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(54) MANIFOLD AND HEAT EXCHANGER HAVING SAME

(57) Disclosed is a collecting pipe (1), comprising: an axially extending inner chamber (20), the inner chamber (20) comprising a refrigerant inlet chamber (18) and a refrigerant distribution chamber (19), the refrigerant inlet chamber (18) and refrigerant distribution chamber (19) being separated from each other and in fluid communication with each other, a refrigerant entering the refrigerant inlet chamber (18) and being distributed to heat exchange tubes (2) at the refrigerant distribution chamber (19); and a plurality of axially extending individual components (11, 12), wherein the refrigerant inlet chamber (18) and the refrigerant distribution chamber (19) are formed by successively placing and connecting the plurality of axially extending individual components (11, 12) in an assembling direction perpendicular to the axial direction. The collecting pipe (1) is composed of the plurality of individual components (11, 12). The plurality of individual components (11, 12) are connected together, such that the problem of two-phase flow distribution in a heat exchanger is mitigated, the heat exchange performance is improved, the problem of unstable product quality is mitigated, and the currently existing problem of the high cost of high frequency welded tubes is solved.

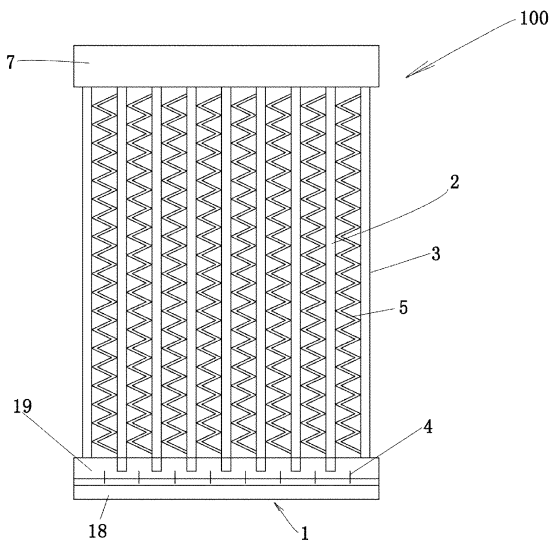

Fig. 1

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Description

Technical field

[0001] The present invention relates to a collecting pipe and a heat exchanger having the collecting pipe.

Background Art

[0002] A heat exchanger is disclosed in US patent application US 2011/0315363 A1, which comprises a first collecting pipe and a second collecting pipe. A distribution plate is disposed within the first collecting pipe in a length direction to divide the first collecting pipe into a refrigeration medium inlet section and a refrigeration medium distribution section, and flat multichannel tubes extend into the first collecting pipe to form a plurality of refrigerant distribution chambers in the refrigeration medium distribution section. Each flat multichannel tube has a first end in contact with the distribution plate in the first collecting pipe and a second end disposed in the second collecting pipe, and a plurality of generally parallel flow paths are formed between the first and second collecting pipes and are at least partially blocked by the distribution plate. An outer wall at one end of the flat multichannel tube is removed to allow a refrigeration medium to enter the interior of the flat tubes from the distribution chambers.

[0003] High frequency welded collecting pipes are still used in the heat exchanger disclosed in US patent application US 2011/0315363 A1, so that the problem of the high cost of high frequency welded tubes is not solved. In addition, the distribution plate is inserted into the inlet collecting pipe such that the complexity of the manufacturing process is increased, and the product quality is difficult to control. Moreover, the end of the flat tubes being in contact with the distribution plate tends to result in the flat tubes being blocked by welding.

Summary of the Invention

[0004] The present invention provides a collecting pipe and a heat exchanger having the collecting pipe, thereby making it possible to solve the problem of the high cost of high frequency welded tubes and improve the heat exchange performance.

[0005] According to an aspect of the present invention, provided is a collecting pipe comprising: an axially extending inner chamber, comprising a refrigerant inlet chamber and a refrigerant distribution chamber which are separated from each other and in fluid communication with each other, a refrigerant entering said refrigerant inlet chamber and being distributed to heat exchange tubes at said refrigerant distribution chamber; and a plurality of axially extending individual components, wherein at least one of said refrigerant inlet chamber and refrigerant distribution chamber or said collecting pipe is formed by successively placing and connecting the plurality of axially extending individual components in an assembling direction perpendicular to the axial direction.

[0006] According to a further aspect of the present invention, said plurality of axially extending individual components comprises individual first and second components, the first component comprises one of said refrigerant inlet chamber and refrigerant distribution chamber, and at least a portion of a wall of said first component and the second component form the other of said refrigerant inlet chamber and refrigerant distribution chamber by placing and connecting the first and second components in said assembling direction.

[0007] According to a further aspect of the present invention, when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, and second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part.

[0008] According to a further aspect of the present invention, when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part, and a partition wall part extending between inner ends of said step parts.

[0009] According to a further aspect of the present invention, said first component further comprises protrusions which are formed on the partition wall part and are spaced apart from said second wall parts by a predetermined distance.

[0010] According to a still further aspect of the present invention, when viewed in cross section, said first component comprises: a first arc-shaped wall part, step parts extending outwardly from two ends of the first arc-shaped wall part, and second arc-shaped wall parts extending from outer ends of said step parts towards the side remote from the first arc-shaped wall part.

[0011] According to a yet further aspect of the present invention, when viewed in cross section, said first component comprises: a first arc-shaped wall part, step parts extending outwardly from two ends of the first arc-shaped wall part, second arc-shaped wall parts extending from outer ends of said step parts towards the side remote from the first arc-shaped wall part, and a partition wall part extending between inner ends of said step parts.

