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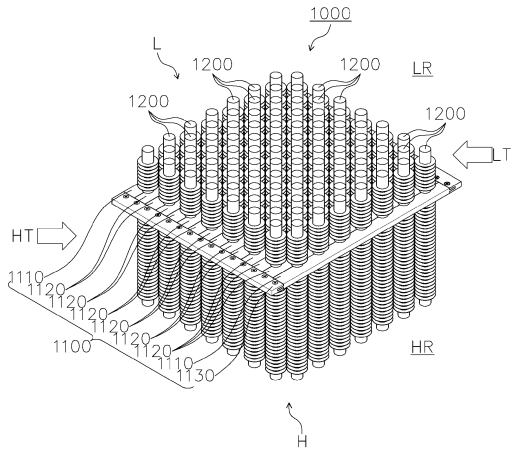
(54) HEAT PIPE HEAT EXCHANGER

(57) According to the present invention, there is provided a heat pipe heat exchanger of the present invention including a high temperature portion formed with a high temperature chamber through which a high temperature fluid flows in and out; a low temperature portion formed with a low temperature chamber through which a low temperature fluid flows in and out; a separation plate installed between the high temperature portion and the low temperature portion to partition the high temperature portion and the low temperature portion; and a plurality of heat exchange units installed to pass through the separation plate and transferring heat from the high temperature portion to the low temperature portion for heat exchange, in which the separating plate includes a pair of first separation portions spaced apart from each other, a plurality of second separation portions disposed between the pair of first separation plates, and a pair of guide rails that slidably support both ends of the first and second separation portions, and are spaced apart from each other, and the plurality of heat exchange portions are inserted and fixed between the first separation portion and the second separation portion, and between the second separation portions adjacent to each other.

[FIG. 3]



EP 4 215 859 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a heat pipe heat exchanger, and more particularly, to a heat pipe heat exchanger for exchanging heat between a high temperature portion and a low temperature portion using a heat pipe.

BACKGROUND

[0002] In general, a heat exchanger is a device for exchanging heat by directly or indirectly contacting two fluids having different temperatures. such a heat exchanger is classified into various types according to an energy transfer method between the two fluids.

[0003] Among various types of heat exchangers, there are a plate type heat exchanger, a radiation fin tube heat exchanger, and a tube heat exchanger as a method for exchanging only energy by separating heat exchange fluids so as not to mix them.

[0004] In particular, in the case of the radiation fin tube heat exchanger (hereinafter referred to as a 'heat pipe heat exchanger') using a heat pipe, it is possible to transfer heat from the high temperature portion to the low temperature portion without requiring additional power, and since it is easy to clean against contamination, the heat pipe heat exchanger is used in various types of heat transfer devices.

[0005] FIG 1 shows an example of a conventional heat pipe heat exchanger 1. As shown, when heat is exchanged using the heat pipe heat exchanger 1, a high temperature gas HT is flowed into a high temperature chamber 4a of a high temperature portion 4 to heat a heat pipe 2, and then discharged to the outside. In addition, a low temperature fluid LT passing through a low temperature chamber 3a of a low temperature portion 3 installed above the high temperature portion 4 exchanges heat with the heat pipe 2 and is then discharged to the outside of the low temperature chamber 3a.

[0006] Here, in order to prevent the high temperature gas HT flowed into the high temperature chamber 4a and the low temperature fluid LT flowed into the low temperature chamber 3a from mixing with each other, a separation plate 5 is installed between the high temperature portion 4 and the low temperature portion 3.

[0007] In the conventional heat pipe heat exchanger 1 as described above, as shown in FIG 2, a coupling portion 2b is formed in the middle of the heat pipe 2 and is screwed to the separation plate 5.

[0008] Meanwhile, the heat pipe 2 couples heat radiation fins 2a to expand a heat exchange area.

[0009] However, in order to couple the heat pipe 2 and the separation plate 5, the heat pipe 2 has to be inserted into the separation plate 5 from the high temperature part 4 side to the low temperature part 3 side or from the low temperature part 3 side to the high temperature part 4 side. For this reason, the heat radiation fins 2a cannot be coupled to a portion of the heat pipe 2 which is inserted and the heat radiation fins 2a can be coupled to only a portion thereof which is not inserted.

[0010] Therefore, in the conventional heat pipe heat exchanger 1, because of the assembly of the heat pipe 2, the heat radiation fins 2a for expanding the heat exchange area can be formed on only one selected side of the low temperature portion side and the high temperature portion side, and consequently, there is a problem that the heat exchange efficiency is reduced.

[0011] As prior art for the present invention, Korean Patent Laid-Open Publication No. 10-2016-0138720 (title of the invention: modular heat exchanger) can be exemplified.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0012] The present invention has been created to solve the above problems, and an object of the present invention is to provide a heat pipe heat exchanger implemented to improve heat exchange performance by coupling heat radiation fins for expanding a heat exchange area of a heat pipe to both sides of a high temperature portion and a low temperature portion.

TECHNICAL SOLUTION

[0013] A heat pipe heat exchanger of the present invention includes a high temperature portion formed with a high temperature chamber through which a high temperature fluid flows in and out; a low temperature portion formed with a low temperature chamber through which a low temperature fluid flows in and out; a separation plate installed between the high temperature portion and the low temperature portion to partition the high temperature portion and the low temperature portion; and a plurality of heat exchange units installed to pass through the separation plate and transferring heat from the high temperature portion to the low temperature portion for heat exchange, in which the separating plate includes a pair of first separation portions spaced apart from each other, a plurality of second separation portions disposed between the pair of first separation plates, and a pair of guide rails that slidably support both ends of the first and second separation portions, and are spaced apart from each other, and the plurality of heat exchange portions are inserted and fixed between the first separation portion and the second separation portion, and between the second separation portions adjacent to each other.

[0014] The heat exchange unit may include a heat pipe, a high temperature radiation fin disposed in the high temperature portion and coupled to an outer circumferential surface of the heat pipe to expand a heat exchange area, and a low temperature radiation fin disposed in the low temperature portion and coupled to the outer circum-

ferential surface of the heat pipe to expand a heat exchange area.

[0015] The pair of first separation portions may be formed with a plurality of semicircular first insertion grooves into which the heat pipes are inserted, the plurality of second separation portions may be formed with a plurality of semicircular second insertion grooves into which the heat pipes are inserted, side by side on both sides in a width direction, and the heat pipe may be inserted and fixed between the first insertion groove and the second insertion groove, and between the second insertion grooves adjacent to each other. Here, it is preferable that the second insertion grooves are disposed to be staggered from each other rather than side by side along the width direction.

[0016] In the heat pipe, a portion exposed between the high temperature radiation fin and the low temperature radiation fin may be inserted and fixed between the first insertion groove and the second insertion groove, and between the second insertion grooves adjacent to each other.

