



(11) **EP 3 581 868 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.12.2019 Bulletin 2019/51

(51) Int Cl.:
F28D 1/053 (2006.01)

(21) Application number: **19179799.2**

(22) Date of filing: **12.06.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **mitsubishi heavy industries thermal systems, ltd.**
108-8215 Tokyo (JP)

(72) Inventors:
• **matsumoto, Kohei**
TOKYO, 108-8215 (JP)
• **KOSAKA, Masatomo**
TOKYO, 108-8215 (JP)

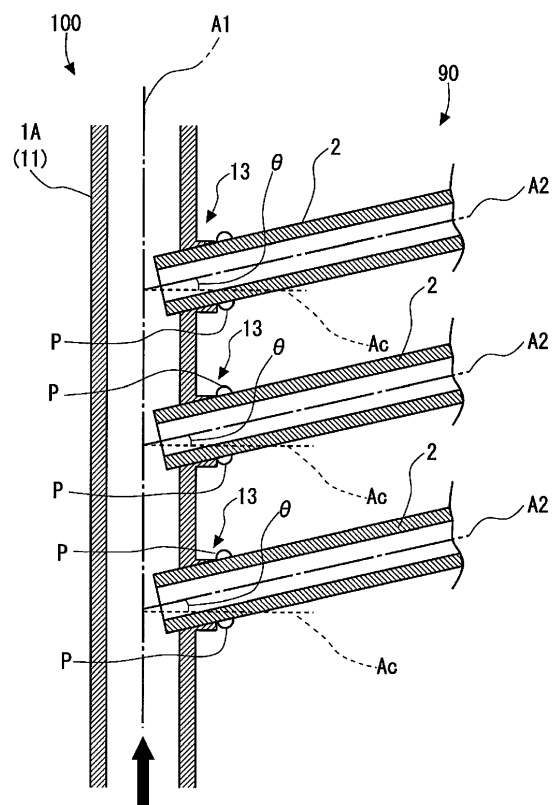
(30) Priority: **15.06.2018 JP 2018114765**

(74) Representative: **Cabinet Beau de Loménie**
158, rue de l'Université
75340 Paris Cedex 07 (FR)

(54) **WATER HEAT EXCHANGER AND GAS COOLER**

(57) A water heat exchanger (90) is provided with a header (1) including a tubular header main body (11) extending in a direction of a first axis (A1) and through which water flows toward a first side in the direction of the first axis (A1); and a tubular heat transfer pipe (2) which is installed on the header main body (11) so as to be inserted from an outer peripheral surface of the header main body (11) into the header (1), and which extends along a second axis (A2) inclined so as to approach a second side in the direction of the first axis (A1) as it goes further from the outer peripheral surface of the header main body (11) outward.

FIG. 2



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a water heat exchanger and a gas cooler.

Description of Related Art

[0002] As an example of a heat exchanger, the heat exchanger described in Japanese Unexamined Patent Application, First Publication No. 2012-21682 includes a pair of first headers and a pair of second headers formed in a cylindrical shape, a plurality of first heat transfer pipes which connect the pair of first headers to each other, and a second heat transfer pipe which connects the pair of second headers to each other. The plurality of first heat transfer pipes are arranged to be spaced apart from each other between the paired first headers. Similarly, the plurality of second heat transfer pipes are arranged to be spaced apart from each other between the paired second headers. Holes for inserting the first heat transfer pipes and the second heat transfer pipes are formed on outer peripheral surfaces of the first headers and the second headers. End portions of the first heat transfer pipes and end portions of the second heat transfer pipes slightly protrude into spaces inside the first headers and the second headers. When the first heat transfer pipes is in contact with the second heat transfer pipes, a heat exchange is performed between the fluids flowing inside the first heat transfer pipes and the second heat transfer pipes.

[0003] Here, in the heat exchanger described in Japanese Unexamined Patent Application, First Publication No. 2012-21682, the end portions (insertion portions) of the first heat transfer pipes and the second heat transfer pipes are exposed inside the first headers and the second headers. Furthermore, the first heat transfer pipes and the second heat transfer pipes are inserted in a direction orthogonal to the first headers and the second headers, respectively. Therefore, when the refrigerant flows from the headers to the heat transfer pipes, there is a possibility that a separation may occur in the flow of the refrigerant. When a separation occurs in the flow of the refrigerant, the local flow velocity increases, and there is a risk of an occurrence of erosion or pitting in that portion.

[0004] The present invention has been made to solve the above-mentioned problems, and an object of the present invention is to provide a water heat exchanger and a gas cooler with improved durability.

SUMMARY OF THE INVENTION

[0005] According to a first aspect of the present invention, a water heat exchanger is provided with: a header including a tubular header main body extending in a direction of a first axis and through which water flows to-

ward a first side in the direction of the first axis; and a tubular heat transfer pipe which is installed on the header main body so as to be inserted from an outer peripheral surface of the header main body into the header, and which extends along a second axis inclined so as to approach a second side in the direction of the first axis as it goes further from the outer peripheral surface of the header main body outward.