[0012] According to a further aspect of the present invention, said first component comprises protrusions which are formed on the partition wall part and are spaced apart from said second arc-shaped wall parts by a predetermined distance.

[0013] According to a still further aspect of the present invention, said plurality of axially extending individual components comprise individual first, second and third components, and by means of successively placing and connecting the first component, third component and second component in said assembling direction, the re-

frigerant inlet chamber is formed between said first component and third component, and the refrigerant distribution chamber is formed between the third component and second component.

[0014] According to a further aspect of the present invention, when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, and second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part.

[0015] According to a further aspect of the present invention, when viewed in cross section, said second component has an inverted U-shaped wall part, and two ends of the inverted U-shaped wall part of said second component are arranged on the inner sides of the second wall parts of said first component.

[0016] According to a further aspect of the present invention, when viewed in cross section, the first U-shaped wall part is approximately arc-shaped.

[0017] According to a further aspect of the present invention, when viewed in cross section, said second wall parts are approximately arc-shaped.

[0018] According to a further aspect of the present invention, when viewed in cross section, the inverted U-shaped wall part of said second component is approximately arc-shaped.

[0019] According to a yet further aspect of the present invention, when viewed in cross section, said first component comprises: a first arc-shaped wall part, step parts extending outwardly from two ends of the first arc-shaped wall part, and second arc-shaped wall parts extending from outer ends of said step parts towards the side remote from the first arc-shaped wall part.

[0020] According to a further aspect of the present invention, when viewed in cross section, said third component has a first end and a second end, and the first and second ends of said third component are respectively placed on and connected to said step parts.

[0021] According to a still further aspect of the present invention, when viewed in cross section, said second component has an arc-shaped wall part, and two ends of the arc-shaped wall part of said second component are arranged on the inner sides of the second arc-shaped wall parts of said first component.

[0022] According to a further aspect of the present invention, when viewed in cross section, a central angle corresponding to each component, which constitutes an outer wall of the collecting pipe, of said plurality of axially extending individual components is less than 360 degrees, or when viewed in cross section, a central angle corresponding to the portion forming an outer surface of the collecting pipe of each component, which constitutes an outer wall of the collecting pipe, of said plurality of axially extending individual components is less than 360 degrees.

[0023] According to a further aspect of the present invention, the width of a portion of the inverted U-shaped wall part of said second component overlapping the second wall parts of said first component is greater than or equal to 3 mm.

[0024] According to a further aspect of the present invention, when viewed in cross section, a central angle corresponding to said first component is approximately equal to or less than 180 degrees.

[0025] According to a further aspect of the present invention, said partition wall part protrudes towards said refrigerant distribution chamber.

[0026] According to a further aspect of the present invention, a surface of said partition wall part on the side remote from said refrigerant distribution chamber is integrally formed with a refrigerant pipeline, and the refrigerant pipeline is spaced apart from said first U-shaped wall part.

[0027] According to a further aspect of the present invention, the inner side of said collecting pipe is approximately circular.

[0028] According to an aspect of the present invention, provided is a heat exchanger, comprising heat exchange tubes and a collecting pipe as mentioned above, end portions of said heat exchange tubes being in fluid communication with the refrigerant distribution chamber of the collecting pipe.

[0029] According to a further aspect of the present invention, said collecting pipe has a plurality of openings which are formed in a tube wall of said collecting pipe and arranged in the axial direction, the end portion of said heat exchange tube has a step and is inserted into said opening, and at least a portion of the step of said heat exchange tube abuts a periphery of said opening.

[0030] According to a further aspect of the present invention, said refrigerant inlet chamber and refrigerant distribution chamber are separated by the partition wall part and are in fluid communication with each other through holes in the partition wall part, and at least one of said holes is provided between two adjacent heat exchange tubes.

[0031] In the present invention, an inlet collecting pipe of the heat exchanger is formed by welding a plurality of components or connecting them in another way, some of the components divide the collecting pipe into two or more separated chambers, the chamber in communication with the flat tubes is the refrigerant distribution chamber, one of the remaining chambers is the refrigerant inlet chamber, and the refrigerant inlet chamber is in communication with the refrigerant distribution chamber through a round hole or another form of opening. In this way, the refrigeration medium enters the collecting pipe from the inlet chamber, and then enters the refrigerant distribution chamber through the opening between the two chambers, a plurality of openings are distributed in the length direction of the collecting pipe, each flat tube or multiple flat tubes generally correspond to at least one opening, and the refrigeration medium then enters the flat tubes from the refrigerant distribution chamber, so as to achieve the purpose of uniformly distributing the refrig-

eration medium.

[0032] The collecting pipe of the heat exchanger of the present invention is formed by welding two or more individual components or connecting them in another way, such that the cross section of the collecting pipe is divided into at least two individual chambers. Moreover, the inner side of the cross section of the collecting pipe formed by assembling several individual components is circular. As the collecting pipe is formed by connecting multiple components, the problem of the high cost of high frequency welded tubes can be solved. Since the inner side of the cross section of the collecting pipe is circular, a circular end cover can be used, so that the processing is convenient and the reliability is high. The process of inserting a distribution plate into the inside of the collecting pipe is omitted, such that the process complexity is greatly reduced.

Description of the Drawings

[0033]

Fig. 1 is a schematic view of a heat exchanger according to a first embodiment of the present invention.

Fig. 2 is a schematic partial sectional view of the heat exchanger according to the first embodiment of the present invention.

Fig. 3 is a schematic partial sectional view of the heat exchanger according to a second embodiment of the present invention.

Fig. 4 is a schematic partial sectional view of the heat exchanger according to a third embodiment of the present invention.

Fig. 5 is a schematic partial sectional view of the heat exchanger according to a fourth embodiment of the present invention.