[0017] On the other hand, in the guide rail, a guide groove may be formed for guiding ends of the first separation portion and the second separation portion to slide. In addition, the first separation portion may include a first plate in which the plurality of first insertion grooves are formed, and a pair of first slide portions respectively protruding from both ends of the first plate and slidably installed in the guide groove. Here, the first slide portion and the guide rail may be coupled by bolt.

[0018] In addition, the second separation portion may include a second plate on which the plurality of second insertion grooves are formed, and a pair of second slide portions respectively protruding from both ends of the second plate and slidably installed in the guide groove. Here, the second slide portion and the guide rail may be coupled by bolt.

[0019] The heat pipe heat exchanger of the present invention described above may further include a plurality of sealing members interposed between the first and second separation portions, and the heat exchange unit to maintain airtightness between the low temperature portion and the high temperature portion, in which in the first and second separation portions, sealing grooves into which the sealing member is inserted may be respectively formed on an insertion surface of the heat exchange unit. Here, the sealing member may be a line O-ring.

ADVANTAGEOUS EFFECTS

[0020] According to the heat pipe heat exchanger of the present invention, since the first and second separation portions that can be separated and coupled to each other in order to separate the high temperature portion and the low temperature portion, even if the heat radiation fins for expanding the heat exchange area are coupled to both the high temperature portion and the low temperature portion of the heat pipe, the separation plate and the heat pipe can be easily coupled. In this way, the heat exchange efficiency can be improved by expanding the heat exchange area to both the high temperature portion and the low temperature portion of the heat pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG 1 is a view showing an example of a conventional heat pipe heat exchanger,
FIG 2 is a perspective view of a heat pipe applied to FIG 1,
FIG 3 is a perspective view of coupling of a heat pipe heat exchanger according to an example of the present invention,
FIG 4 is a plan view of FIG 3,
FIG 5 is a perspective view showing a heat exchange unit shown in FIG 3,
FIG 6 is a perspective view showing a first separation portion of a separation plate shown in FIG 3,
FIG 7 is a perspective view showing a second separation portion of the separation plate shown in FIG 3
FIG 8 is a perspective view showing a guide rail of the separation plate shown in FIG 3, and
FIGS. 9 to 13 are perspective views sequentially explaining for an assembling process of the heat exchange unit and the separation plate in the heat pipe heat exchanger shown in FIG 3.

BEST MODE FOR INVENTION

[0022] Although the present invention has been described with reference to the examples shown in the drawings, this is only exemplary, and those skilled in the art will understand that various modifications and equivalent other examples are possible therefrom. Therefore, the true technical scope of protection of the present invention has to be determined by the technical spirit of the appended claims.

[0023] Hereinafter, a heat pipe heat exchanger according to an example of the present invention will be described in detail with reference to the accompanying drawings.

[0024] FIG 3 is a perspective view of coupling of a heat pipe heat exchanger according to an example of the present invention, and FIG 4 is a plan view of FIG 3.

[0025] Referring to the drawings, a heat pipe heat exchanger 1000 of the present invention includes a high temperature portion H, a low temperature portion L, a separation plate 1100, and a heat exchange portion 1200.

[0026] A high temperature chamber HR is formed in the high temperature portion H, and a high temperature fluid HT such as hot gas flows in and out of the high temperature chamber HR.

[0027] A low temperature chamber LR is formed in the low temperature portion L, and a low temperature fluid

LT such as water flows in and out of the low temperature chamber LR.

[0028] The separation plate 1100 is installed between the high temperature portion H and the low temperature portion L to separate and partition the high temperature portion H and the low temperature portion L.

[0029] The heat exchange portion 1200 transfers heat from the high temperature portion H to the low temperature portion L. FIG 5 is a perspective view showing such a heat exchange unit 1200.

[0030] As shown, the heat exchange unit 1200 includes a heat pipe 1210, high temperature radiation fins 1230 disposed in the high temperature portion H, and low temperature radiation fins 1220 disposed in the low temperature portion L.

[0031] The heat pipe 1210 is generally made by vacuuming an inside of a metal pipe and adding a small amount of refrigerant. The refrigerant (typically water) is determined according to a temperature to be used, and the refrigerant. a metal (usually copper) that does not react with the refrigerant is selected according to the refrigerant to make the pipe. When the temperature difference between a heating portion and a cooling portion at both ends of the heat pipe 1210 occurs, the refrigerant in the heat pipe 1210 convects both ends of the heat pipe 1210 while holding the heat, thereby transferring heat.

[0032] The high temperature radiation fins 1230 and the low temperature radiation fins 1220 are coupled to an outer circumferential surface of the heat pipe 1210 to expand a heat exchange area. Here, the high temperature radiation fins 1230 and the low temperature radiation fins 1220 may be made into an annular shape as shown, but this is exemplary and does not limit the shape thereof.

[0033] Hereinafter, the separation plate 1100 partitioning the high temperature portion H and the low temperature portion L will be described in detail with reference to the drawings, and an assembling process of the separation plate 1100 and the heat exchange portion 1200 will be described.

[0034] FIG 6 is a perspective view showing a first separation portion 1110 of the separation plate 1100 shown in FIG 3, FIG 7 is a perspective view showing a second separation portion 1120 of the separation plate 1100 shown in FIG 3, and FIG 8 is a perspective view showing a guide rail 1130 of the separation plate 1100 shown in FIG 3. In addition, FIGS. 9 to 13 are perspective views sequentially explaining for the assembling process of the heat exchange unit 1200 and the separation plate 1100 in the heat pipe heat exchanger 1000 shown in FIG 3.

[0035] Referring to the drawings, the separation plate 1100 includes a pair of first separation portions 1110, a plurality of second separation portions 1120, and a pair of guide rails 1130.

[0036] The pair of first separation plates 1110 are spaced apart from each other. Each of the first separation plates 1110 may include a first plate 1111 on which a plurality of first insertion grooves 1111a are formed, and a pair of first slide portions 1112 protruding from both ends of the first plate 1111, respectively. Here, the first insertion grooves 1111a have a semicircular shape and one side of the heat pipe 1210 is inserted thereto.

[0037] The plurality of second separation plates 1120 are disposed between the pair of first separation plates 1110 spaced apart from each other. In addition, each of the second separation plates 1120 may include a second plate 1121 having a plurality of second insertion grooves 1121a formed thereon, and a pair of second slide portions 1121a protruding from both ends of the second plate 1121, respectively. Here, the second insertion grooves 1121a have a semicircular shape and the other side of the heat pipe 1210 is inserted thereto. In addition, these second insertion grooves 1121a are formed side by side on both sides in a width direction.

[0038] The pair of guide rails 1130 are spaced apart from each other to slidably support both ends of the first and second separation plates 1110 and 1120. To this end, guide grooves 1130a are formed to slidably guide both ends of the first and second separation plates 1110 and 1120. That is, the first slide portion 1112 of the first separation portion 1110 and the second slide portion 1122 of the second separation portion 1120 slide along the guide groove 1130a.

