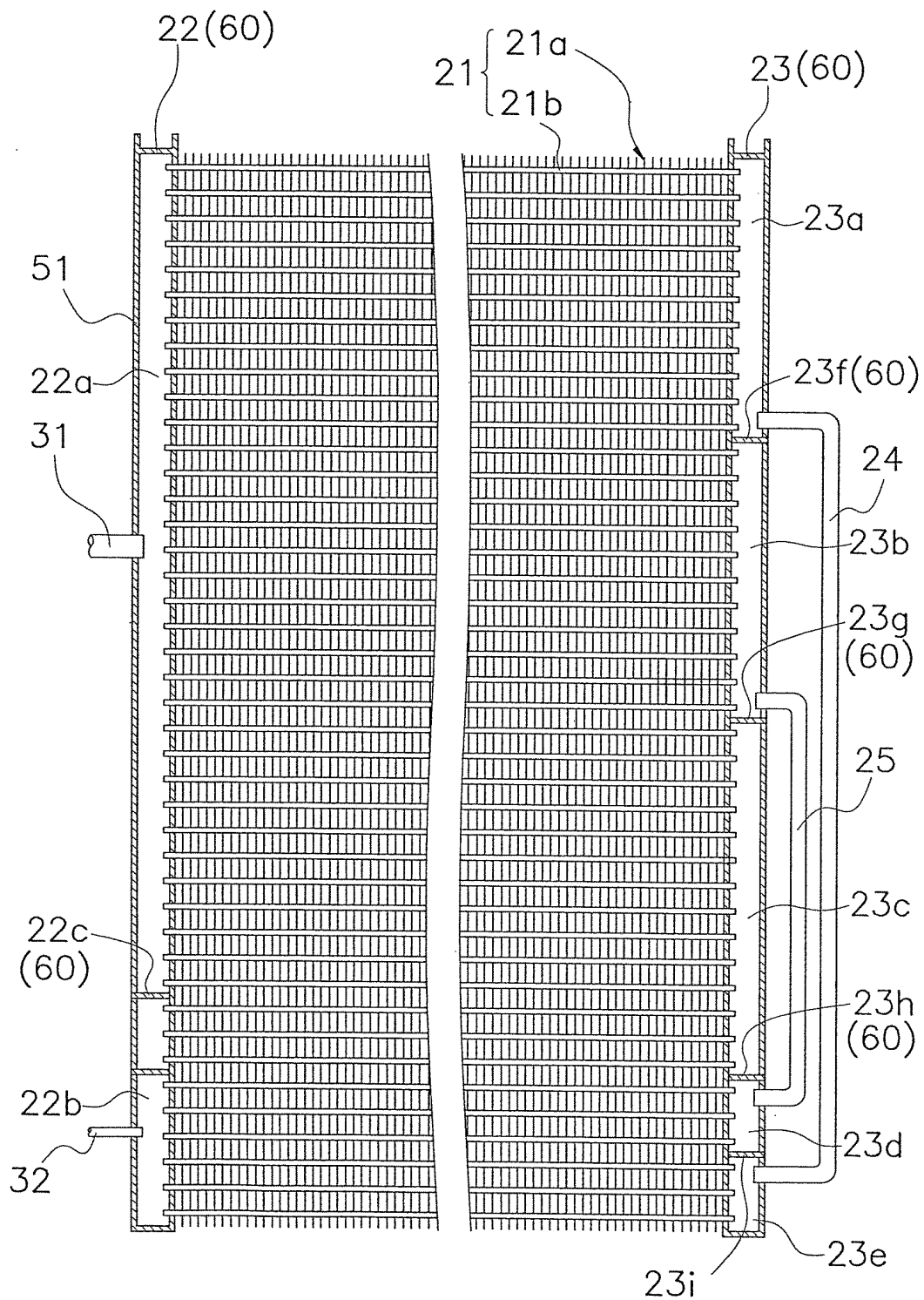


FIG. 6

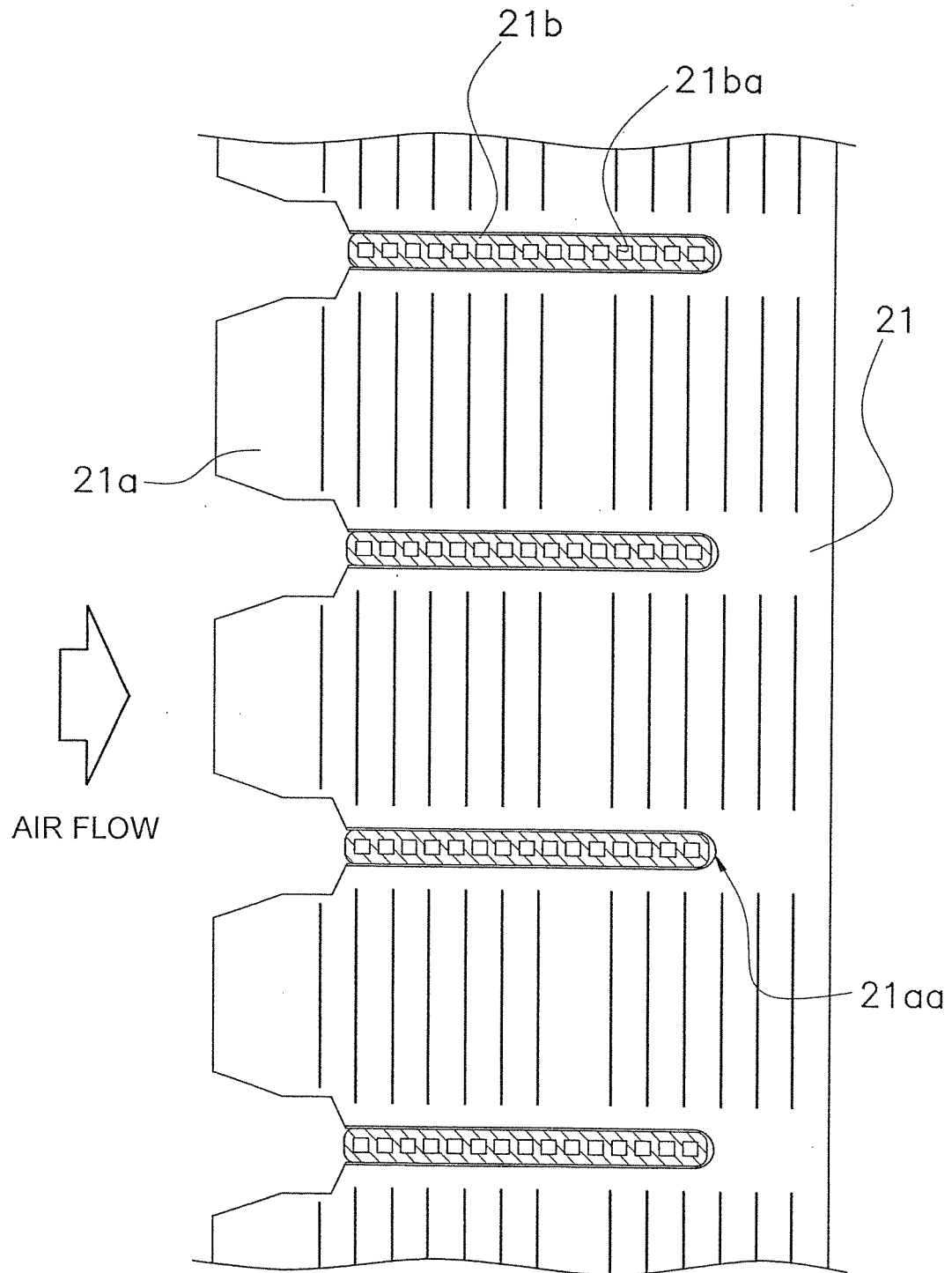