Particular Embodiments

Embodiment 1

[0034] As shown in Fig. 1, a heat exchanger 100, such as a micro-channel heat exchanger, according to the embodiment of the present invention, comprises: collecting pipes 1, 7 (for example, an inlet collecting pipe 1 and an outlet collecting pipe 7); heat exchange tubes 2 such as flat tubes; fins 5 arranged between the heat exchange tubes 2; and side plates 3. The heat exchanger can be used in the fields of heating ventilation air conditioning, vehicles, refrigeration and transportation, and can be used as a heat exchanger such as an evaporator, a condenser and a water tank. End portions of the heat exchange tubes 2 are in fluid communication with the refrigerant distribution chamber 19 of the collecting pipe. The collecting pipe 1 has a plurality of openings which are formed in a tube wall of said collecting pipe and arranged in the axial direction, the end portion of the heat exchange tube 2 has a step, such as a step positioned at a predetermined distance from an end face of the end portion of the heat exchange tube 1 in an axial direction of the heat exchange tube 1, the cross section of the heat exchange tube 1 between the end face of the end portion and the step being smaller than that of the remaining portion of the heat exchange tube 1. The end portion of the heat exchange tube 2 is inserted into said opening, and at least a portion of the step of the heat exchange tube 2 abuts a periphery of said opening. In this way, the length by which the heat exchange tubes 1 are inserted into the collecting pipes 1, 7 can be controlled, the means for positioning the heat exchange tubes 1 are reduced, and the uniformity of the length by which the heat exchange tubes 1 are inserted into the collecting pipes 1, 7 can also be guaranteed.

[0035] As shown in Figs. 1 and 2, the collecting pipe 1 according to a first embodiment of the present invention comprises: an axially extending inner chamber 20, the inner chamber 20 comprising a refrigerant inlet chamber 18 and a refrigerant distribution chamber 19 which are separated from each other and in fluid communication with each other, a refrigerant entering said refrigerant inlet chamber 18 and being distributed to heat exchange tubes 2 at the refrigerant distribution chamber 19; and a plurality of axially extending individual components 11 and 12, wherein at least one of the refrigerant inlet chamber 18 and the refrigerant distribution chamber 19 or the collecting pipe 1 is formed by successively placing and connecting the plurality of axially extending individual components 11 and 12 in an assembling direction A perpendicular to the axial direction. The components 11 and 12 can be connected together by welding or other connecting methods.

[0036] As shown in Fig. 2, the inner chamber 20 may have an approximately circular cross section; in addition, as an option, the cross section of the inner chamber 20 may be approximately elliptical or other shapes.

[0037] As shown in Fig. 2, the plurality of axially extending individual components 11 and 12 comprises an individual first component 11 and second component 12. The first component 11 comprises one of the refrigerant inlet chamber 18 and the refrigerant distribution chamber 19. In the example shown in Fig. 2, the first component 11 comprises the refrigerant inlet chamber 18. At least a portion of a wall of the first component 11 and the second component 12 form the other of the refrigerant inlet chamber 18 and the refrigerant distribution chamber 19 by placing and connecting the first component 11 and second component 12 in the assembling direction A, and in the example shown in Fig. 2, at least a portion of the wall of the first component 11 and the second component 12 form the refrigerant distribution chamber 19.

[0038] As shown in Fig. 2, when viewed in cross section, for example in the view of the cross section shown in Fig. 2, the first component 11 comprises: a first arc-shaped wall part 111 (an example of a first U-shaped wall part), step parts 112 extending outwardly from two

ends of the first arc-shaped wall part 111, second arc-shaped wall parts 113 (an example of second wall parts) extending from outer ends of said step parts 112 towards the side remote from the first arc-shaped wall part 111, and a partition wall part 114 extending between inner ends of said step parts 112.

[0039] As shown in Fig. 2, when viewed in cross section, the second component 12 has an arc-shaped wall part (an example of an inverted U-shaped wall part), and two ends of the arc-shaped wall part of the second component 12 are arranged on the inner sides of the second arc-shaped wall parts 113 of the first component 11. The two ends of the arc-shaped wall part of the second component 12 and the second arc-shaped wall parts 113 of the first component 11 can be connected together by means of welding or the like.

[0040] As shown in Fig. 2, a surface of said partition wall part 114 on the side remote from the refrigerant distribution chamber 19 is integrally formed with a refrigerant pipeline 115, and the refrigerant pipeline 115 is spaced apart from the first arc-shaped wall part 111. The refrigerant inlet chamber 18 is defined by the refrigerant pipeline 115. A chamber 17 is formed between the partition wall part 114, the refrigerant pipeline 115 and the first arc-shaped wall part 111.

[0041] As shown in Fig. 2, the partition wall part 114 protrudes towards the refrigerant distribution chamber 19. As shown in Fig. 2, the refrigerant inlet chamber 18 and the refrigerant distribution chamber 19 are separated by the partition wall part 114 and are in fluid communication with each other through holes 14 in the partition wall part 114. Each heat exchange tube 2 at least corresponds to one hole 14, that is to say, the number of holes 14 is at least equal to the number of heat exchange tubes 2. As shown in Fig. 1, for example, the position 4 of each hole 14 is between two adjacent heat exchange tubes 2 in the length or axial direction of the collecting pipe 1. At least one hole such as a round hole or an opening is provided between two adjacent heat exchange tubes 1 in the length or axial direction of the collecting pipe 1. In this way, the uniformity of entry of the refrigeration medium into the heat exchange tubes 1 can be ensured, the refrigeration medium flows from the refrigerant inlet chamber 18 to the refrigerant distribution chamber 19, then after a collision with an upper wall of the refrigerant distribution chamber 19, vapor and liquid are mixed uniformly, and then enter the heat exchange tubes 1 again, so that it is possible to ensure the uniformity of the refrigeration medium in the heat exchange tubes 1 and improve the heat exchange performance.

