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(54) HEAT EXCHANGER AND AIR CONDITIONING SYSTEM HAVING SAME

(57) Disclosed in the present invention are a heat exchanger and an air conditioning system having same. The heat exchanger comprises a manifold extending in a first direction, the manifold having a first opening penetrating the pipe wall of the manifold; a tubular member arranged side by side with the manifold, the tubular member having a second opening penetrating the pipe wall of the tubular member; and a connecting pipe assembly, wherein the connecting pipe assembly comprises a connecting pipe, the connecting pipe extending in a second direction that intersects with the first direction and being provided with a first end portion and a second end portion which are opposite each other; and a first flange portion and a second flange portion which extend radially outward from the first end portion and the second end portion, respectively. The surface of the first flange portion that faces the manifold is connected to the outer surface of the pipe wall of the manifold, and the surface of the second flange portion that faces the tubular member is connected to the outer surface of the pipe wall of the tubular member, so that the manifold and the tubular member are in fluid communication by means of the first opening, the connecting pipe, and the second opening. Therefore, the quality of the heat exchanger is improved, and the process difficulty is reduced.

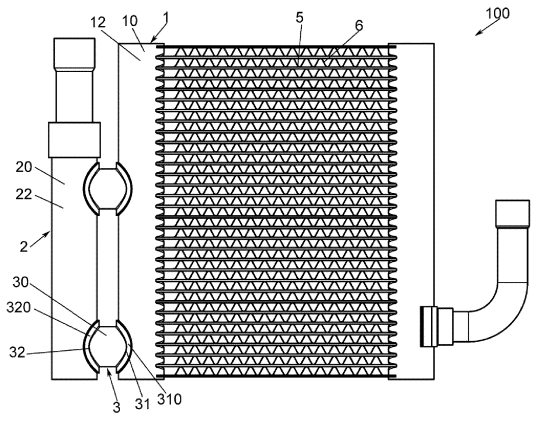

Fig. 1

EP 4 443 094 A1

Description

Technical Field

[0001] The embodiments of the present invention relate to a heat exchanger and an air conditioning system having same.

Background

[0002] A heat exchanger comprises a manifold and a collecting manifold or storage tank connected to the manifold. The manifold is connected to and in fluid communication with the collecting manifold or storage tank through a connecting pipe.

Summary of the Invention

[0003] An objective of embodiments of the present invention is to provide a heat exchanger and an air conditioning system having same, thereby improving the quality of the heat exchanger, for example.

[0004] An embodiment of the present invention provides a heat exchanger comprising a manifold extending in a first direction, the manifold having a first opening penetrating the pipe wall of the manifold; a tubular member arranged side by side with the manifold, the tubular member having a second opening penetrating the pipe wall of the tubular member; and a connecting pipe assembly, wherein the connecting pipe assembly comprises a connecting pipe, the connecting pipe extending in a second direction that intersects with the first direction and being provided with a first end portion and a second end portion which are opposite each other; and a first flange portion and a second flange portion which extend radially outward from the first end portion and the second end portion, respectively, wherein the surface of the first flange portion that faces the manifold is connected to the outer surface of the pipe wall of the manifold, and the surface of the second flange portion that faces the tubular member is conne • 1cted to the outer surface of the pipe wall of the tubular member, so that the manifold and the tubular member are in fluid communication by means of the first opening, the connecting pipe, and the second opening.

[0005] According to an embodiment of the present invention, the surface of the first flange portion that faces the manifold has the same shape as the corresponding part surrounding the first opening of the outer surface of the pipe wall of the manifold, and the surface of the second flange portion that faces the tubular member has the same shape as the corresponding part surrounding the second opening of the outer surface of the pipe wall of the tubular member.

[0006] According to an embodiment of the present invention, an angle between the axis of the manifold and the axis of the tubular member is within the range of 0 degrees to 5 degrees.

[0007] According to an embodiment of the present invention, an angle between the axis of the connecting pipe and the axis of the manifold is within the range of 85 degrees to 90 degrees.