FIG. 7

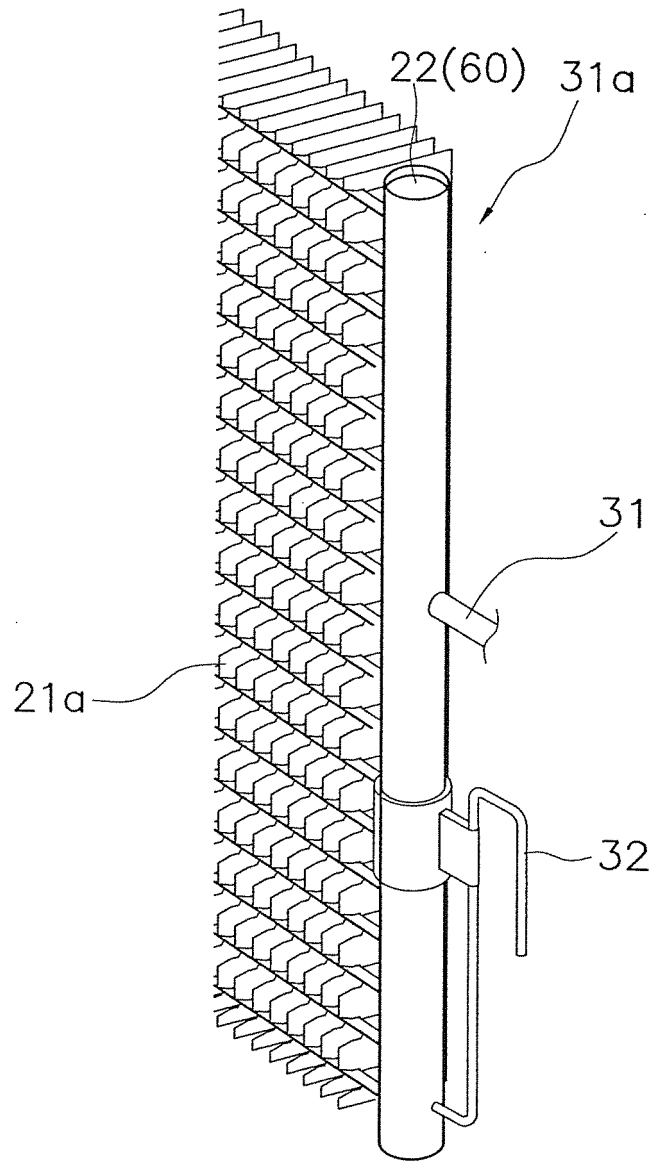


FIG. 8