[0042] As an option, each heat exchange tube 1 at least corresponds to one hole 14 in the length or axial direction of the collecting pipe 1, and the number of holes 14 at each position in the length or axial direction of the collecting pipe 1 is less than 3.

[0043] As shown in Fig. 2, when viewed in cross section, a central angle corresponding to each component, which constitutes an outer wall of the collecting pipe 1, of the plurality of axially extending individual components 11, 12 is less than 360 or 270 degrees, or when viewed in cross section, a central angle corresponding to the portion forming an outer surface of the collecting pipe 1 of each component, which constitutes an outer wall of the collecting pipe 1, of the plurality of axially extending individual components 11, 12 is less than 360 or 270 degrees. As shown in Fig. 2, when viewed in cross section, a central angle corresponding to the first component 11 is approximately equal to or less than 180 degrees, thereby facilitating the installation of the second component 12.

[0044] In embodiment 1, the collecting pipe 1 of the heat exchanger 100 is formed by welding two or more individual components or connecting them in another way, such that the cross section of the collecting pipe 1 is divided into at least two individual chambers. Moreover, the inner side of the cross section of the collecting pipe formed by assembling several individual components is circular. As the collecting pipe is formed by connecting multiple components, the problem of the high cost of high frequency welded tubes can be solved. Since the inner side of the cross section of the collecting pipe is circular, a circular end cover can be used, so that the processing is convenient and the reliability is high. Furthermore, the process of inserting a distribution plate into the inside of the collecting pipe is omitted, such that the process complexity is greatly reduced. Since the inner side of the collecting pipe 1 is approximately circular, it is possible to ensure that the in-built end cover is designed as circular, so that the collecting pipe 1 has a simple structure and a good sealing performance.

[0045] Furthermore, as shown in Fig. 2, a line 119 connecting the end portions of the second arc-shaped wall portions 113 does not exceed a central line of the inner circle of the cross section. In this way, the installation is convenient in the production process, the process complexity is reduced, and the reliability is ensured.

[0046] In addition, as shown in Fig. 2, the width of a portion of each second arc-shaped wall part 113 overlapping the arc-shaped wall part of the second component 12 is greater than or equal to 3 mm. In this way, welding is easily achievable from a technical perspective, and the welding strength of the collecting pipe can also be improved, thereby mitigating the problem of low compression strength of multi-sheet collecting pipes.

[0047] The collecting pipe 1 of the present invention comprises a refrigerant inlet chamber and a refrigerant distribution chamber which are in communication with each other through holes 14, such as round holes or other forms of openings. In this way, the amount of refrigerant entering the refrigerant distribution chamber can be determined according to requirements, thereby improving the distribution of the refrigerant.

[0048] The end portions of the heat exchange tubes 2, such as flat tubes, adopt a reduced opening configuration, the end portions are inserted into the openings of the collecting pipe 1, and the reduced openings are used

for positioning relative to the collecting pipe 1; as shown in Fig. 2, it is possible to avoid welding blockage caused by contact between the heat exchange tubes 2, such as flat tubes, and the partition wall part 114 of the collecting pipe 1.

Embodiment 2

[0049] As shown in Fig. 3, embodiment 2 according to the present invention is further improved on the basis of embodiment 1. Specifically, the first component 11 further comprises protrusions 116, and the protrusions 116 are formed on the partition wall part 114, such as a surface of the partition wall part 114 facing the refrigerant distribution chamber 19, and are spaced apart from the second arc-shaped wall parts 113 by a predetermined distance. The distance may be approximately equal to the thickness of the two ends of the arc-shaped wall part of the second component 12, such that the two ends of the arc-shaped wall part of the second component 12 are inserted between the protrusions 116 and the second arc-shaped wall parts 113. With the provision of the protrusions 116, it is possible to ensure that the two individual components 11, 12 are in good contact, and the welding strength is improved.

Embodiment 3

[0050] As shown in Fig. 4, the plurality of axially extending individual components 11, 12, 13 comprise an individual first component 11, second component 12 and third component 13; the first component 11, the third component 13 and the second component 12 are successively placed in the assembling direction A and are connected together, for example, the first component 11, the third component 13 and the second component 12 are connected together by welding. The refrigerant inlet chamber 18 is formed between the first component 11 and the third component 13, and the refrigerant distribution chamber 19 is formed between the third component 13 and the second component 12.

[0051] As shown in Fig. 4, when viewed in cross section, for example in the view of the cross section shown in Fig. 4, the first component 11 comprises: a first arc-shaped wall part 111, step parts 112 extending outwardly from two ends of the first arc-shaped wall part 111, and second arc-shaped wall parts 113 extending from outer ends of said step parts 112 towards the side remote from the first arc-shaped wall part 111. When viewed in cross section, the third component 13 has a first end and a second end, and the first and second ends of the third component 13 are respectively placed on and connected to the step parts 112.

[0052] As shown in Fig. 4, the refrigerant inlet chamber 18 and the refrigerant distribution chamber 19 are in fluid communication with each other through holes 14 in the third component 13. The third component 13 protrudes towards the refrigerant distribution chamber 19.

[0053] As shown in Fig. 4, these individual components 11, 12, 13 constituting the collecting pipe 1 are in contact with one another, and in the contacted portion, one component 11 contains the other two components 12, 13.