[0039] In the structure of the separation plate 1100 as described above, the heat exchange unit 1200 is inserted and fixed between the first insertion groove 1111a and the second insertion groove 1121a, and between the second insertion grooves 1121a adjacent to each other. More specifically, an exposed portion of the heat pipe 1210 is inserted and fixed between the high temperature radiation fin 1230 and the low temperature radiation fin 1220 in the heat exchange unit 1200.

[0040] In order to form grooves or holes for inserting and fixing the heat pipe 1210, the first insertion groove 1111a and the second insertion groove 1121a have to be formed at positions corresponding to each other. In addition, it is preferable that the second insertion grooves 1121a are not parallel to each other in the width direction, but are staggered from each other. Accordingly, the heat exchange unit 1200 is evenly distributed throughout the high temperature chamber HR and the low temperature chamber LR, so that overall heat exchange efficiency can be improved.

[0041] Meanwhile, in order to maintain airtightness between the low temperature portion L and the high temperature portion H, a sealing member 1300 may be intervened between the first separation portion 1110, the second separation portion 1120, and the heat exchange unit 1200. To this end, in the first separation portion 1110 and the second separation portion 1120, sealing grooves 1111b and 1121b into which the sealing members 1300 are inserted may be respectively formed on an insertion surface of the heat exchange unit 1200. A line O-ring may be used as the sealing member 1300, but its structure or material is not limited.

[0042] Hereinafter, the assembling process of the heat exchange unit 1200 and the separation plate 1100 in the

heat pipe heat exchanger 1000 according to the present invention will be sequentially described with reference to FIGS. 9 to 13.

[0043] First, as shown in FIG 9, the first separation portion 1110 is fixedly installed to the pair of guide rails 1130. To this end, the first slide portion 1112 of the first separation portion 1110 is slid along the guide groove 1130a of the guide rail 1130. Then, the first slide portion 1112 and the guide rail 1130 are fixed. As shown, the first slide portion 1112 and the guide rail 1130 may be fixed by bolt coupling, but this is exemplary and may be fixed through other fastening methods.

[0044] When the first separation portion 1110 is fixed, the sealing member 1300 such as a line O-ring is inserted into the sealing groove 1111b of the first separation portion 1110.

[0045] Next, as shown in FIG 10, one side surface of a portion of the heat pipe 1210 exposed between the high temperature radiation fin 1230 and the low temperature radiation fin 1220 is inserted into the first insertion groove 1111a of the first separation portion 1110.

[0046] Next, the second slide portion 1122 of the second separation portion 1120 in which the sealing member 1300 is inserted into the sealing groove 1121b is slid into the guide groove 1130a of the guide rail 1130. Accordingly, the other surface of the heat pipe 1210, one side of which is inserted into the first insertion groove 1111a of the first separation portion 1110, is inserted into the second insertion groove 1121a formed on one side of the second separation portion 1120.

[0047] When the heat pipe 1210 is inserted between the first insertion groove 1111a and the second insertion groove 1121a, the second slide portion 1122 and the guide rail 1130 are fixed. Here, as shown in FIG 11, the second slide portion 1122 and the guide rail 1130 may be fixed by bolt coupling, but the fixing method is not limited.

[0048] Next, as shown in FIG 12, the sealing member 1300 is inserted into the sealing groove 1121b of the second separation portion 1120. Then, one side of other heat pipes 1210 is inserted into the second insertion groove 1121a formed on the other side of the second separation portion 1120.

[0049] Next, the second slide portion 1122 of the second separation portion 1120 in which the sealing member 1300 is inserted into the sealing groove 1121b is slid into the guide groove 1130a of the guide rail 1130. Accordingly, the other side of the heat pipe 1210 inserted into the second insertion groove 1121a of the second separation portion 1120 adjacent to one side thereof is inserted. In a state where the heat pipes 1210 are inserted into the second insertion grooves 1121a of the adjacent second separation plates 1120 as described above, they are fixed to the guide rails 1130 using bolts or the like.

[0050] After repeating the assembling process of the heat exchange unit 1200 and the second separation portion 1120 as described above, and finally assembling the first separation portion 1110, the assembly of the separation plate 1200 and the heat exchange unit 1200 is completed.

[0051] As described above, according to the heat pipe heat exchanger 1000 of the present invention, since the first and second separation portions 1110 and 1120 that can be separated and coupled to each other in order to separate the high temperature portion H and the low temperature portion L, even if the heat radiation fins 1220 and 1230 for expanding the heat exchange area are coupled to both the high temperature portion H and the low temperature portion L of the heat pipe 1210, the separation plate 1100 and the heat pipe 1210 can be easily coupled. In this way, the heat exchange efficiency can be improved by expanding the heat exchange area to both the high temperature portion and the low temperature portion of the heat pipe 1210.

Claims

1. A heat pipe heat exchanger comprising:

a high temperature portion formed with a high temperature chamber through which a high temperature fluid flows in and out;
a low temperature portion formed with a low temperature chamber through which a low temperature fluid flows in and out;
a separation plate installed between the high temperature portion and the low temperature portion to partition the high temperature portion and the low temperature portion; and
a plurality of heat exchange units installed to pass through the separation plate and transferring heat from the high temperature portion to the low temperature portion for heat exchange,
wherein the separating plate includes
a pair of first separation portions spaced apart from each other,
a plurality of second separation portions disposed between the pair of first separation plates, and
a pair of guide rails that slidably support both ends of the first and second separation portions, and are spaced apart from each other, and
the plurality of heat exchange portions are inserted and fixed between the first separation portion and the second separation portion, and between the second separation portions adjacent to each other.

2. The heat pipe heat exchanger of claim 1, wherein the heat exchange unit includes

a heat pipe,
a high temperature radiation fin disposed in the high temperature portion and coupled to an outer circumferential surface of the heat pipe to ex-

pand a heat exchange area, and
a low temperature radiation fin disposed in the low temperature portion and coupled to the outer circumferential surface of the heat pipe to expand a heat exchange area.

3. The heat pipe heat exchanger of claim 2, wherein the pair of first separation portions are formed with a plurality of semicircular first insertion grooves into which the heat pipes are inserted,

the plurality of second separation portions are formed with a plurality of semicircular second insertion grooves into which the heat pipes are inserted, side by side on both sides in a width direction, and
the heat pipe is inserted and fixed between the first insertion groove and the second insertion groove, and between the second insertion grooves adjacent to each other.

4. The heat pipe heat exchanger of claim 3, wherein the second insertion grooves are disposed to be staggered from each other rather than side by side along the width direction.

5. The heat pipe heat exchanger of claim 3, wherein in the heat pipe,
a portion exposed between the high temperature radiation fin and the low temperature radiation fin is inserted and fixed between the first insertion groove and the second insertion groove, and between the second insertion grooves adjacent to each other.