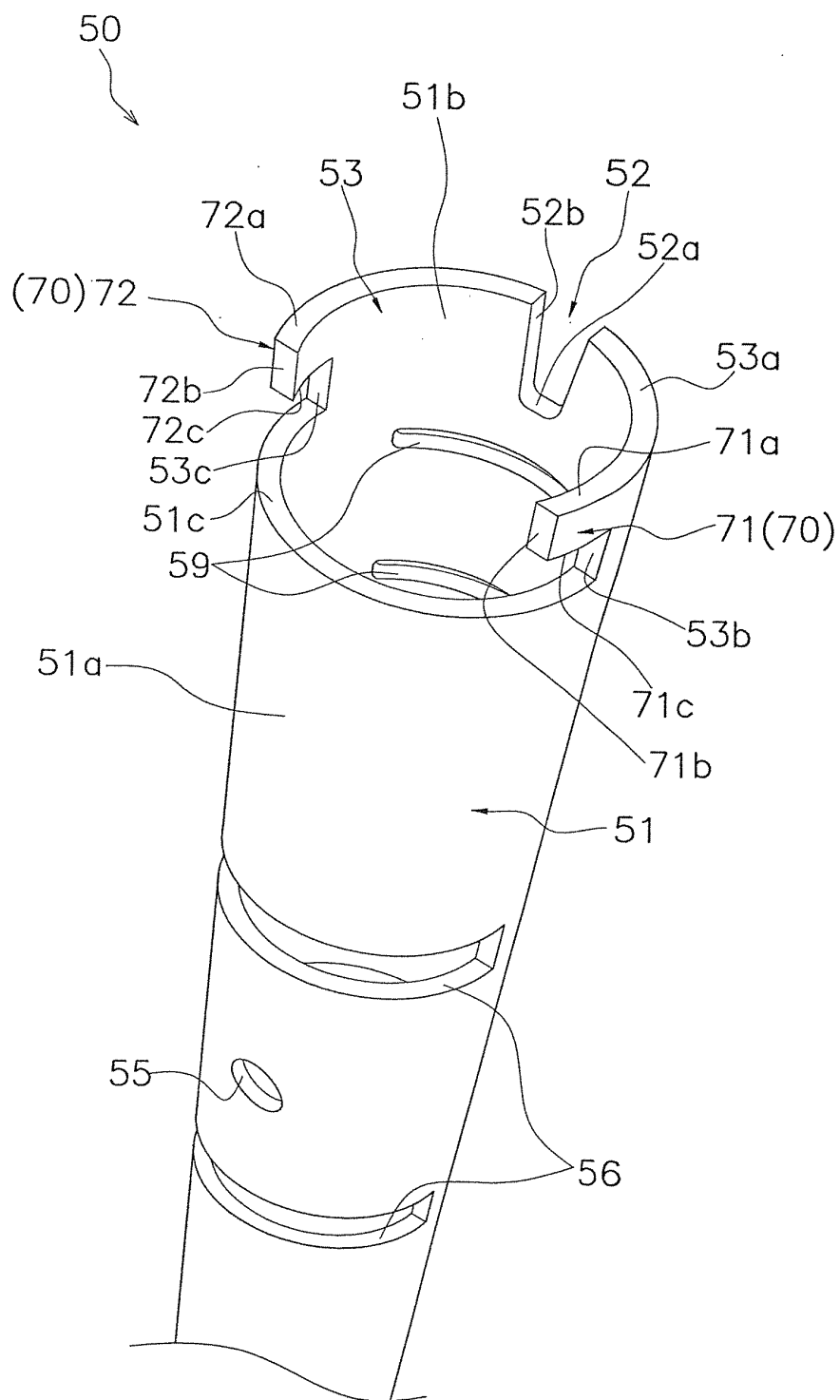


FIG. 9

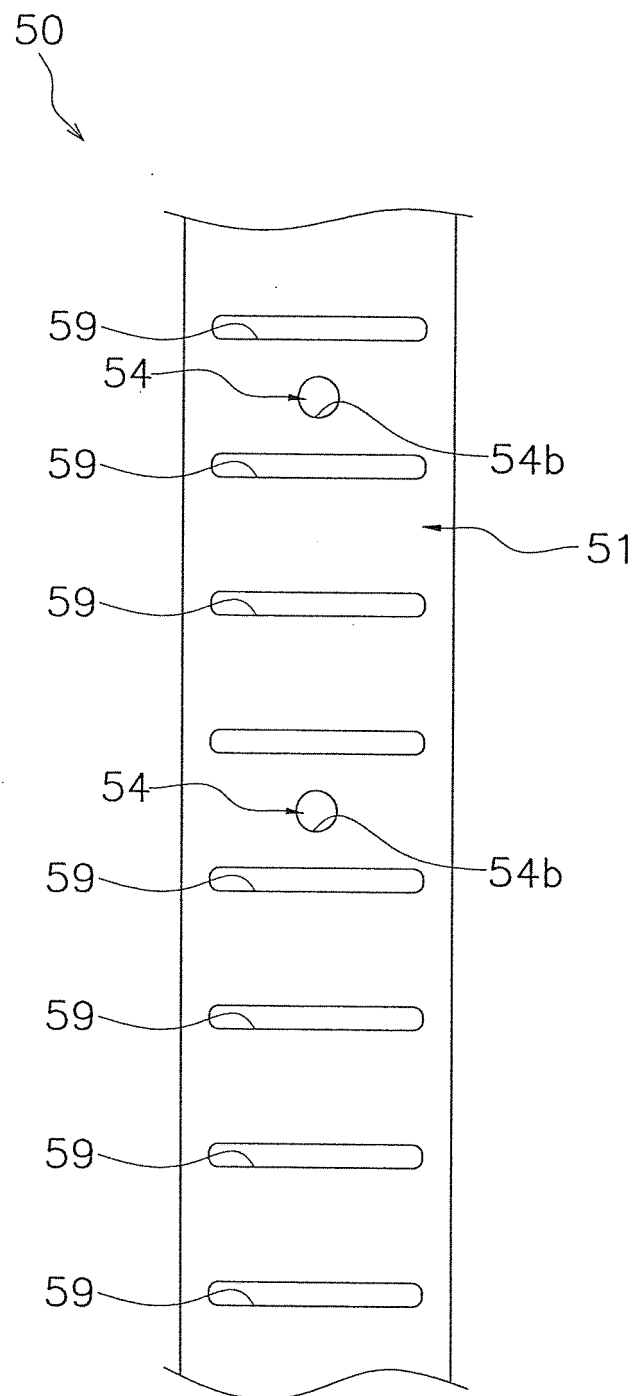


