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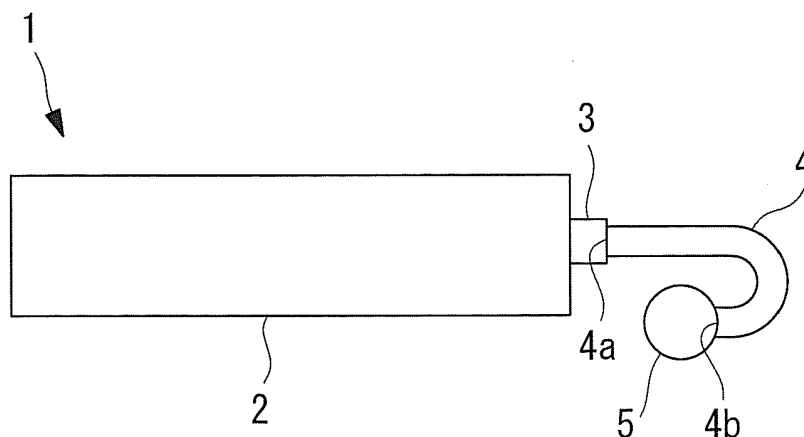
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(54) **Heat exchanger**

(57) There is provided a heat exchanger (1) which can alleviate the effects of stress due to thermal elongation of branch pipes with a more compact structure. The heat exchanger (1) includes: a heat exchange unit (2) which exchanges heat between a refrigerant flowing through an inside thereof and an external fluid; a plurality of hairpin tubes (3) which is installed at an end of the heat exchange unit (2) and serves as an outlet or an inlet of the refrigerant flowing through the inside of the heat

exchange unit (2); a plurality of connecting pipes (4) which has one ends thereof connected to the plurality of hairpin tubes (3), respectively; and a header pipe (5) to which the other ends of the plurality of connecting pipes (4) are connected. Each of the plurality of connecting pipes (4) includes a detour section which is bent such that a pipe length becomes longer than a linear distance between the hairpin tube (3) and the header pipe (5).

FIG. 2



Description

{Technical Field}

[0001] The present invention relates to a heat exchanger which is used in air conditioners, chillers, and the like.

{Background Art}

[0002] Conventionally, a heat exchanger is known which includes a plurality of heat-transfer pipes between a gas header and an external fluid, and passes the fluid through fins provided between the heat-transfer pipes to thereby perform heat exchange between the fluid passing through the heat-transfer pipes and the fluid passing through the fins.

[0003] A plurality of pipes is connected to the gas header, and these pipes carry out distribution of a refrigerant to the heat exchanger by being connected to hairpin tubes.

[0004] Due to its larger volume compared with the pipe which introduces the refrigerant into the gas header, the gas header undergoes rapid thermal expansion upon inflow of a refrigerant at pressure or temperature higher than specified one. This poses a problem that the hairpin tube, which is fixed to the heat exchanger, may crack under stress as the gas header expands while pulling the hairpin tube. This may lead to shorter life of the heat exchanger.

[0005] Patent Literature 1 is cited as a literature which discloses a countermeasure against this problem.

[0006] Patent Literature 1 shows that, of auxiliary connecting pipes, at least the auxiliary connecting pipes at the center in the width direction or those at both ends are formed into a curved shape, so that contraction deformation or extension deformation occurs, which prevents generation of stress due to bending of a lower header tank.

{Citation List}

{Patent Literature}

[0007]

{PTL 1}

Japanese Unexamined Patent Application, Publication No. Hei 10-148482

{Summary of Invention}

{Technical Problem}

[0008] Patent Literature 1 describes a method, in which, of the auxiliary connecting pipes, at least the auxiliary connecting pipes at the center in the width direction or those at both ends are formed into a curved shape,

so that contraction deformation or extension deformation occurs, which prevents generation of stress due to bending of the lower header tank. However, the method described in Patent Literature 1 has a problem that, since the facility cannot structurally afford enough space for the auxiliary connecting pipes to be installed in a curved state, only straight short connecting pipes can be installed.

[0009] In addition, the method described in Patent Literature 1 has another problem that, since the auxiliary connecting pipes and the gas header are connected, the facility becomes larger.

[0010] The present invention has been made in view of the above circumstances, and an object thereof is to provide a heat exchanger which can alleviate the effects of stress due to thermal elongation of branch pipes with a more compact structure.

{Solution to Problem}

[0011] The heat exchanger according to the present invention includes: a heat exchange unit which exchanges heat between a refrigerant flowing through an inside thereof and an external fluid; a plurality of hairpin tubes which is installed at an end of the heat exchange unit and serves as an outlet or an inlet of the refrigerant flowing through the inside of the heat exchange unit; a plurality of connecting pipes which has one ends thereof connected to the plurality of hairpin tubes, respectively; and a header pipe to which the other ends of the plurality of connecting pipes are connected. Each of the plurality of connecting pipes includes a detour section which is bent such that a pipe length becomes longer than a linear distance between the hairpin tube and the header pipe.