6. The heat pipe heat exchanger of claim 3, wherein in the guide rail,
a guide groove is formed for guiding ends of the first separation portion and the second separation portion to slide.

7. The heat pipe heat exchanger claim 6, wherein the first separation portion includes

a first plate in which the plurality of first insertion grooves are formed, and
a pair of first slide portions respectively protruding from both ends of the first plate and slidably installed in the guide groove.

8. The heat pipe heat exchanger of claim 7, wherein the first slide portion and the guide rail are coupled by bolt.

9. The heat pipe heat exchanger of claim 6, wherein the second separation portion includes

a second plate on which the plurality of second insertion grooves are formed, and
a pair of second slide portions respectively protruding from both ends of the second plate and slidably installed in the guide groove.

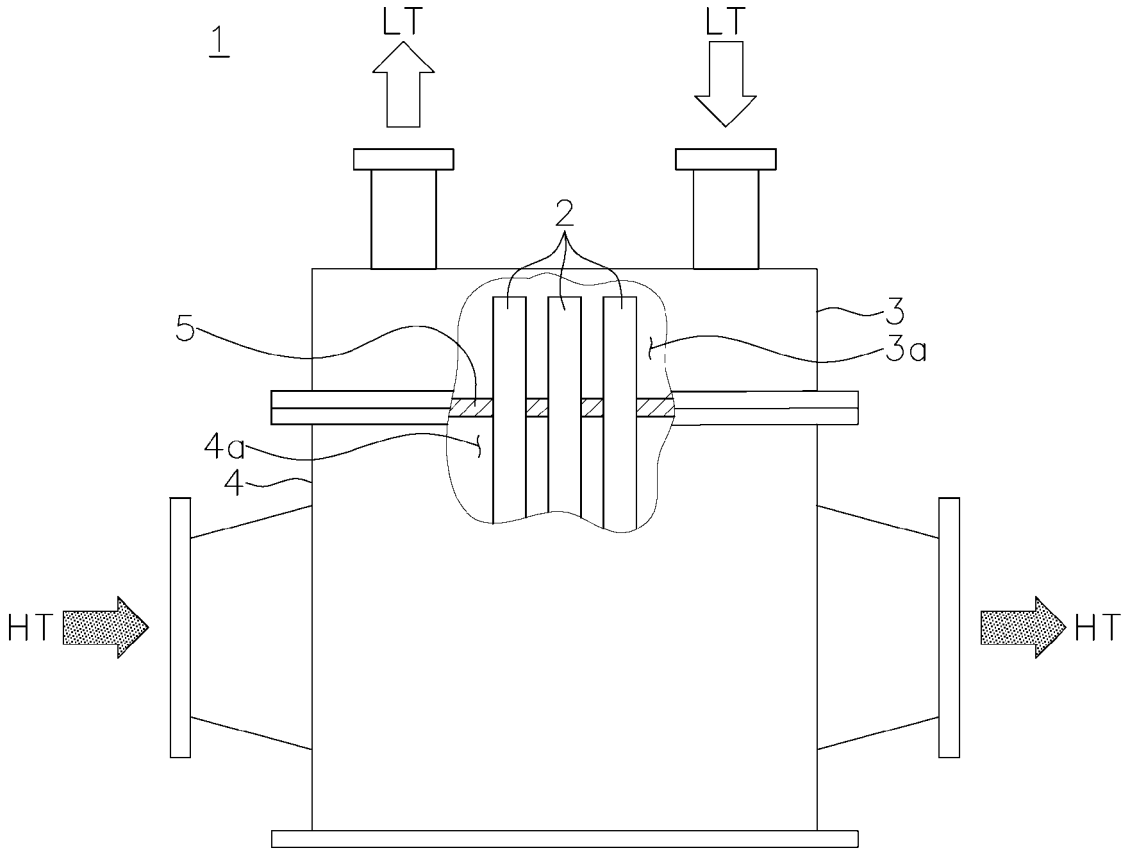
10. The heat pipe heat exchanger of claim 9, wherein the second slide portion and the guide rail are coupled by bolt.

11. The heat pipe heat exchanger of any one of claims 1 to 10, further comprising:

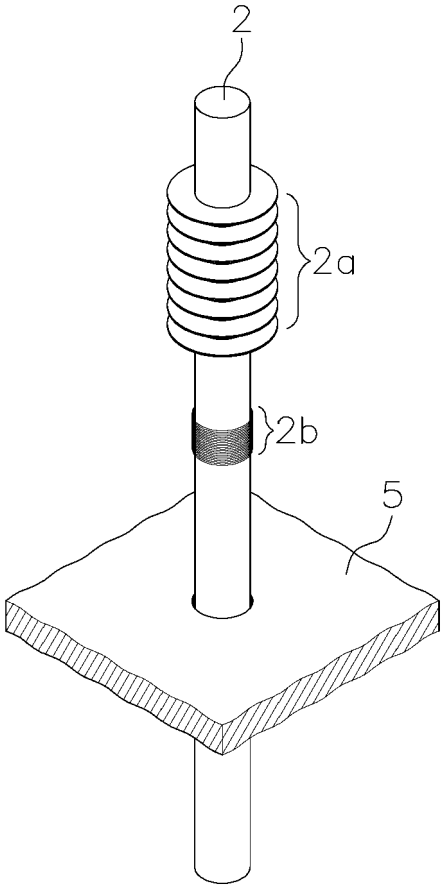
a plurality of sealing members interposed between the first and second separation portions, and the heat exchange unit to maintain airtightness between the low temperature portion and the high temperature portion,
wherein in the first and second separation portions, sealing grooves into which the sealing member is inserted are respectively formed on an insertion surface of the heat exchange unit.