FIG. 10

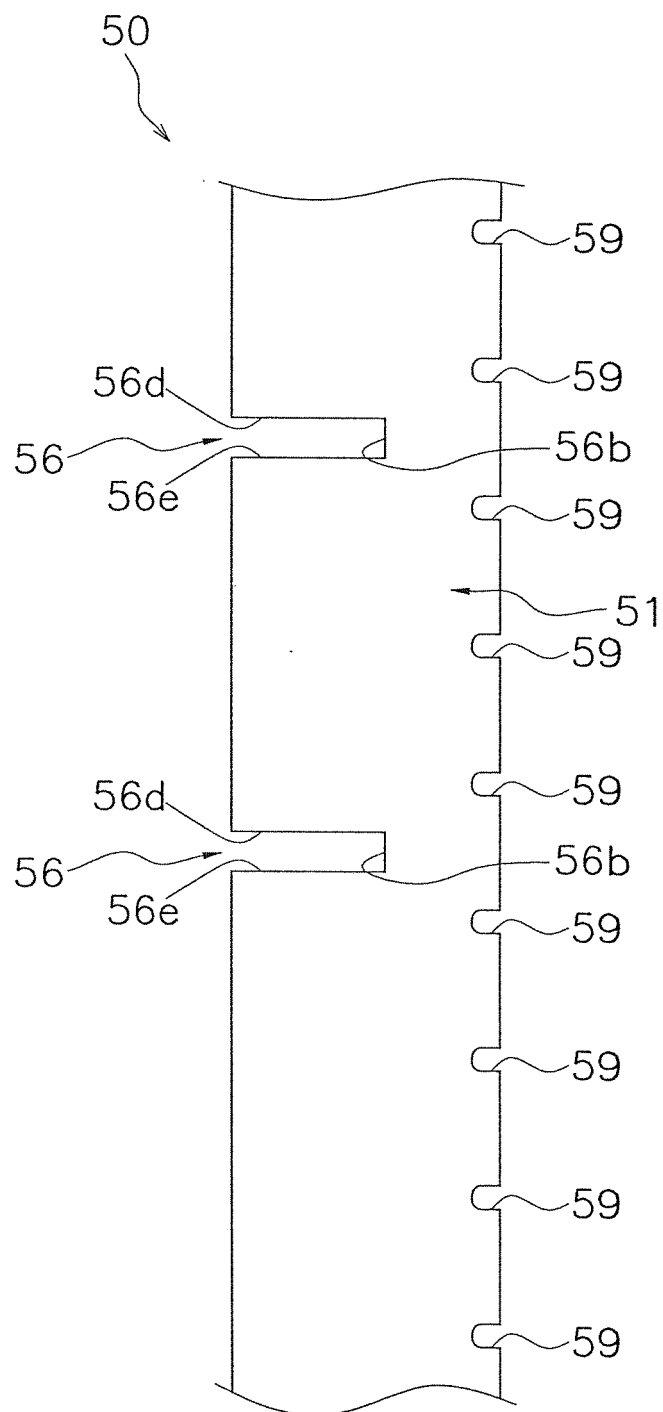


FIG. 11

FIG. 12