[0008] According to an embodiment of the present invention, the heat exchanger further comprises a plurality of heat exchange pipes connected to and in fluid communication with the manifold, and a plurality of fins arranged alternately with the plurality of heat exchange pipes.

[0009] According to an embodiment of the present invention, the tubular member is a manifold, a distribution header, a collecting header, or a storage tank.

[0010] According to an embodiment of the present invention, the ratio of each of the diameter of the first opening and the diameter of the second opening to the inner diameter of the connecting pipe ranges from 0.95 to 1.05.

[0011] According to an embodiment of the present invention, the inner diameter of the connecting pipe remains the same over its entire length.

[0012] According to an embodiment of the present invention, the axis of the manifold is parallel to the axis of the tubular member, and the axis of the connecting pipe is perpendicular to the axis of the manifold and the axis of the tubular member.

[0013] According to an embodiment of the present invention, the outer surface of the pipe wall of the manifold and the outer surface of the pipe wall of the tubular member are cylindrical, and the surface of the first flange portion that faces the manifold and the surface of the second flange portion that faces the tubular member are partially cylindrical.

[0014] According to an embodiment of the present invention, the connecting pipe assembly is formed from a pipe, wherein the inner side of the pipe is covered with a composite layer that functions as solder.

[0015] According to an embodiment of the present invention, the thickness of the pipe wall of the connecting pipe is equal to the thickness of the first flange portion and/or the second flange portion, and the pipe wall of the connecting pipe has a uniform thickness.

[0016] According to an embodiment of the present invention, the connecting pipe assembly is located on the outer side in a radial direction of the manifold and on the outer side in a radial direction of the tubular member.

[0017] Embodiments of the present invention further provide an air conditioning system, comprising the heat exchanger described above.

[0018] With a heat exchanger according to an embodiment of the present invention, the quality of the heat exchanger may be improved, for example.

Brief Description of the Drawings

[0019]

Fig. 1 is a schematic main view of a heat exchanger according to an embodiment of the present inven-

tion.

Fig. 2 is a schematic partial enlarged perspective view of the heat exchanger shown in Fig. 1;

Fig. 3 is a schematic perspective view of the connecting pipe assembly of the heat exchanger shown in Fig. 1;

Fig. 4 is a schematic partially enlarged sectional view of the heat exchanger shown in Fig. 1.

Detailed Description of the Invention

[0020] The present invention will be described in further detail below in conjunction with the drawings and specific embodiments.

[0021] An air conditioning system according to embodiments of the present invention comprises a heat exchanger. Specifically, the air conditioning system according to embodiments of the present invention comprises a compressor, a heat exchanger serving as an evaporator, a heat exchanger serving as a condenser, and an expansion valve, etc.

[0022] Referring to Fig. 1 to Fig. 4, a heat exchanger 100 according to an embodiment of the present invention comprises a manifold 1 extending in a first direction, the manifold 1 having a first opening 11 penetrating the pipe wall 10 of the manifold 1; a tubular member 2 arranged side by side with the manifold 1, the tubular member 2 having a second opening 21 penetrating the pipe wall 20 of the tubular member 2; and a connecting pipe assembly 3. The heat exchanger 100 may further comprise a plurality of heat exchange pipes 5 connected to and in fluid communication with the manifold 1, and a plurality of fins 6 arranged alternately with the plurality of heat exchange pipes 5. Referring to Fig. 1 to Fig. 4, the connecting pipe assembly 3 comprises a connecting pipe 30, the connecting pipe 30 extending in a second direction that intersects with the first direction and being provided with a first end portion 31 and a second end portion 32 which are opposite each other; and a first flange portion 310 and a second flange portion 320 which extend radially outward from the first end portion 31 and the second end portion 32, respectively. The surface 311 of the first flange portion 310 that faces the manifold 1 is connected to the outer surface 12 of the pipe wall 10 of the manifold 1, and the surface 321 of the second flange portion 320 that faces the tubular member 2 is connected to the outer surface 22 of the pipe wall 20 of the tubular member 2, so that the manifold 1 and the tubular member 2 are in fluid communication by means of the first opening 11, the connecting pipe 30, and the second opening 21. The manifold 1, the tubular member 2, and the connecting pipe 30 may be round pipes, etc. There may be one or more (for example, two, three, etc.) connecting pipe assemblies 3. According to an example of the present invention, the connecting pipe assembly 3 is located on the outer side in a radial direction of the manifold 1 and on the outer side in a radial direction of the tubular member 2.