12. The heat pipe heat exchanger of claim 11, wherein the sealing member is a line O-ring.

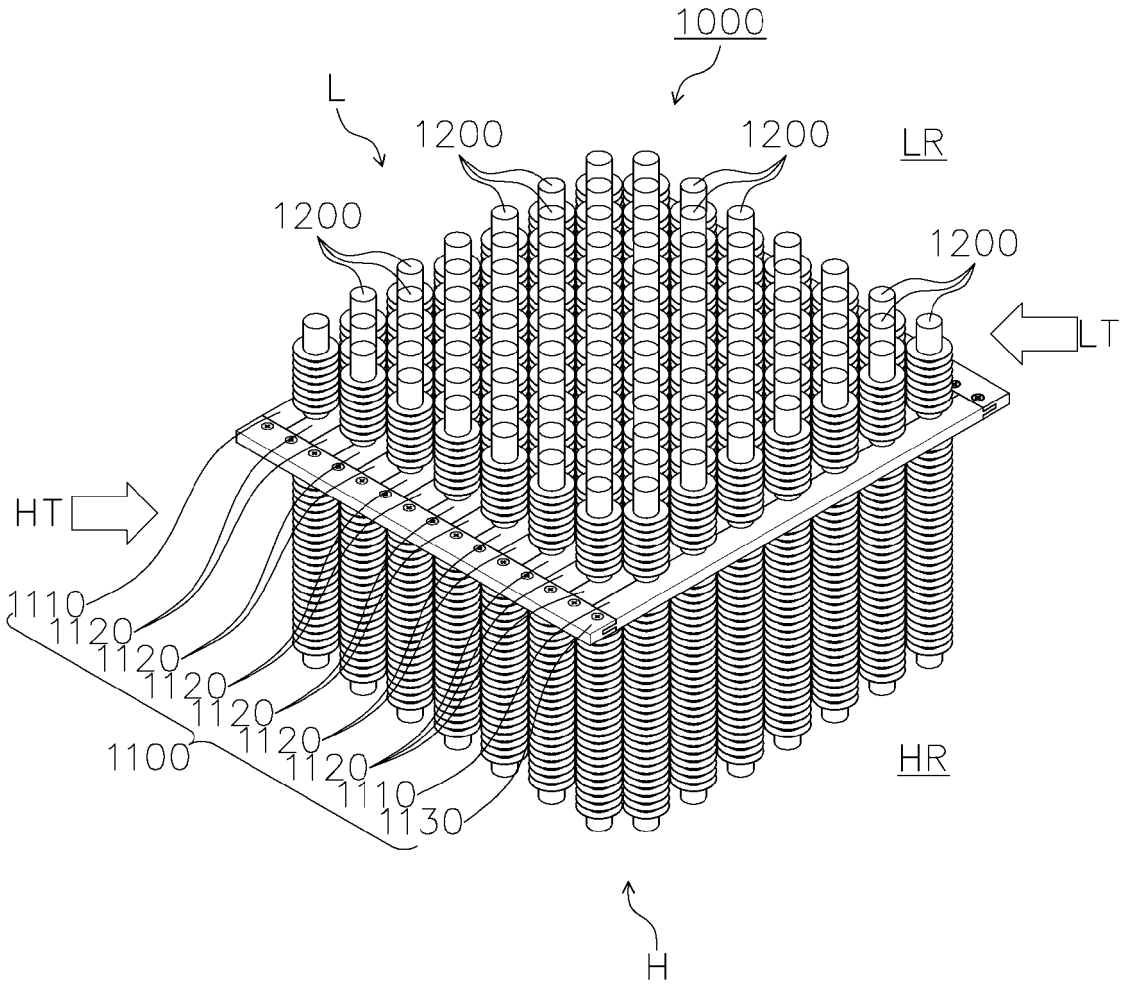
[FIG. 1]



[FIG. 2]



[FIG. 3]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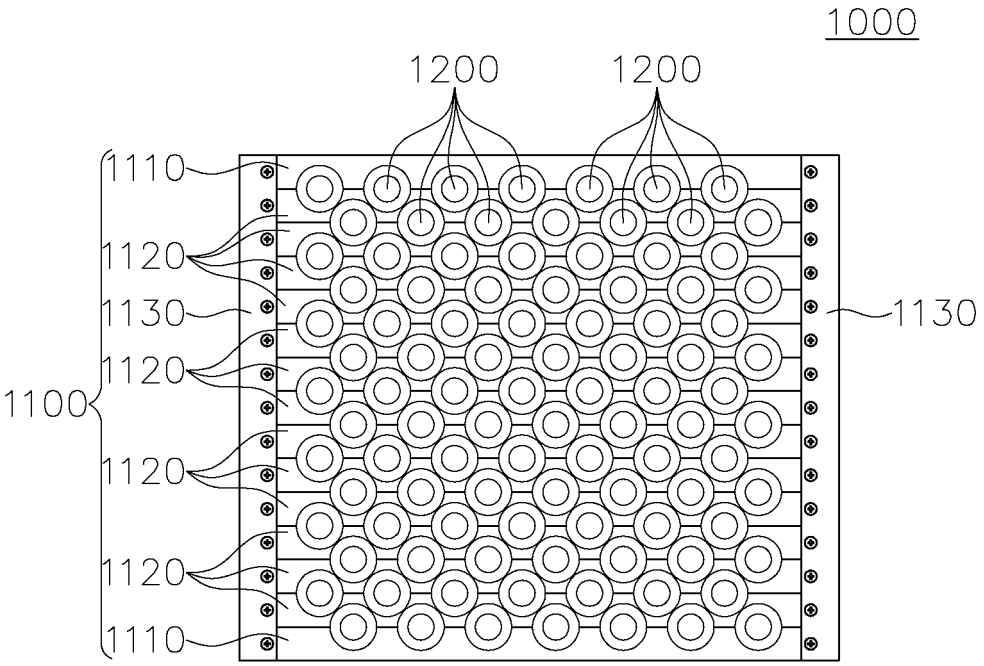
H

[FIG. 4]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1200
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1110
1120
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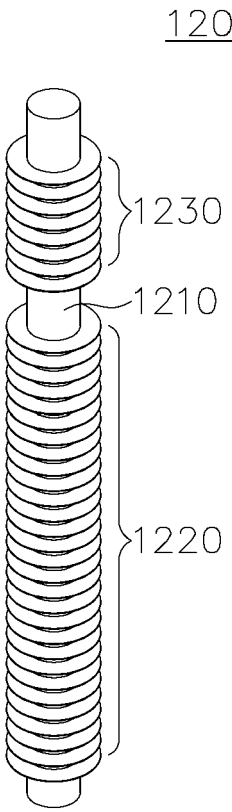
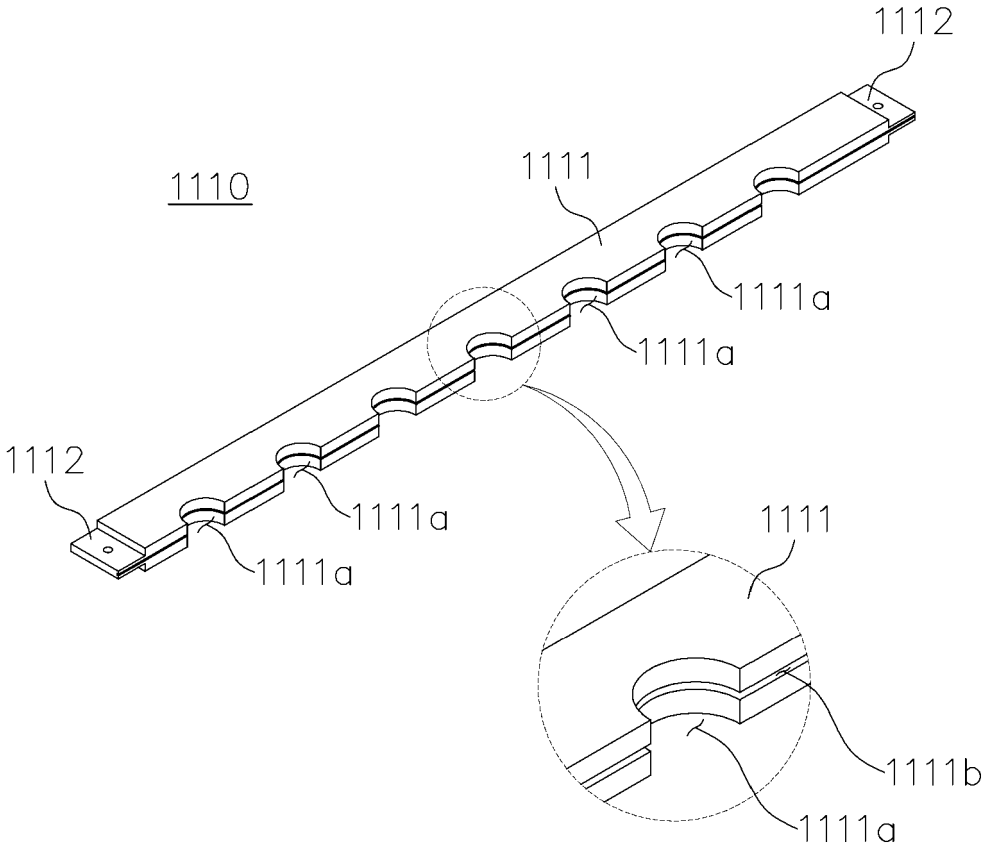
1100
1120
1120
1110
1130