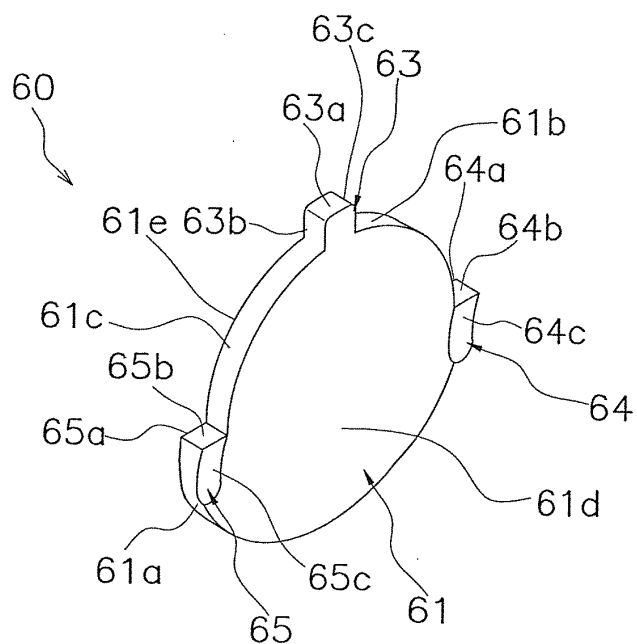
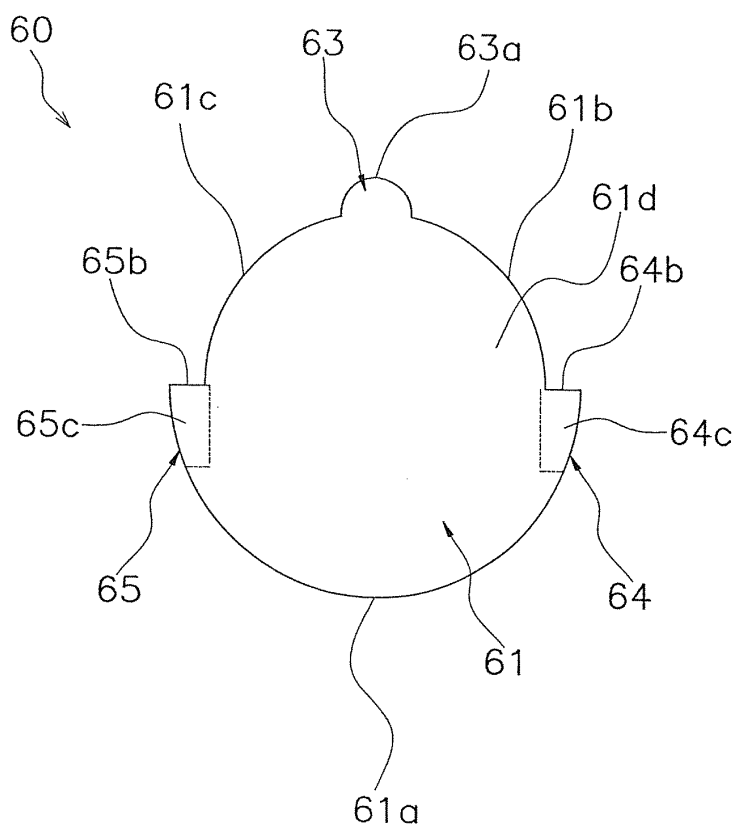