[0054] As shown in Fig. 4, the end portions of the heat exchange tubes 2, such as flat tubes, adopt a reduced opening configuration, the end portions are inserted into the openings of the collecting pipe, and the reduced openings are used for positioning relative to the collecting pipe 1; as shown in Fig. 4, it is possible to avoid welding blockage caused by contact between the heat exchange tubes 2, such as flat tubes, and the third component 13 of the collecting pipe 1.

Embodiment 4

[0055] Embodiment 4 according to the present invention is further improved on the basis of embodiment 1. Specifically, as shown in Fig. 5, the collecting pipe 1 does not have the refrigerant pipeline 115 shown in Fig. 2, and the refrigerant inlet chamber 18 is defined by the first arc-shaped wall part 111 and the partition wall part 114.

[0056] The embodiments shown in Figs. 2 and 3, with respect to the embodiments shown in Figs. 4 and 5, have the advantages of further reducing the refrigerant inlet chamber 18 while ensuring that the other components and the process are the same, so that it is possible to mitigate the problem of two-phase refrigeration medium separation after the refrigeration medium enters the collecting pipe 1, improve the distribution of the refrigeration medium, and improve the heat exchange performance of the heat exchanger.

[0057] In the above-mentioned embodiments, the collecting pipe 1 is used as an inlet collecting pipe, but clearly, the collecting pipe 1 can also be used as an outlet collecting pipe.

[0058] It can be seen from the above that the present invention provides a collecting pipe and a heat exchanger, in which a plurality of individual components are connected together, so that the problem of two-phase flow distribution in a heat exchanger such as a micro-channel heat exchanger is mitigated, and the heat exchange performance is improved. In addition, due to the simple assembly process, the problem of unstable product quality can be mitigated in the present invention. Furthermore, the currently existing problem of the high cost of high frequency welded tubes is solved by the present invention.

[0059] Although in the above-mentioned embodiments, a circular collecting pipe is described, the above-mentioned embodiments are also suitable for collecting pipes with other cross-sectional shapes, such as an oval collecting pipe and a rectangular collecting pipe etc. In the case of the collecting pipe being of any suitable shape, the first arc-shaped wall part in the above-mentioned embodiments is a first U-shaped wall part, and the second arc-shaped wall part is a second wall part. The arc-shaped wall part of the second component is an in-

verted U-shaped wall part of the second component.

Claims

1. A collecting pipe comprising:

   an axially extending inner chamber comprising a refrigerant inlet chamber and a refrigerant distribution chamber which are separated from each other and in fluid communication with each other, a refrigerant entering said refrigerant inlet chamber and being distributed to heat exchange tubes at said refrigerant distribution chamber; and

   a plurality of axially extending individual components, wherein at least one of said refrigerant inlet chamber and refrigerant distribution chamber or said collecting pipe is formed by successively placing and connecting the plurality of axially extending individual components in an assembling direction perpendicular to the axial direction.

2. The collecting pipe as claimed in claim 1, wherein said plurality of axially extending individual components comprises individual first and second components, the first component comprises one of said refrigerant inlet chamber and refrigerant distribution chamber, and at least a portion of a wall of said first component and the second component form the other of said refrigerant inlet chamber and refrigerant distribution chamber by placing and connecting the first and second components in said assembling direction.

3. The collecting pipe as claimed in claim 2, wherein when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, and second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part.

4. The collecting pipe as claimed in claim 2, wherein when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part, and a partition wall part extending between inner ends of said step parts.

5. The collecting pipe as claimed in claim 4, wherein said first component further comprises protrusions which are formed on the partition wall part and are spaced apart from said second wall parts by a predetermined distance.

6. The collecting pipe as claimed in claim 1, wherein said plurality of axially extending individual components comprise individual first, second and third components, and by means of successively placing and connecting the first component, the third component and the second component in said assembling direction, the refrigerant inlet chamber is formed between said first component and third component, and the refrigerant distribution chamber is formed between the third component and second component.

7. The collecting pipe as claimed in claim 6, wherein when viewed in cross section, said first component comprises: a first U-shaped wall part, step parts extending outwardly from two ends of the first U-shaped wall part, and second wall parts extending from outer ends of said step parts towards the side remote from the first U-shaped wall part.

8. The collecting pipe as claimed in claim 7, wherein when viewed in cross section, said third component has a first end and a second end, and the first and second ends of said third component are respectively placed on and connected to said step parts.

9. The collecting pipe as claimed in claim 3 or 7, wherein when viewed in cross section, said second component has an inverted U-shaped wall part, and two ends of the inverted U-shaped wall part of said second component are arranged on the inner sides of the second wall parts of said first component.

10. The collecting pipe as claimed in any one of claims 3-5, 7 and 8, wherein when viewed in cross section, the first U-shaped wall part is approximately arc-shaped.

11. The collecting pipe as claimed in any one of claims 3-5, 7 and 8, wherein when viewed in cross section, said second wall parts are approximately arc-shaped.

12. The collecting pipe as claimed in claim 9, wherein when viewed in cross section, the inverted U-shaped wall part of said second component is approximately arc-shaped.

13. The collecting pipe as claimed in claim 9, wherein the width of a portion of the inverted U-shaped wall part of said second component overlapping the second wall parts of said first component is greater than or equal to 3 mm.

14. The collecting pipe as claimed in claim 2 or 6, wherein when viewed in cross section, a central angle corresponding to said first component is approximately equal to or less than 180 degrees.

15. The collecting pipe as claimed in claim 4, wherein said partition wall part protrudes towards said refrigerant distribution chamber.

16. The collecting pipe as claimed in claim 4, wherein a surface of said partition wall part on the side remote from said refrigerant distribution chamber is integrally formed with a refrigerant pipeline, and the refrigerant pipeline is spaced apart from said first U-shaped wall part.