[FIG. 5]


1200
1230
1210
1220

[FIG. 6]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1110
1111
1111a
1111a
1112
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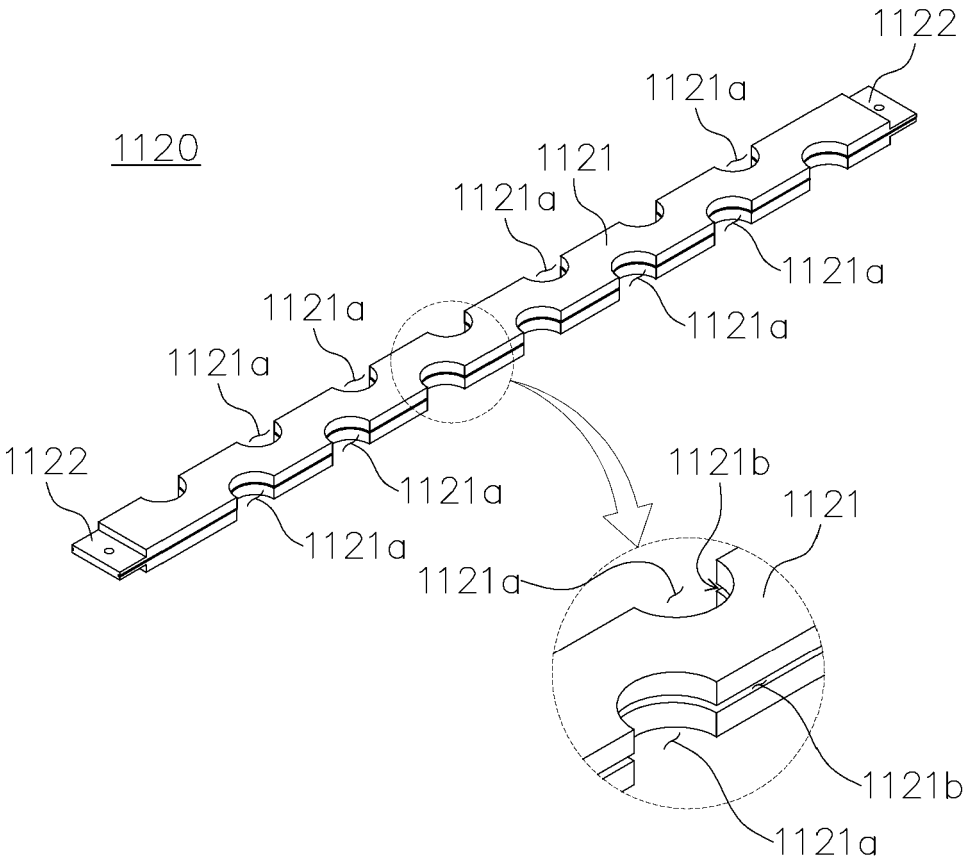
1111a
1111
1111b
1111a

[FIG. 7]


1122
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1120
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1121a
1121a
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1121b
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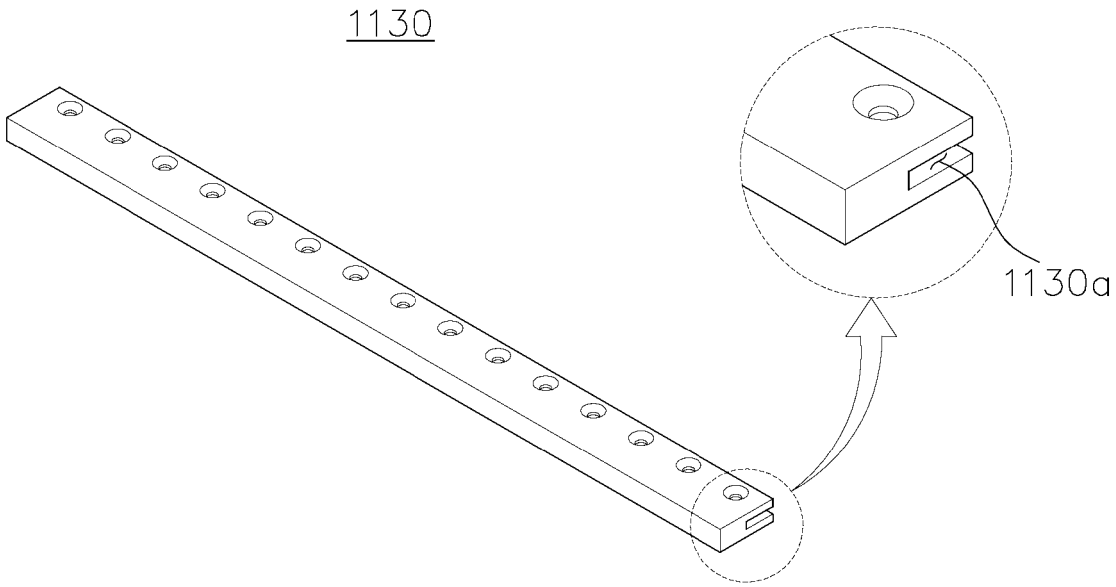
1121b
1121a