[0012] According to this configuration, since a long distance is secured between the hairpin tube and the header pipe, the stress exerted on the hairpin tube can be alleviated even if a refrigerant at pressure or temperature higher than specified one flows into the header pipe. Furthermore, since each of the plurality of connecting pipes includes the bent detour section, the facility can be made compact as compared with a case where each of the plurality of connecting pipes is formed into a linear shape.

[0013] In the above-described configuration, the detour section, as seen from the hairpin tube, may pass by the header pipe and thereafter may have a U-shaped portion which turns around and heads toward the header pipe.

[0014] According to this configuration, the pipe length can be made longer than the linear distance. This allows the facility to be made compact.

{Advantageous Effects of Invention}

[0015] According to the present invention, each of the plurality of connecting pipes connecting the plurality of hairpin tubes and the header pipe includes the detour section which is bent such that the pipe length becomes

longer than the linear distance between the hairpin tube and the header pipe. Thus, since a long distance is secured between the hairpin tube and the header pipe, the stress exerted on the hairpin tube can be alleviated even if a refrigerant at pressure or temperature higher than specified one flows into the header pipe. Furthermore, since each of the plurality of connecting pipes includes the bent detour section, the facility can be made compact as compared with a case where each of the plurality of connecting pipes is formed into a linear shape.

{Brief Description of Drawings}

[0016]

{Fig. 1}

Fig. 1 is a side view showing a heat exchanger according to one embodiment of the present invention.

{Fig. 2}

Fig. 2 is a top view showing the heat exchanger according to the embodiment of the present invention.

{Fig. 3}

Fig. 3 is a top view showing the heat exchanger according to the embodiment of the present invention.

{Fig. 4}

Fig. 4 is a perspective view showing the heat exchanger according to the embodiment of the present invention.

{Description of Embodiments}

[0017] Hereinafter, one embodiment of a heat exchanger according to the present invention will be described with reference to the drawings.

Fig. 1 is a side view showing a heat exchanger according to the embodiment of the heat exchanger according to the present invention.

A heat exchanger 1 includes a heat exchange unit 2 which is constituted of fins (not shown) and hairpin tubes 3 positioned close to each other so as to increase the heat exchange efficiency. The plurality of hairpin tubes 3 is connected to connecting pipes 4 at connecting parts 4a, and each of the hairpin tubes 3 is connected as a continuous integral part to constitute a refrigerant circuit.

[0018] As shown in Fig. 2, one end of the connecting pipe 4 is connected to the hairpin tube 3 at the connecting part 4a. The other end of the connecting pipe 4 and a refrigerant supply port (not shown) of a header pipe 5 are connected at a connecting part 4b. As a connection method, for example, pipe welding such as butt welding is used. Each of the plurality of connecting pipes 4 is bent such that a pipe length of the connecting pipe 4 becomes longer than a linear distance between the hairpin tube 3 and the header pipe 5. The bent connecting pipe 4" as seen from the hairpin tube 3, passes by the header pipe 5 and thereafter have a U-shaped portion which turns around and heads toward the header pipe 5. The U-shape of the connecting pipe 4 is formed, for example,

by welding a substantially linear pipe and a U-shaped pipe with their ends butted against each other.

[0019] Since the connecting pipe 4 is bent such that the pipe length becomes longer, the connecting pipe 4 makes a detour to be connected to the header pipe 5. As a shape into which the connecting pipe 4 is bent so as to make a detour, the connecting pipe 4 is bent into a U-shape. The connecting pipes 4 are positioned at pre-determined intervals such that the connecting pipes 4 are roughly parallel to each other. The connecting pipes 4 are bent into the same shape, but if the facility does not structurally allow for the same shape, the connecting pipes 4 are bent such that the pipe length becomes longer than the linear distance between the hairpin tube 3 and the header pipe 5. In addition, the connecting pipes 4 are bent on the same plane.

[0020] Next, operation in the above configuration will be described.

In the above configuration, a refrigerant for heat exchange is introduced inside the hairpin tube 3 on a refrigerant fluid side which is at a higher temperature than an external fluid. Fins on an external fluid side, which is at a lower temperature than the refrigerant fluid, are provided between the plurality of hairpin tubes 3 penetrating the heat exchange unit 2. By passing a fluid through the hairpin tubes 3 and the fins, heat exchange is performed between the fluid passing through the hairpin tubes 3 and the fluid passing through the fins.

[0021] According to the present embodiment, the following operational effects can be obtained.