[0023] According to an embodiment of the present invention, as shown in Fig. 2 to Fig. 4, the first flange portion 310 and the second flange portion 320 are saddle-shaped. The connecting pipe assembly 3 is formed by stamping the two ends of a pipe. The first flange portion 310 and the second flange portion 320 function as welded parts having curved surfaces that fit the manifold and the tubular member. The surface 311 of the first flange portion 310 and the surface 321 of the second flange portion 320 fit the manifold and the tubular member. In a brazing furnace, the composite layer on the surface of the manifold is melted and fills the gap between the manifold and the surface 311 of the first flange portion 310, while the composite layer on the surface of the tubular member 2 is melted and fills the gap between the tubular member 2 and the surface 321 of the second flange portion 320, thereby completing the welding of the connecting pipe assembly 3 to the manifold and the tubular member 2. According to an embodiment of the present invention, the thickness of the pipe wall of the connecting pipe 30 is substantially uniform, and the connecting pipe assembly 3 does not need to be inserted into an opening in the pipe wall of the manifold or an opening in the pipe wall of the tubular member 2. Since the surface 311 of the first flange portion 310 and the surface 321 of the second flange portion 320 are welded surfaces, the welding area is increased, the welding difficulty is reduced, and the welding quality is more reliable. In addition, since the connecting pipe assembly 3 does not need to be inserted into an opening in the pipe wall of the manifold or an opening in the pipe wall of the tubular member 2, the fluid flow is not hindered and the pressure drop is low, and, at the same time, since the inner diameter of the connecting pipe 30 may be equal to the diameter of an opening, the hydraulic diameter of the connecting pipe 30 is relatively large and thus the pressure drop is relatively low.

[0024] According to an embodiment of the present invention, as shown in Fig. 2 to Fig. 4, the surface 311 of the first flange portion 310 that faces the manifold 1 has the same shape as the corresponding part surrounding the first opening 11 of the outer surface 12 of the pipe wall 10 of the manifold 1, and the surface 321 of the second flange portion 320 that faces the tubular member 2 has the same shape as the corresponding part surrounding the second opening 21 of the outer surface 22 of the pipe wall 20 of the tubular member 2. In other words, the surface 311 of the first flange portion 310 corresponds to and has the same shape as the annular portion surrounding the first opening 11 of the outer surface 12 of the pipe wall 10 of the manifold 1, while the surface 321 of the second flange portion 320 corresponds to and has the same shape as the annular portion surrounding the second opening 21 of the outer surface 22 of the pipe wall 20 of the tubular member 2. For example, the surface 311 of the first flange portion 310 that faces the manifold 1 and the corresponding part surrounding the first opening 11 of the outer surface 12 of the pipe wall 10 of the

manifold 1 have a partially cylindrical shape, and the surface 321 of the second flange portion 320 that faces the tubular member 2 and the corresponding part surrounding the second opening 21 of the outer surface 22 of the pipe wall 20 of the tubular member 2 have a partially cylindrical shape.

[0025] According to an embodiment of the present invention, as shown in Fig. 1, Fig. 2, and Fig. 4, an angle between the axis of the manifold 1 and the axis of the tubular member 2 is within the range of 0 degrees to 5 degrees. For example, the axis of the manifold 1 is parallel to the axis of the tubular member 2. An angle between the axis of the connecting pipe 30 and the axis of the manifold 1 is within the range of 85 degrees to 90 degrees. For example, the axis of the connecting pipe 30 may be perpendicular to the axis of the manifold 1. In the example shown, the axis of the manifold 1 is parallel to the axis of the tubular member 2, and the axis of the connecting pipe 3 is perpendicular to the axis of the manifold 1 and the axis of the tubular member 2.