17. The collecting pipe as claimed in claim 1, wherein the inner side of said collecting pipe is approximately circular.

18. A heat exchanger comprising:

heat exchange tubes, and
a collecting pipe as claimed in claim 1, end portions of said heat exchange tubes being in fluid communication with the refrigerant distribution chamber of the collecting pipe.

19. The heat exchanger as claimed in claim 18, wherein said collecting pipe has a plurality of openings which are formed in a tube wall of said collecting pipe and arranged in the axial direction, the end portion of said heat exchange tube has a step and is inserted into said opening, and at least a portion of the step of said heat exchange tube abuts a periphery of said opening.

20. The heat exchanger as claimed in claim 18, wherein said refrigerant inlet chamber and refrigerant distribution chamber are separated by the partition wall part and are in fluid communication with each other through holes in the partition wall part, and at least one of said holes is provided between two adjacent heat exchange tubes.

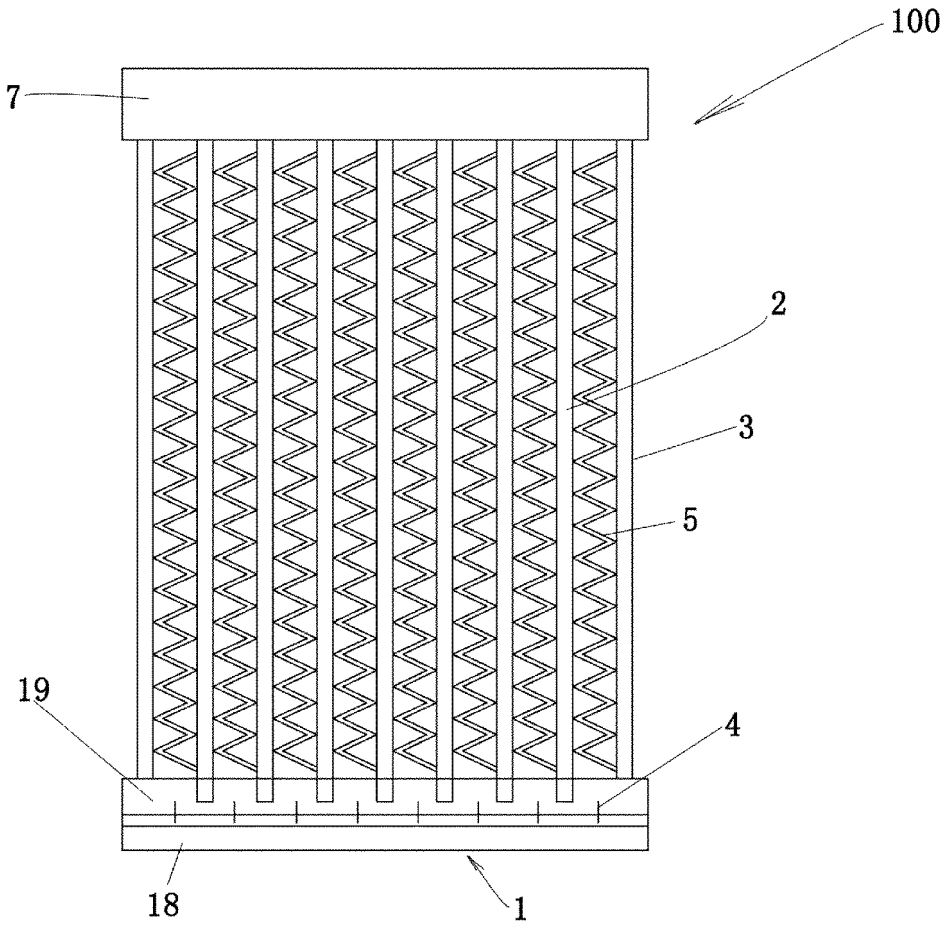