Each of the connecting pipes 4 includes the detour section which is bent such that the pipe length becomes longer than the linear distance between the hairpin tube 3 and the header pipe 5. Thus, since a long distance is secured between the hairpin tube 3 and the header pipe 5, the stress exerted on the hairpin tube 3 can be alleviated even if a refrigerant at pressure or temperature higher than specified one flows into the header pipe 5 and causes thermal expansion of the header pipe 5.

[0022] In addition, since each of the plurality of connecting pipes 4 includes the bent detour section, the facility can be made compact as compared with a case where each of the plurality of connecting pipes 4 is formed into a linear shape.

[0023] Further, as shown in Fig. 3, the connecting pipe 4 may be bent into a round shape such that the pipe length of the connecting pipe 4 becomes longer. The connecting pipe 4 is bent so as to, as seen from the hairpin tube 3, pass by the header pipe 5 and thereafter to be shaped into U-shape which turns around and heads toward the header pipe 5. The connecting pipe 4 is provided such that the connecting pipe 4 gains in pipe length from the connecting part 4a, at which the connecting pipe 4 is connected to the hairpin tube 3, before reaching the connecting part 4b, at which the connecting pipe 4 is connected to the header pipe 5. By providing the connecting pipe 4 so as to extend around the outer circumference of the header pipe 5, the connecting pipe 4 assumes a

round shape before reaching the connecting part 4b and being connected.

[0024] Moreover, as shown in Fig. 4, the connecting pipe 4 may be provided three-dimensionally such that the pipe length of the connecting pipe 4 becomes longer. 5
More specifically, while the connecting pipe 4 has been provided such that the pipe length becomes longer in an X-Y coordinate plane (two dimensions), the freedom of extending the pipe length of the connecting pipe 4 can be further increased by three-dimensionally providing the 10
connecting pipe 4 using a Z-axis.

{Reference Signs List}

[0025] 15

- 1 Heat exchanger
- 2 Heat exchange unit
- 3 Hairpin tube
- 4 Connecting pipe 20
- 4a Connecting part (hairpin tube side)
- 4b Connecting part (header pipe side)
- 5 Header pipe

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Claims

1. A heat exchanger (1), **characterized in that** it comprises: 30
 - a heat exchange unit (2) which exchanges heat between a refrigerant flowing through an inside thereof and an external fluid;
 - a plurality of hairpin tubes (3) which is installed at an end of the heat exchange unit (2) and serves as an outlet or an inlet of the refrigerant flowing through the inside of the heat exchange unit (2); 35
 - a plurality of connecting pipes (4) which has one ends thereof connected to the plurality of hairpin tubes (3), respectively; and 40
 - a header pipe (5) to which the other ends of the plurality of connecting pipes (4) are connected, wherein
 - each of the plurality of connecting pipes (4) includes a detour section which is bent such that a pipe length becomes longer than a linear distance between the hairpin tube (3) and the header pipe (5). 45
2. The heat exchanger (1) according to claim 1, wherein the detour section, as seen from the hairpin tube (3), passes by the header pipe (5) and thereafter has a U-shaped portion which turns around and heads toward the header pipe (5). 50 55