[0006] According to this configuration, the heat transfer pipe is extended along a second axis inclined so as to approach a second side in the direction of the first axis as it goes further from the outer peripheral surface of the header main body outward. Water flows inside the header main body from the second side toward the first side in the direction of the first axis. That is, the heat transfer pipe extends in the direction including the flow direction component of the water. Therefore, the water in the header main body can be more smoothly guided to the heat transfer pipe in the above configuration, for example, as compared to a case of adopting a configuration in which the heat transfer pipe extends in a direction orthogonal to the first axis. As a result, separation or swirling in the flow of water is reduced, and the flow velocity of water in the header main body and the heat transfer pipe can be made uniform.

[0007] According to a second aspect of the present invention, an inclination angle which is formed by the second axis with respect to a reference axis orthogonal to the first axis may be 10 to 45°.

[0008] According to this configuration, the water in the header main body can be guided more smoothly toward the heat transfer pipe. As a result, separation or swirling in the flow of water is reduced, and the flow velocity of water in the header main body and the heat transfer pipe can be made uniform.

[0009] According to a third aspect of the present invention, the header may further include an annular burring portion in contact with an outer peripheral surface of the heat transfer pipe, the burring portion is formed at a portion of the outer peripheral surface of the header main body to which the heat transfer pipe is to be inserted, and an inner peripheral surface of the burring portion may have a cylindrical surface shape extending around the second axis.

[0010] According to this structure, the burring portion is formed at the portion of the outer peripheral surface of the header main body to which the heat transfer pipe is to be inserted. The heat transfer pipe can be fixed to the header main body via the burring portion. As a result, compared to a case in which the burring portion is not formed, a depth of a penetrating portion of the transfer pipe, which is inserted from the outer peripheral surface of the header main body into the header, can be reduced. If the depth of the penetrating portion of the heat transfer pipe is too long, there is a possibility that the flow of water may be disturbed by the end portion of the heat transfer pipe protruding to the inside of the head main body. As a result, separation or swirl occurs in the flow of water.

However, according to the above configuration, because the insertion margin is small, such a likelihood can be reduced.

[0011] According to a fourth aspect of the present invention, a plurality of the heat transfer pipes may be installed on the header main body so as to be aligned at intervals in the direction of the first axis, and as the heat transfer pipe is located further to a second side in the direction of the first axis, the inclination angle which is formed by the second axis with respect to the reference axis orthogonal to the first axis may increase.

[0012] Here, the water flows in the header main body from the second side to the first side in the direction of the first axis. On the way, water sequentially flows into the plurality of heat transfer pipes. That is, when the heat transfer pipe is located on the second side in the direction of the first axis, water having a higher flow velocity flows therein. According to the above configuration, since the inclination angle increases as the heat transfer pipe is located on the second side in the direction of the first axis, water having a high flow velocity can be smoothly guided into the heat transfer pipe. That is, the possibility of an occurrence of disturbance in the water flow can be further reduced.

[0013] According to a fifth aspect of the present invention, a gas cooler has the water heat exchanger according to any one of the above aspects, and a gas circulation pipe which is in contact with the outer peripheral surface of the heat transfer pipe and through which gas flows.

[0014] According to the present invention, it is possible to provide a water heat exchanger and a gas cooler with improved durability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a schematic view showing a configuration of a gas cooler according to a first embodiment of the present invention.

FIG. 2 is an enlarged cross-sectional view of a main part of the gas cooler according to the first embodiment of the present invention.

FIG. 3 is an enlarged cross-sectional view showing a configuration of a burring portion according to the first embodiment of the present invention.

FIG. 4 is an enlarged cross-sectional view of a main part of a gas cooler according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

(First Embodiment)

[0016] A first embodiment of the present invention will be described with reference to FIGS. 1 and 2. A gas cooler 100 according to this embodiment is disposed in a cycle of a water heater as an example. More specifically,

the gas cooler 100 heats water by performing a heat exchange between the water and the gas as a heat medium.

[0017] As shown in FIG. 1, the gas cooler 100 includes a water heat exchanger 90 and a plurality of gas circulation pipes 3. The water heat exchanger 90 has a header 1 and a plurality of heat transfer pipes 2. The header 1 has an inlet side header 1A and an outlet side header 1B. The inlet side header 1A has a tubular header main body 11 extending along a first axis A1, an introduction portion 12, and a burring portion 13 (see FIG. 2). The introduction portion 12 for guiding water from outside is provided at the other end portion of the header main body 11 in the direction of the first axis A1. The water guided from the introduction portion 12 flows from the second side to the first side in the direction of the first axis A1. The outlet side header 1B is a tubular member disposed in parallel to the inlet side header 1A. A discharge portion 14 for guiding the heated water to outside is provided at an end portion of the outlet side header 1B. The introduction portion 12 may be provided not only at the end portion of the header main body 11 but also at an intermediate portion in an extending direction of the header main body 11.