[FIG. 8]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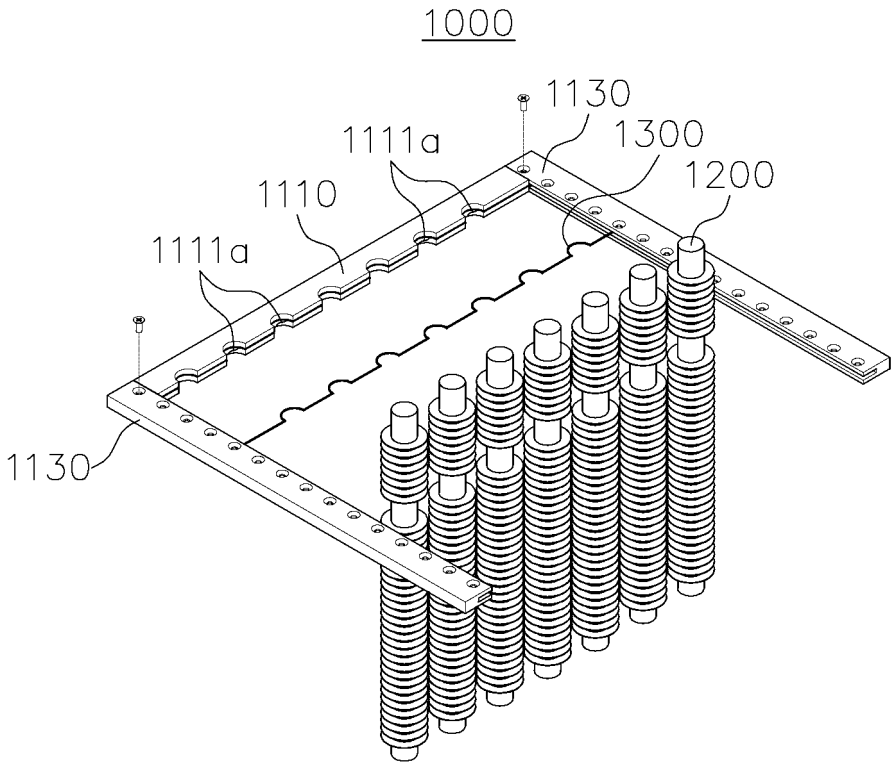
[FIG. 9]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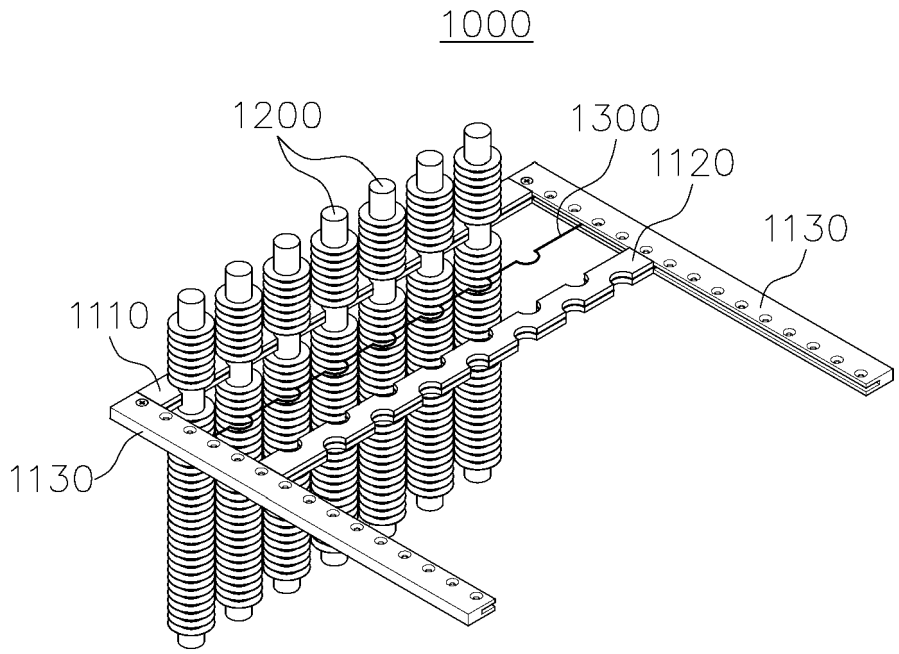
[FIG. 10]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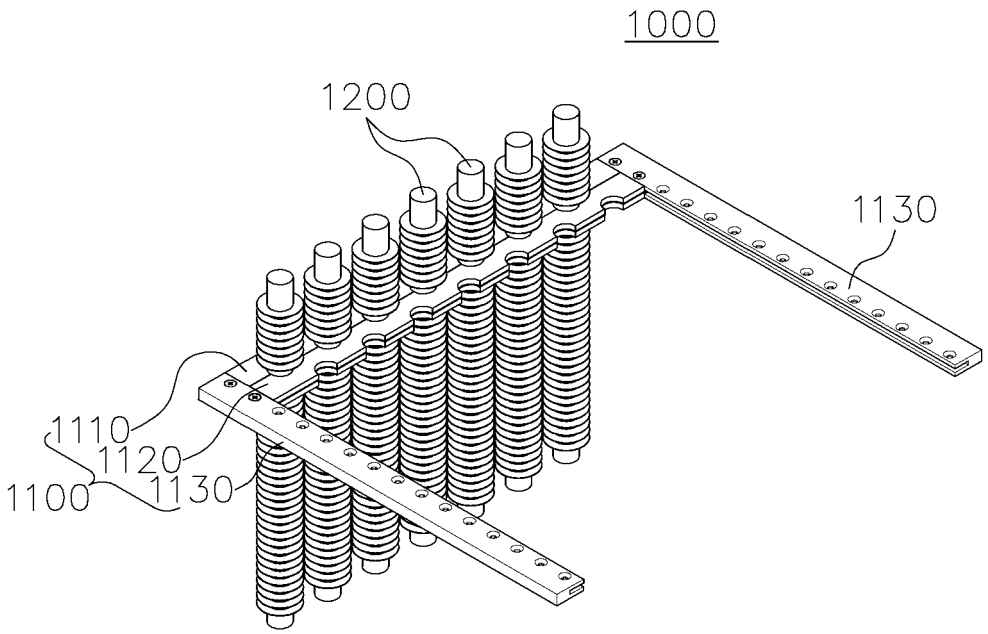
[FIG. 11]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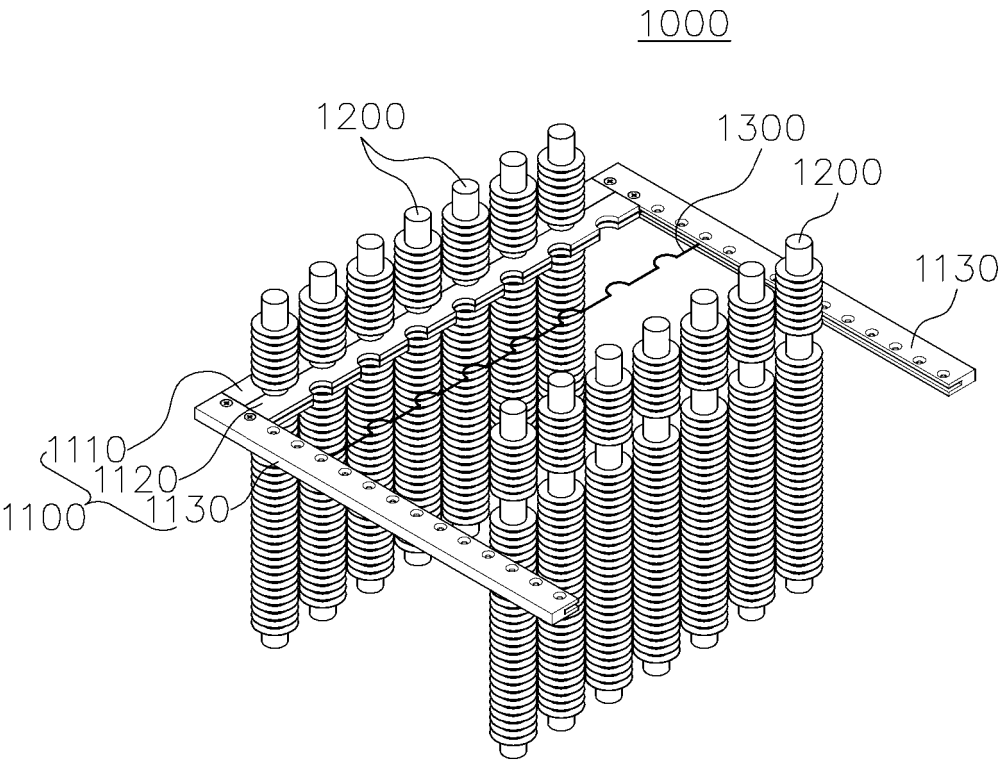
[FIG. 12]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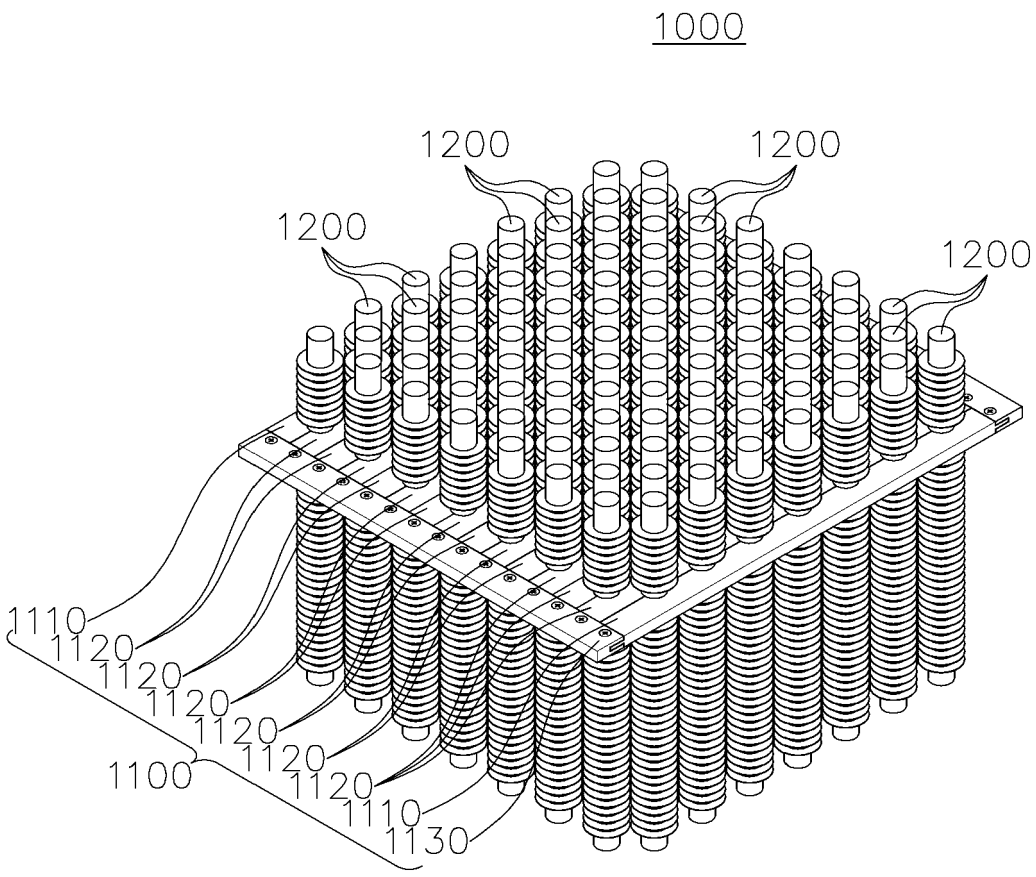
[FIG. 13]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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2022/017312