[0026] According to an embodiment of the present invention, as shown in Fig. 1, Fig. 2, and Fig. 4, the tubular member 2 is a manifold, a distribution header, a collecting header 1, or a storage tank, etc.

[0027] According to an embodiment of the present invention, as shown in Fig. 4, the ratio of each of the diameter of the first opening 11 and the diameter of the second opening 21 to the inner diameter of the connecting pipe 30 ranges from 0.95 to 1.05. In the example shown, each of the diameter of the first opening 11 and the diameter of the second opening 21 is equal to the inner diameter of the connecting pipe 30, and the inner diameter of the connecting pipe 30 remains the same over its length.

[0028] According to an embodiment of the present invention, as shown in Fig. 1 to Fig. 4, the outer surface 12 of the pipe wall 10 of the manifold 1 and the outer surface 22 of the pipe wall 20 of the tubular member 2 are cylindrical, and the surface 311 of the first flange portion 310 that faces the manifold and the surface 321 of the second flange portion 320 that faces the tubular member 2 are partially cylindrical.

[0029] According to an embodiment of the present invention, as shown in Fig. 1 to Fig. 4, the connecting pipe assembly 3 is formed by stamping the two ends of a pipe. The thickness of the pipe wall of the connecting pipe is equal to the thickness of the first flange portion and/or the second flange portion. The pipe wall of the connecting pipe has a uniform thickness. It should be noted that since the thickness of a pipe may change slightly during the stamping process, the term "equal" as used herein may be substantially equal. The first flange portion 310 and the second flange portion 320 function as welded parts having curved surfaces that fit the manifold and the tubular member. The inner side of the pipe is provided with a composite layer as solder. Therefore, the tubular member 2 may not have a composite layer, for example. During the brazing process, the composite layer on the surface of the first flange portion 310 and that on the surface of the second flange portion 320 of the connecting pipe assembly 3 are used for welding, which can avoid any weld beading caused by the flow and accumulation of solder in the tubular member 2, which has a composite layer, during the brazing process. A pipe is usually rolled from a sheet of material, and a composite layer is often uniformly attached to the surface of a sheet material when the sheet is formed. According to an embodiment of the present invention, solder is absorbable at the position where the manifold 1 is connected to the heat exchange pipe 5, so weld beading due to the flow and accumulation of solder may not be obvious during the brazing process; for the tubular member 2, since the position where solder is absorbable is limited, if the tubular member 2 contains solder, then weld beading is more likely to occur due to the flow and accumulation of solder during the brazing process.

[0030] By using the heat exchanger 100 according to an embodiment of the present invention, the quality of the heat exchanger 100 may be improved.

[0031] In addition, by using the heat exchanger 100 according to an embodiment of the present invention, the reliability of the weld between the connecting pipe assembly 3 and the manifold 1 and the tubular member 2 may be enhanced, the flow area of the manifold 1 and that of the connecting pipe 30 may be increased, the pressure drop caused by the manifold 1 and the connecting pipe 30 may be reduced, and formation of weld beading on the tubular member 2 is prevented.

[0032] Although the above embodiments have been described, certain features in the above embodiments can be combined to form new embodiments.

Claims

1. A heat exchanger, comprising:

a manifold extending in a first direction, the manifold having a first opening penetrating the pipe wall of the manifold;

a tubular member arranged side by side with the manifold, the tubular member having a second opening penetrating the pipe wall of the tubular member; and

a connecting pipe assembly, wherein the connecting pipe assembly comprises a connecting pipe, the connecting pipe extending in a second direction that intersects with the first direction and being provided with a first end portion and a second end portion which are opposite each other; and a first flange portion and a second flange portion which extend radially outward from the first end portion and the second end portion, respectively,

wherein the surface of the first flange portion that faces the manifold is connected to the outer surface of the pipe wall of the manifold, and the

surface of the second flange portion that faces the tubular member is connected to the outer surface of the pipe wall of the tubular member, so that the manifold and the tubular member are in fluid communication by means of the first opening, the connecting pipe, and the second opening.