FIG. 13



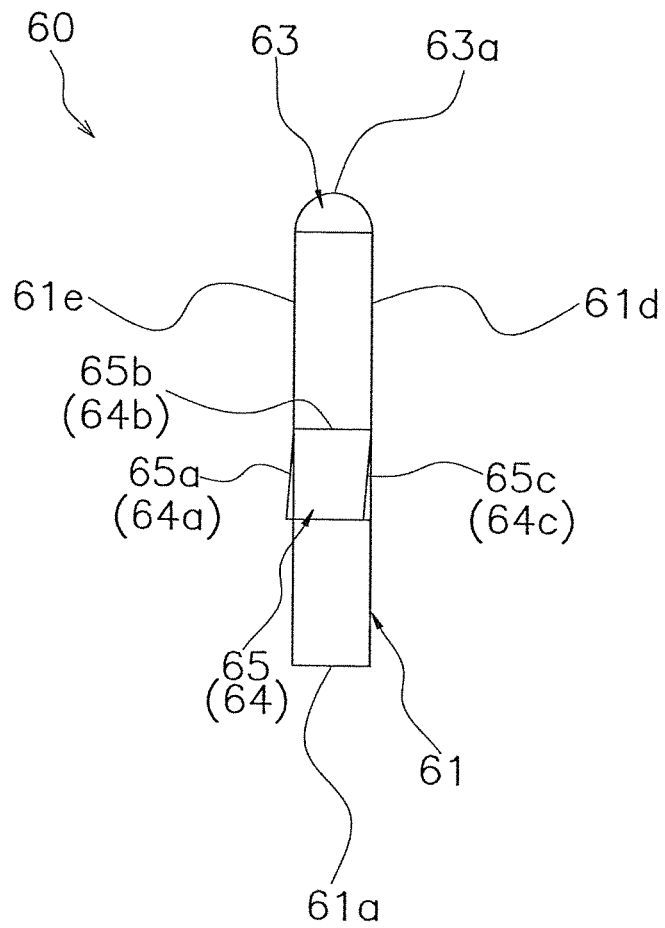


FIG. 14

FIG. 15

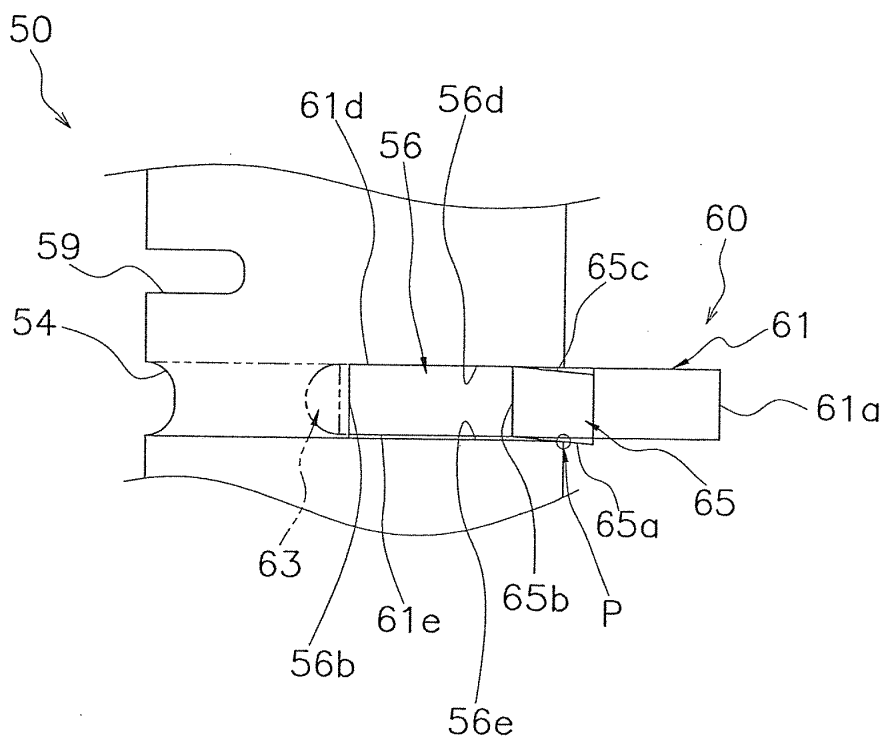
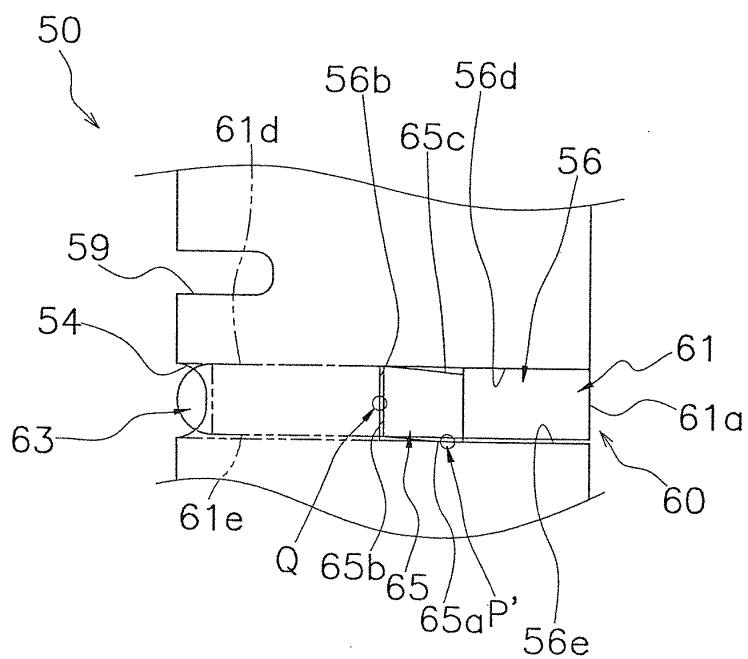