A. CLASSIFICATION OF SUBJECT MATTER

F28D 7/00(2006.01)i; **F28D 15/02**(2006.01)i; **F28F 1/28**(2006.01)i; **F28F 13/00**(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)

F28D 7/00(2006.01); B23K 1/00(2006.01); F25B 21/02(2006.01); F28D 15/00(2006.01); F28D 15/02(2006.01)

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

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 히트파이프(heat pipe), 열교환기(heat exchanger), 분리(division), 슬라이드(slide), 오링(O-ring)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-235291 A (MITSUBISHI ELECTRIC CORP.) 31 August 2001 (2001-08-31) See paragraphs [0002]-[0003] and figures 22-23.	1-12
Y	JP 2002-188894 A (FUJINE SANGYO K.K.) 05 July 2002 (2002-07-05) See paragraphs [0019]-[0028] and figures 1-5.	1-12
Y	US 4098326 A (WATERS, E. Dale) 04 July 1978 (1978-07-04) See column 4, line 67 - column 5, line 36 and figures 4-6.	11,12
A	JP 2006-308111 A (SHOWA DENKO K.K.) 09 November 2006 (2006-11-09) See paragraphs [0032]-[0039] and figures 1-5.	1-12
A	KR 10-2015-0080255 A (KBAUTOTECH CO., LTD.) 09 July 2015 (2015-07-09) See paragraphs [0025]-[0031] and figures 1-2.	1-12

☐ 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
"D" document cited by the applicant in the international application
"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
26 January 2023	**31 January 2023**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208**	
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2022/017312

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2001-235291 A	31 August 2001	JP 3919998 B2	30 May 2007
JP 2002-188894 A	05 July 2002	None	
US 4098326 A	04 July 1978	US 4184862 A	22 January 1980
JP 2006-308111 A	09 November 2006	None	
KR 10-2015-0080255 A	09 July 2015	None	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020160138720 **[0011]**