2. The heat exchanger as claimed in claim 1, wherein: the surface of the first flange portion that faces the manifold has the same shape as the corresponding part surrounding the first opening of the outer surface of the pipe wall of the manifold, and the surface of the second flange portion that faces the tubular member has the same shape as the corresponding part surrounding the second opening of the outer surface of the pipe wall of the tubular member.

3. The heat exchanger as claimed in claim 1, wherein: an angle between the axis of the manifold and the axis of the tubular member is within the range of 0 degrees to 5 degrees.

4. The heat exchanger as claimed in claim 3, wherein: an angle between the axis of the connecting pipe and the axis of the manifold is within the range of 85 degrees to 90 degrees.

5. The heat exchanger as claimed in claim 1, further comprising:
a plurality of heat exchange pipes connected to and in fluid communication with the manifold, and a plurality of fins arranged alternately with the plurality of heat exchange pipes.

6. The heat exchanger as claimed in claim 5, wherein: the tubular member is a manifold, a distribution header, a collecting header, or a storage tank.

7. The heat exchanger as claimed in claim 1, wherein: the ratio of each of the diameter of the first opening and the diameter of the second opening to the inner diameter of the connecting pipe ranges from 0.95 to 1.05.

8. The heat exchanger as claimed in claim 7, wherein: the inner diameter of the connecting pipe remains the same over its entire length.

9. The heat exchanger as claimed in claim 1, wherein: the axis of the manifold is parallel to the axis of the tubular member, and the axis of the connecting pipe is perpendicular to the axis of the manifold and the axis of the tubular member.

10. The heat exchanger as claimed in claim 1, wherein: the outer surface of the pipe wall of the manifold and the outer surface of the pipe wall of the tubular member are cylindrical, and the surface of the first flange portion that faces the manifold and the surface of the second flange portion that faces the tubular member are partially cylindrical.

11. The heat exchanger as claimed in claim 1, wherein: the connecting pipe assembly is formed from a pipe, wherein the inner side of the pipe is covered with a composite layer that functions as solder.

12. The heat exchanger as claimed in claim 1, wherein: a thickness of the pipe wall of the connecting pipe is equal to a thickness of the first flange portion and/or the second flange portion, and the pipe wall of the connecting pipe has a uniform thickness.

13. The heat exchanger as claimed in claim 1, wherein: the connecting pipe assembly is located on the outer side in a radial direction of the manifold and on the outer side in a radial direction of the tubular member.