FIG. 16



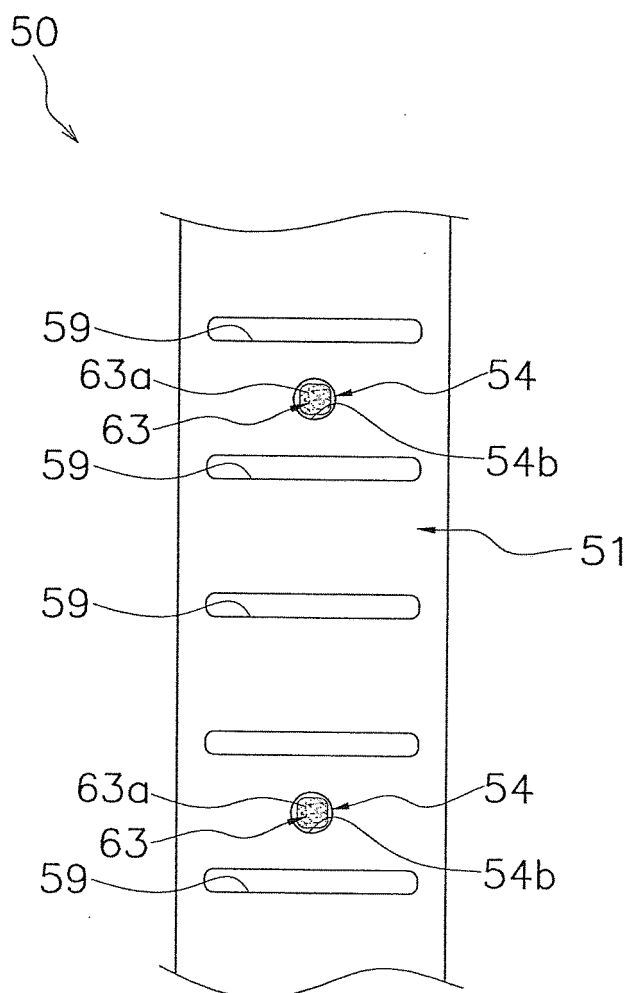


FIG. 17

FIG. 18

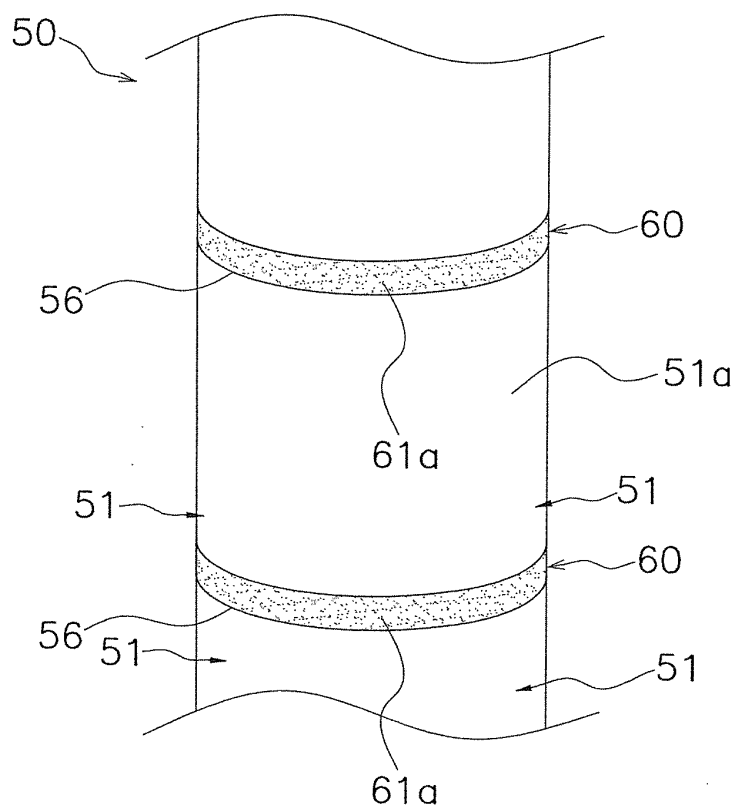
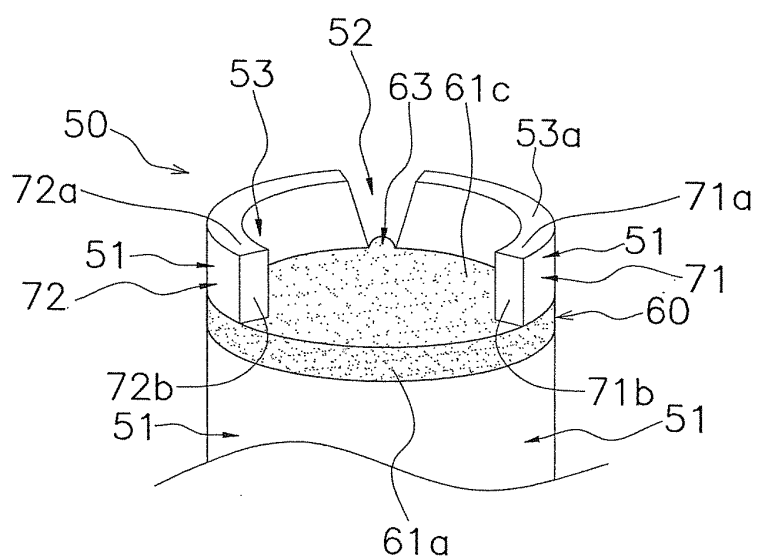