Fig. 1

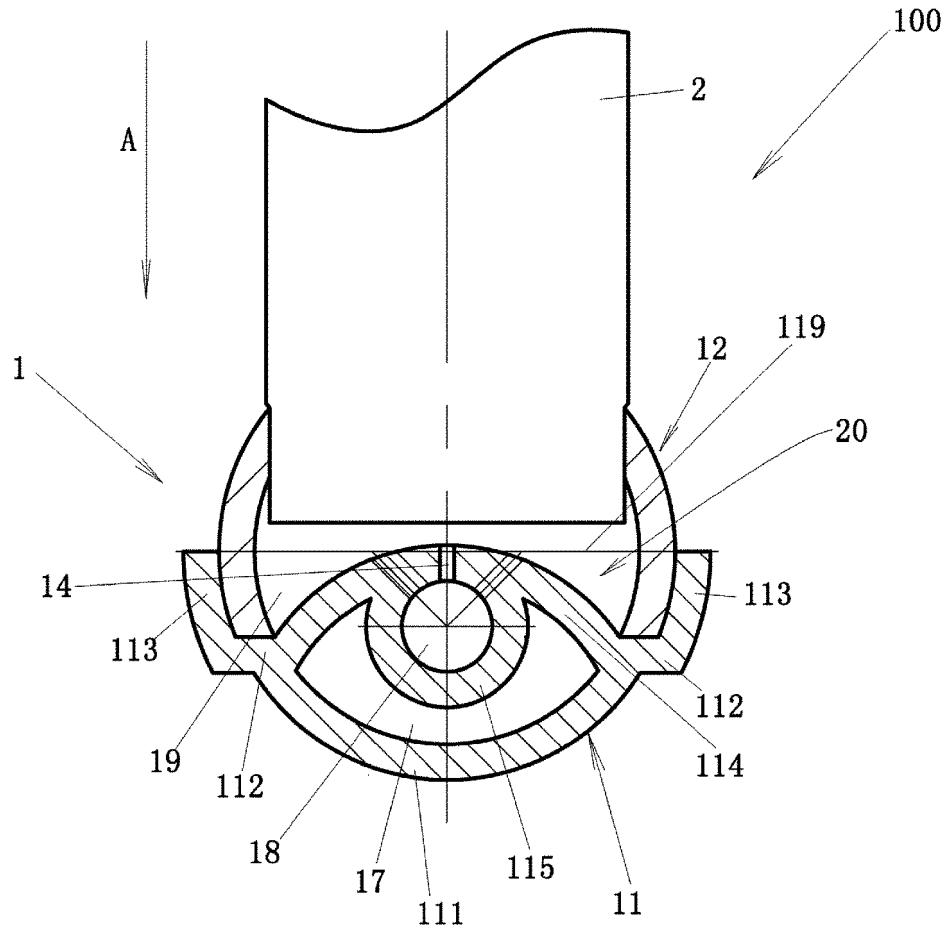

Fig. 2

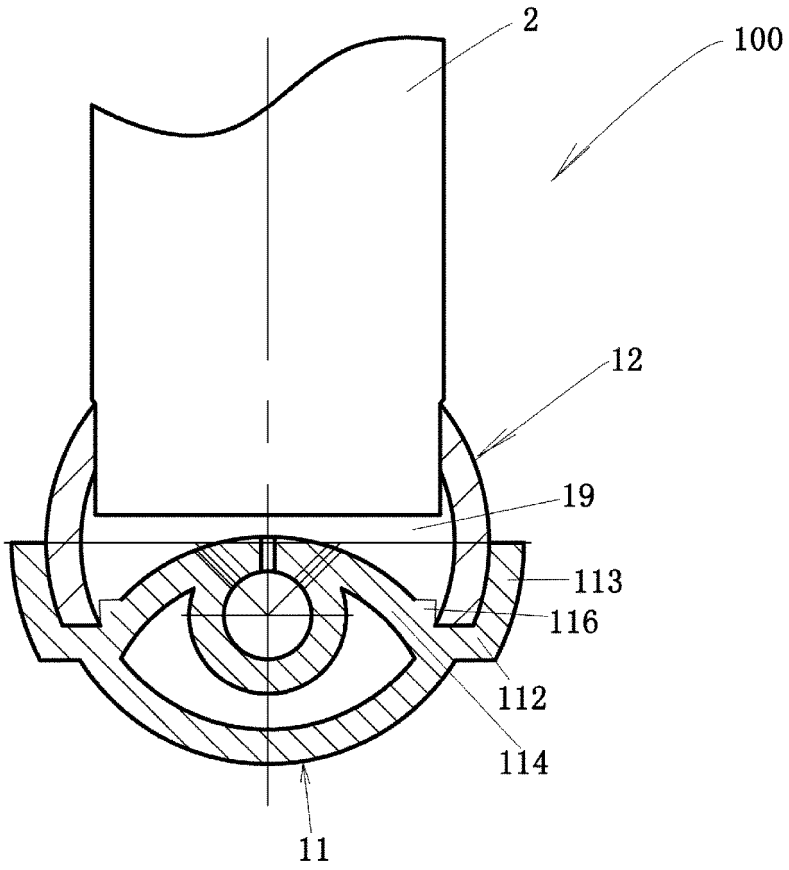

Fig. 3

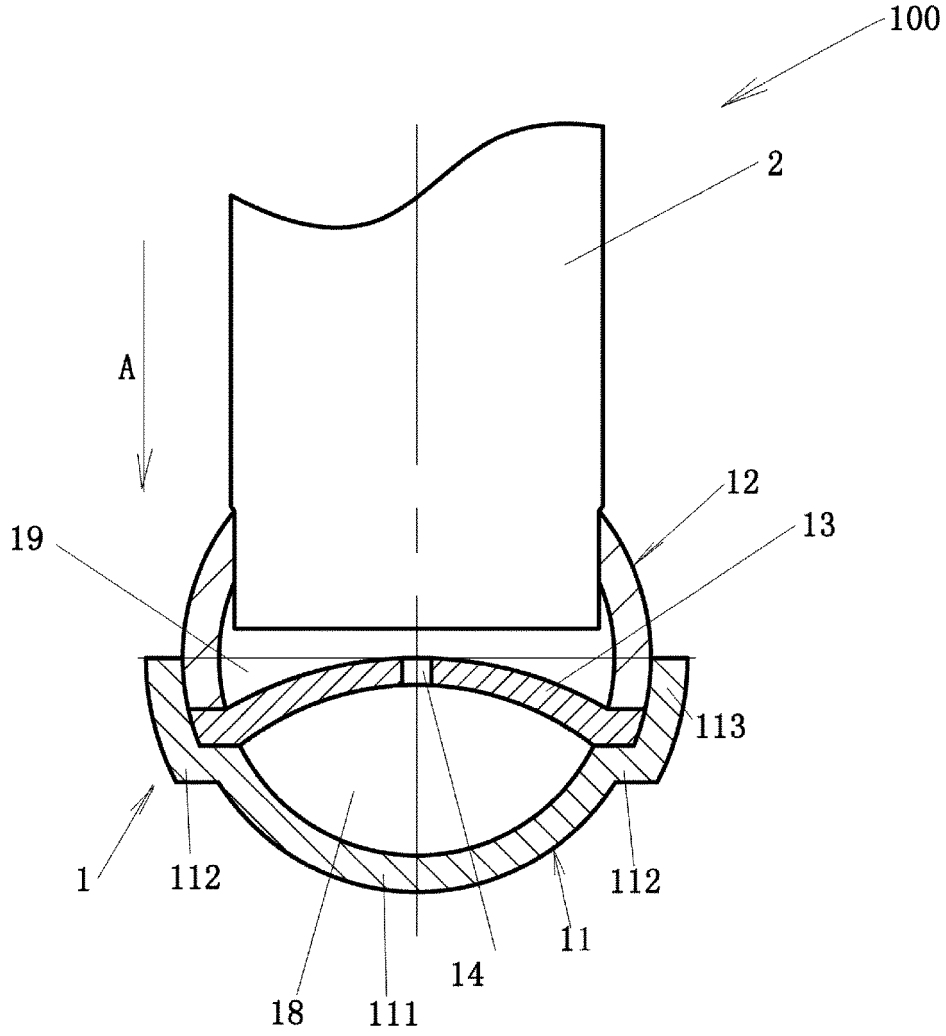

Fig. 4

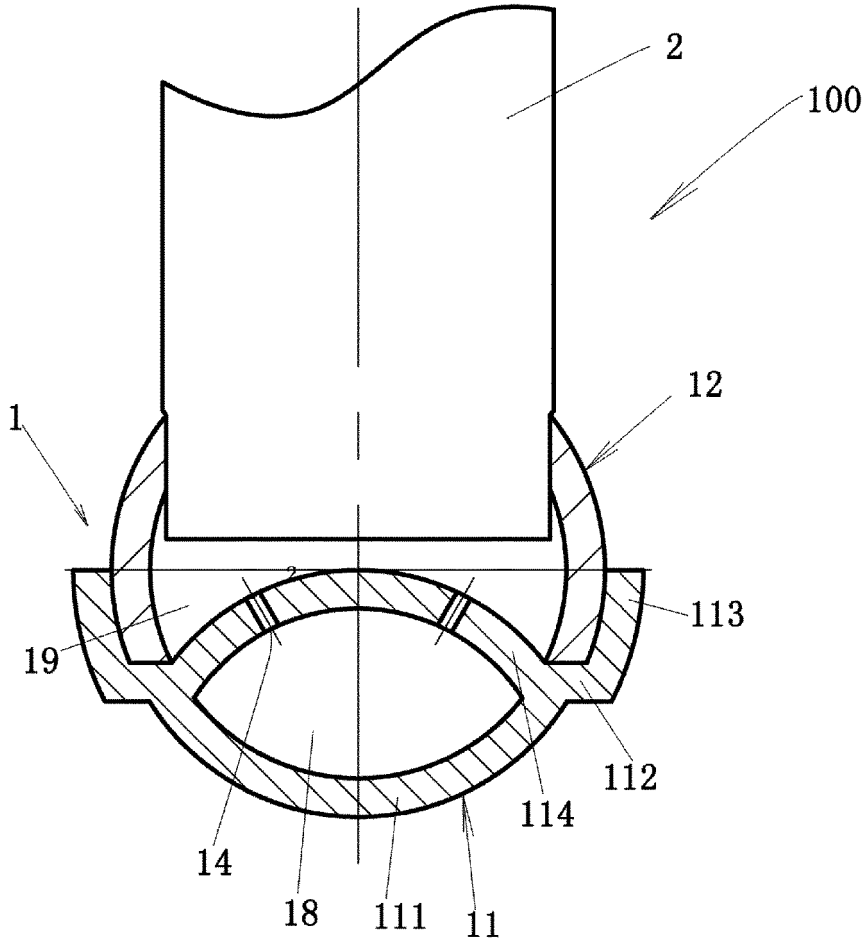

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/072985

A. CLASSIFICATION OF SUBJECT MATTER

F28F 9/02 (2006.01) i; F25B 39/00 (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)

F28F, F25B

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

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

cprs, cnki, epodoc, wpi: manifold, header, collect+, distribut+, hole, orifice, opening

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 103148729 A (DANFOSS MICRO CHANNEL HEAT EXCHANGER JIAXING CO., LTD.), 12 June 2013 (12.06.2013), description, paragraphs [0038]-[0067], and figures 1-5	1-20
X	CN 102384692 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 21 March 2012 (21.03.2012), description, paragraphs [0036]-[0041], and figures 2-8	1-15, 17, 18, 20
Y	CN 102384692 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 21 March 2012 (21.03.2012), description, paragraphs [0036]-[0041], and figures 2-8	16, 19
Y	CN 101660870 A (DANFOSS-SANHUA (HANGZHOU) MICRO CHANNEL HEAT EXCHANGER CO., LTD.), 03 March 2010 (03.03.2010), description, paragraph [0074], and figure 2	16
Y	CN 101713605 A (SHOWA DENKO K. K.), 26 May 2010 (26.05.2010), description, paragraph [0074], and figure 2	19
A	JP 2002022313 A (MATSUSHITA REIKI KK), 23 January 2002 (23.01.2002), the whole document	1-20

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

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May 2014 (28.05.2014)	**17 June 2014 (17.06.2014)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **ZHOU, Yanhong** Telephone No.: (86-10) **62084150**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/072985

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 103148729 A	12.06.2013	None	
CN 102384692 A	21.03.2012	None	
CN 101660870 A	03.03.2010	CN 101660870 B	18.07.2012
		US 2011061844 A1	17.03.2011
		EP 2299224 A2	23.03.2011
CN 101713605 A	26.05.2010	US 2010083694 A1	08.04.2010
		JP 2010112695 A	20.05.2010
JP 2002022313 A	23.01.2002	None	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20110315363 A1 **[0002] [0003]**