14. An air conditioning system, comprising:
the heat exchanger according to any one of claims 1-13.

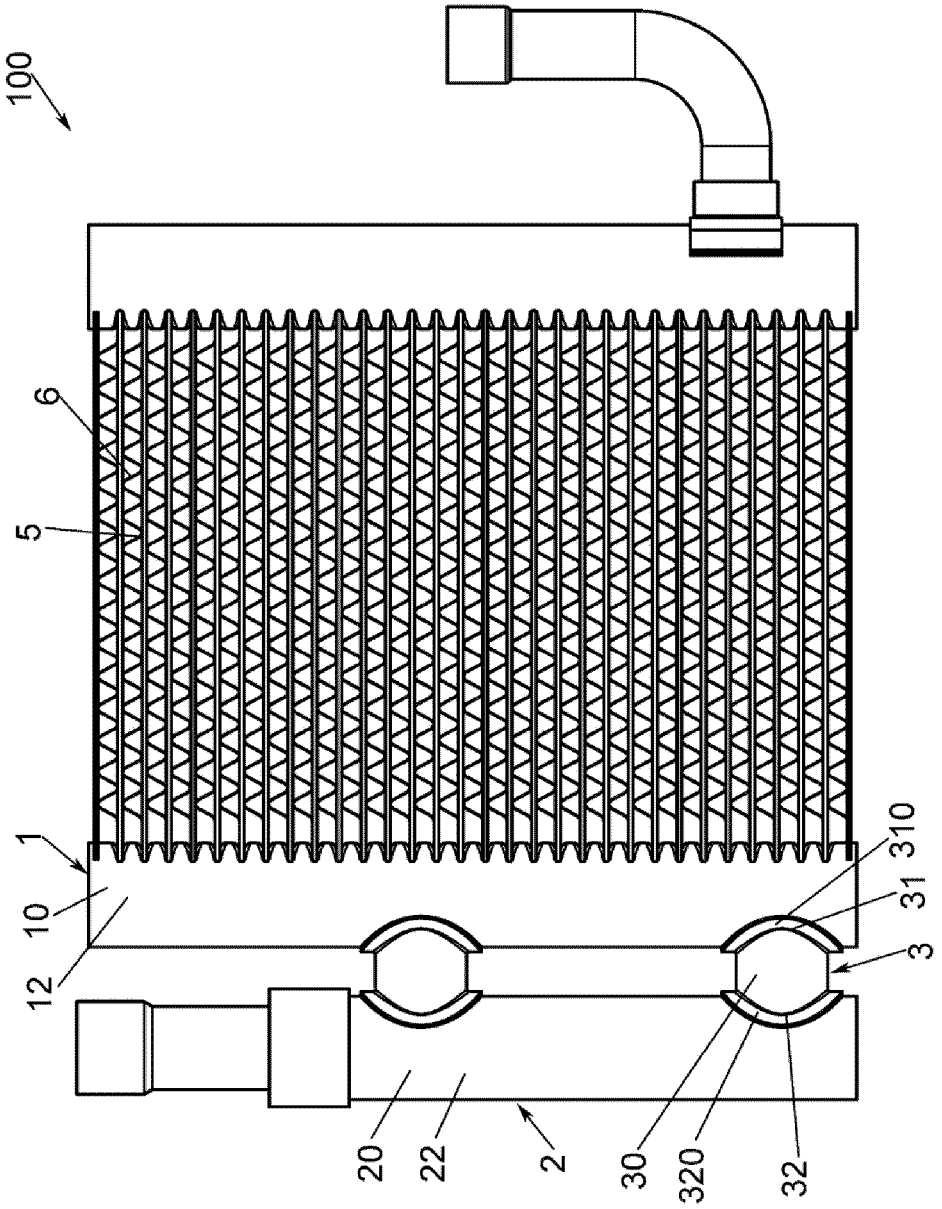

Fig. 1

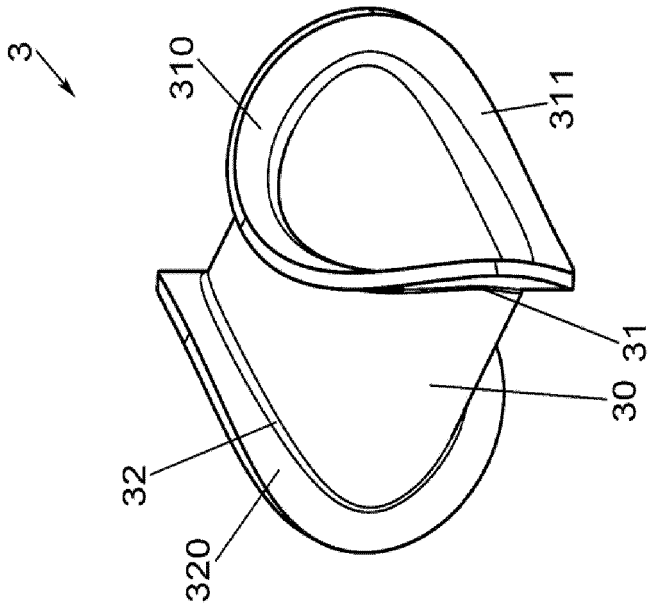

Fig. 3

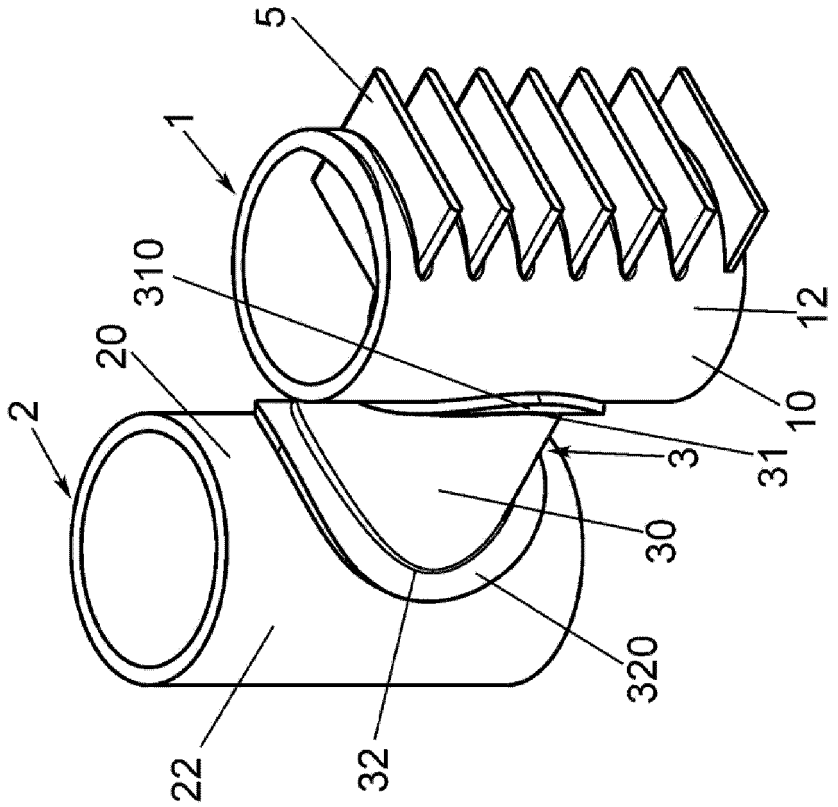

Fig. 2

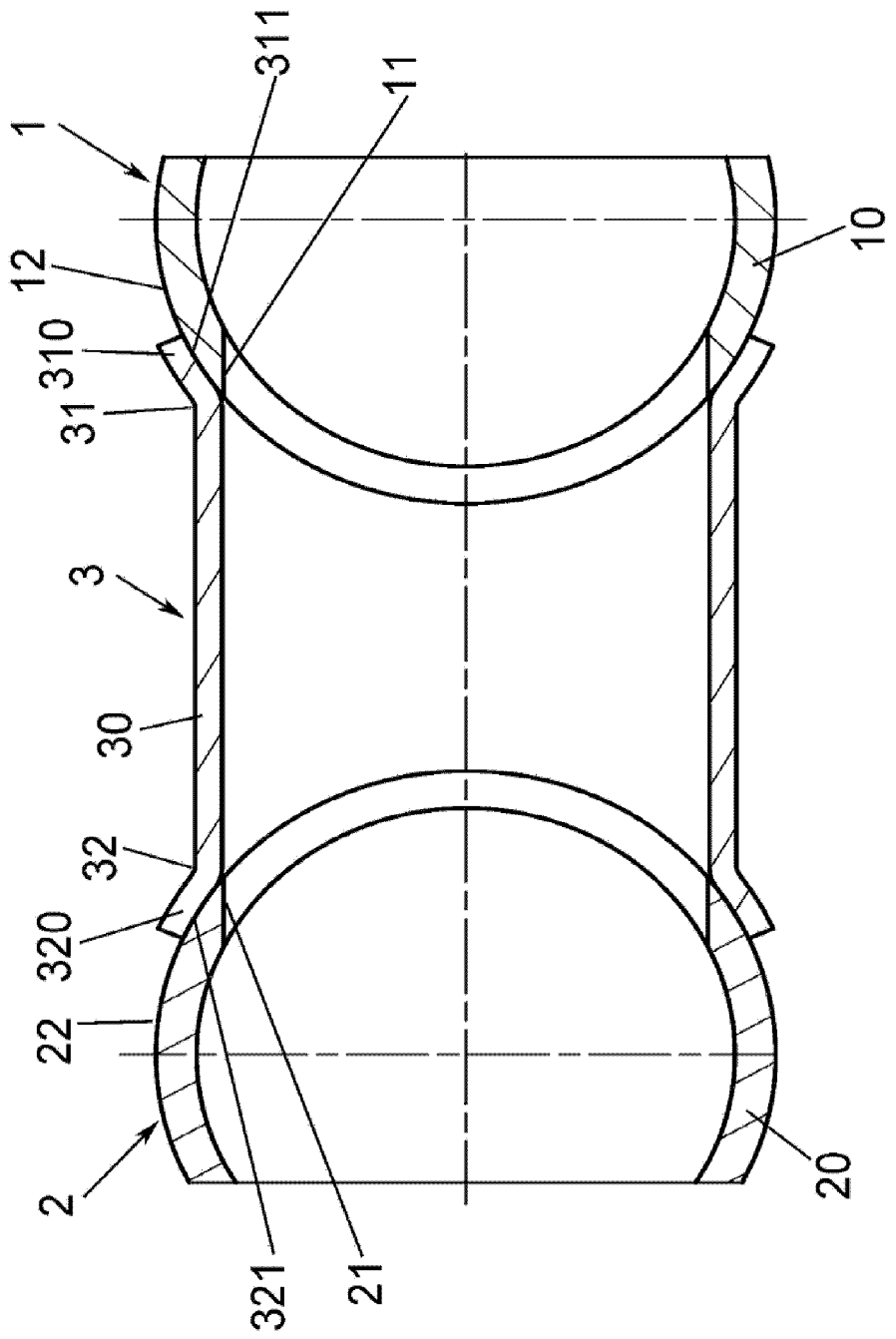

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/135010

A. CLASSIFICATION OF SUBJECT MATTER

F28F 9/26(2006.01)i; F28F 9/02(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)

F28F 9, F28D 1, F25B 39

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)

VEN; CNABS; CNKI: 连接, 贴, 紧密, 凹, 冲压, 焊, junct+, connect+, punch+, concave, dish+, face, close, fillet, weld+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 216845766 U (DANFOSS AS) 28 June 2022 (2022-06-28) claims 1-14	1-14