FIG. 19



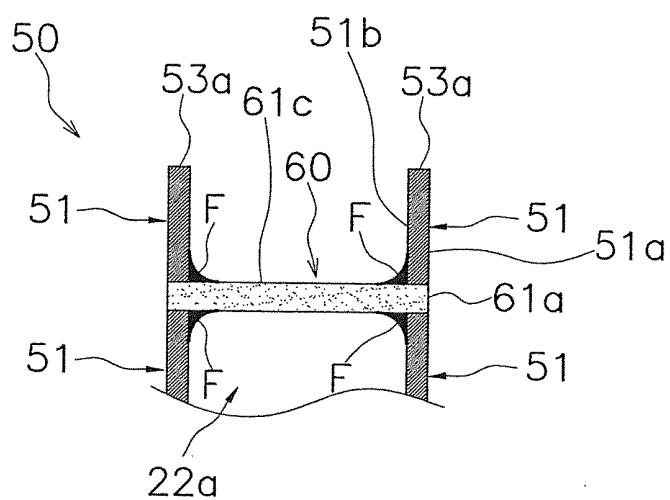


FIG. 20

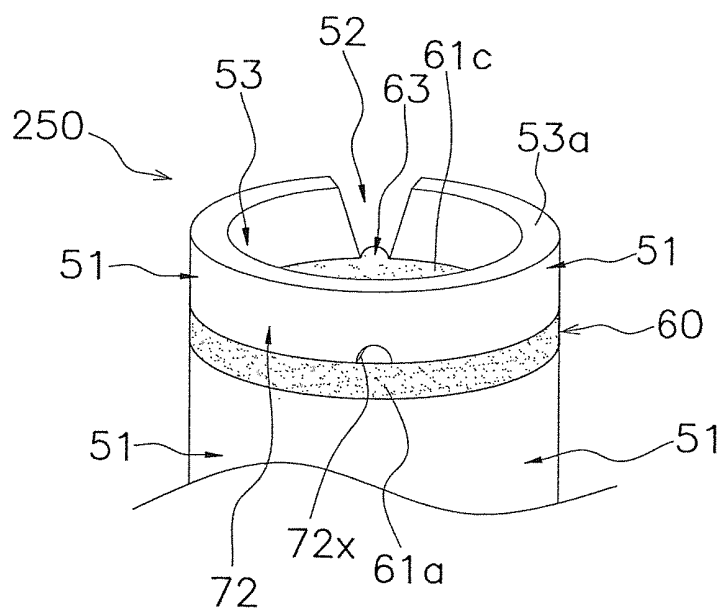


FIG. 21

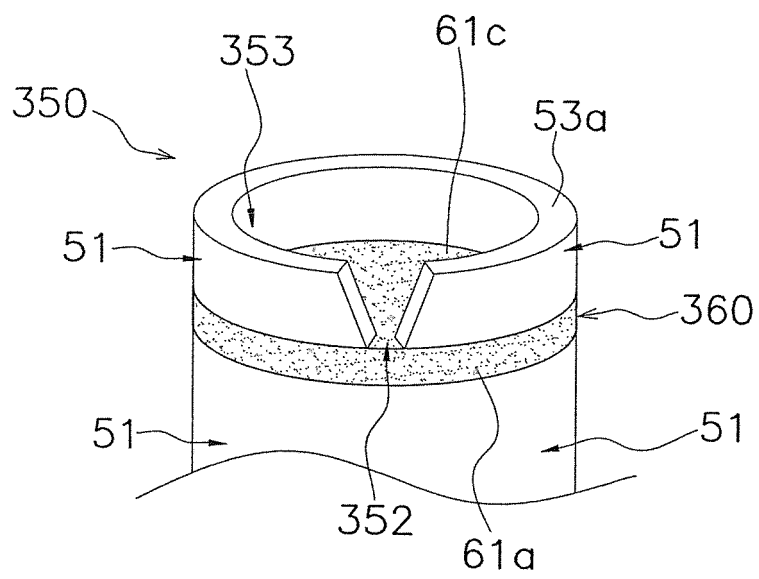


FIG. 22

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/083584

A. CLASSIFICATION OF SUBJECT MATTER

F28F9/02 (2006.01) i, F25B39/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F28F9/02, F25B39/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2005-207685 A (Calsonic Kansei Corp.), 04 August 2005 (04.08.2005), entire text; all drawings (particularly, paragraph [0001]; fig. 7, 8) & US 2005/0173100 A1 & US 2008/0283229 A1 & EP 1557631 A2 & CN 1645029 A	1, 4, 5 2, 3
Y	JP 2007-247891 A (Denso Corp.), 27 September 2007 (27.09.2007), entire text; all drawings (particularly, paragraphs [0074] to [0076]; fig. 3, 4, 6, 11, 13) & US 2007/0205598 A1 & DE 102007007571 A & CN 101025244 A	1, 4, 5

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search
26 March, 2013 (26.03.13)Date of mailing of the international search report
02 April, 2013 (02.04.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/083584

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 75246/1992 (Laid-open No. 40684/1994) (Zexel Corp.), 31 May 1994 (31.05.1994), entire text; all drawings (Family: none)	4
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 75217/1989 (Laid-open No. 14578/1991) (Showa Aluminum Corp.), 14 February 1991 (14.02.1991), entire text; all drawings (Family: none)	4
Y	JP 10-267467 A (Calsonic Corp.), 09 October 1998 (09.10.1998), entire text; all drawings (particularly, paragraph [0002]; fig. 10) (Family: none)	5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010112580 A [0002] [0003] [0004] [0105]