FIG. 1

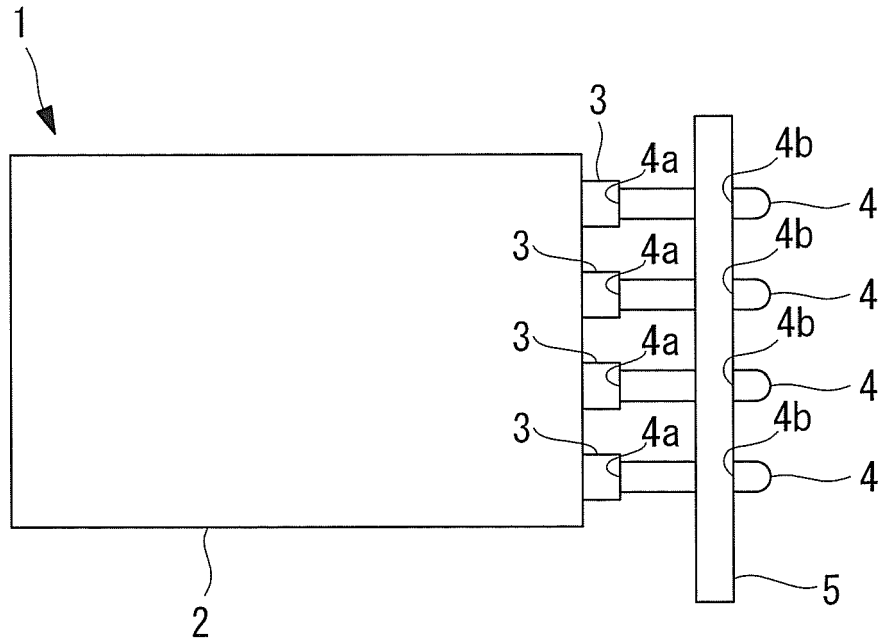


FIG. 2

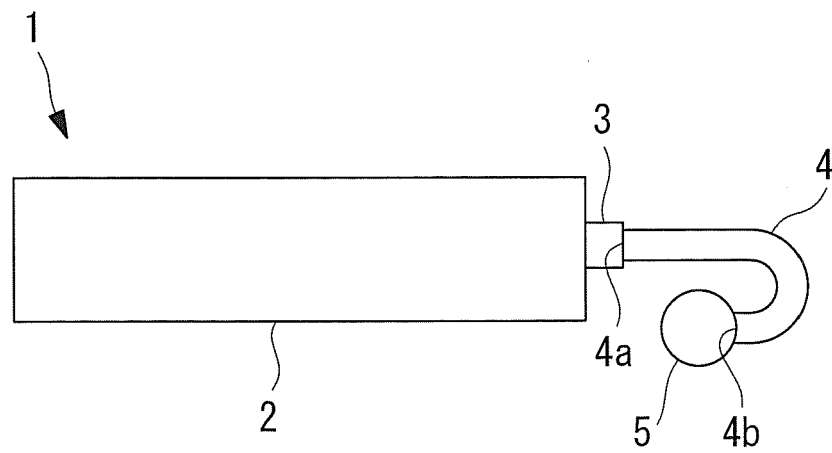


FIG. 3

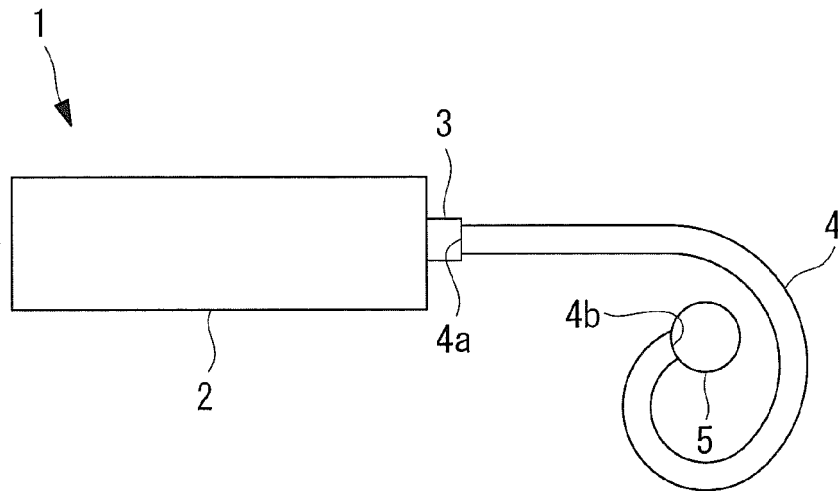
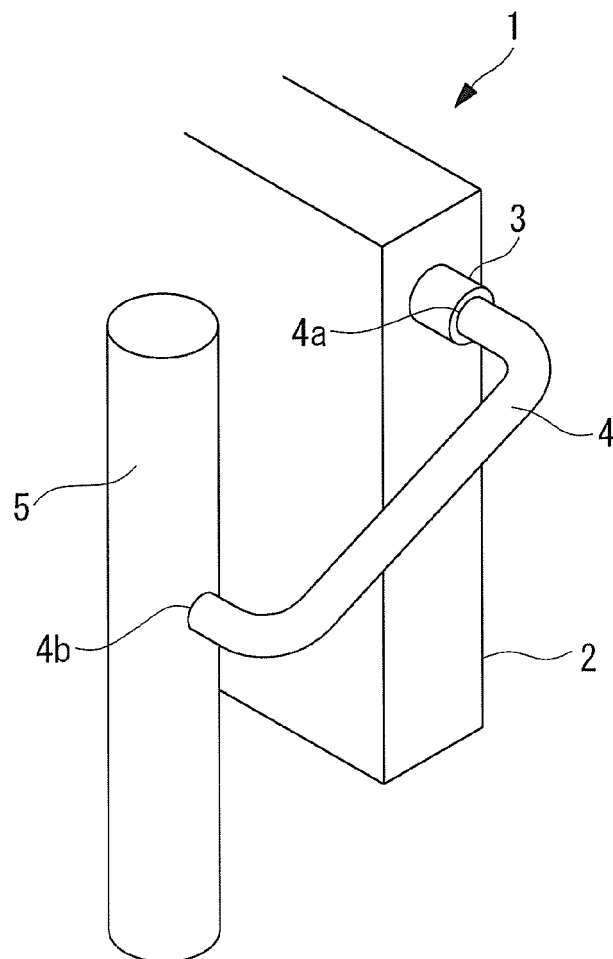


FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP HEI10148482 B [0007]