X	JP 102692 A (ZEXEL CORP.) 06 January 1998 (1998-01-06) description, paragraphs 21-32, and figures 1-5	1-14
A	CN 213067244 U (SANHUA (HANGZHOU) MICRO CHANNEL HEAT EXCHANGER CO., LTD.) 27 April 2021 (2021-04-27) entire document	1-14
A	CN 106813516 A (ZHEJIANG YINLUN MACHINERY CO., LTD.) 09 June 2017 (2017-06-09) entire document	1-14
A	KR 101953666 B1 (DAE JEONG METAL CO., LTD.) 04 March 2019 (2019-03-04) entire document	1-14
A	US 2018164006 A1 (KEIHIN THERMAL TECHNOLOGY CORP.) 14 June 2018 (2018-06-14) entire document	1-14
A	JP 2015117878 A (KEIHIN THERMAL TECHNOLOGY CORP.) 25 June 2015 (2015-06-25) entire document	1-14

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"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
27 December 2022	**11 January 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/135010

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2014052163 A (KEIHIN THERMAL TECHNOLOGY CORP.) 20 March 2014 (2014-03-20) entire document	1-14

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/135010

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CN	216845766	U	28 June 2022	None			
JP	102692	A	06 January 1998	None			
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				CN	204648765	U	16 September 2015
JP	2014052163	A	20 March 2014	None			

Form PCT/ISA/210 (patent family annex) (January 2015)