[0018] A plurality of heat transfer pipes 2 are disposed between the inlet side header 1A and the outlet side header 1B. The plurality of heat transfer pipes 2 are arranged at intervals in the extending direction of the inlet side header 1A and the outlet side header 1B. A flow path through which water circulates is formed inside each heat transfer pipe 2. The water flowing into the inlet side header 1A flows to the outlet side header 1B through the heat transfer pipes 2. The gas circulation pipe 3 is spirally wound around the outer peripheral surfaces of each heat transfer pipe 2 to come into contact with the outer peripheral surfaces. High-temperature gas as a heat medium flows inside the gas circulation pipe 3. For example, carbon dioxide is suitably used as such a gas. The plurality of gas circulation pipes 3 are connected to a header different from the inlet side header 1A and the outlet side header 1B.

[0019] Next, details of a portion connecting between the inlet side header 1A and the heat transfer pipe 2 will be described with reference to FIG. 2. FIG. 2 is an enlarged view of the portion connecting between the inlet side header 1A and the plurality of heat transfer pipes 2. As shown in FIG. 2, the inlet side header 1A has a cylindrical shape centered on first axis A1. Each heat transfer pipe 2 extends along a second axis A2 which is a direction intersecting the direction of the first axis A1, between the inlet side header 1A and the outlet side header 1B. It is preferable that an angle (an inclination angle θ) formed by the second axis A2 with respect to a reference axis Ac orthogonal to the first axis A1 be 10° to 45° . More preferably, the inclination angle θ is set to 20° to 35° with respect to the reference axis Ac. Most preferably, the inclination angle θ is set to 30° with respect to the reference axis Ac. In the present embodiment, the inclination angles θ of each of the heat transfer pipes 2 are identical

to each other.

[0020] The burring portion 13 supporting the end portions of each heat transfer pipe 2 is provided on the outer peripheral surface of the inlet side header 1A (the header main body 11). The burring portion 13 has an annular shape protruding outward in a radial direction with respect to the first axis A1 from the outer peripheral surface of the inlet side header 1A. More specifically, as shown in FIG. 3, the outer peripheral surface of the burring portion 13 has a cylindrical shape centered on the reference axis Ac. On the other hand, the inner peripheral surface (the insertion hole 15) of the burring portion 13 has a cylindrical surface shape centered on the above-mentioned second axis A2. That is, in a cross-sectional view including the first axis A1, the insertion hole 15 extends in a direction inclined by the inclination angle θ with respect to the reference axis Ac.

[0021] Also, as shown in FIG. 2, the end portion of the heat transfer pipe 2 is inserted into each insertion hole 15 from the outer peripheral side. In a condition of being inserted into the insertion hole 15, the end portions of each heat transfer pipe 2 is protruded in the inside of the inlet side header 1A. At least one protrusion P for determining a depth of a penetrating portion of the transfer pipe 2 inserted from the outer peripheral surface of the header main body 11 into the header 2 is formed on the outer peripheral surface of the heat transfer pipe 2. That is, each heat transfer pipe 2 is inserted into the insertion hole 15 until the protrusion P is in contact with the end surface of the burring portion 13. In this way, when the outer peripheral surface of each heat transfer pipe 2 is in contact with the inner peripheral surface (the insertion hole 15) of the burring portion 13, each heat transfer pipe 2 is supported in a non-displaceable manner. In the present embodiment, the burring portion 13 is provided integrally with the header main body 11. However, it is also possible to adopt a configuration in which the burring portion 13 prepared separately from the header main body 11 is attached to the header main body 11 by brazing or the like.

[0022] Subsequently, the operation of the gas cooler 100 according to the present embodiment will be described. With the start of operation of the water heater, low-temperature water (water before heating) circulates through the header 1 and each of the heat transfer pipes 2. Specifically, water is supplied from the introduction portion 12 of the inlet side header 1A and distributed to each heat transfer pipe 2. At the same time, relatively high-temperature gas (a heat medium) circulates through the gas circulation pipe 3. Since the gas circulation pipe 3 is in contact with the outer peripheral surface of the heat transfer pipe 2 in this way, a movement of heat occurs between the water and the gas. That is, since the heat of the relatively high-temperature gas is transmitted to the relatively low-temperature water in the heat transfer pipe 2, the water is heated. The heated water is collected from each heat transfer pipe 2 to the outlet side header 1B, and then is taken out through the discharge

portion 14.

[0023] Here, each heat transfer pipe 2 has an angle with respect to the inlet side header 1A. Therefore, when water flows to the heat transfer pipe 2 from the inlet side header 1A, there is a possibility of an occurrence of separation of the flow. If separation occurs in the flow of water, the local flow velocity increases, and there is a risk of an occurrence of erosion or pitting in that portion. In particular, when the inlet side header 1A and each heat transfer pipe 2 are connected to be orthogonal to each other, since the direction of the flow of water changes rapidly, the above-mentioned phenomenon easily occurs.

[0024] However, in the gas cooler 100 according to the present embodiment, the heat transfer pipe 2 extends along the second axis A2 inclined so as to approach the second side in the direction of the first axis A1 as it goes further from the outer peripheral surface of the header main body 11 outward. Water flows inside the header main body 11 from the second side toward the first side in the direction of the first axis A1. That is, the heat transfer pipe 2 extends in the direction including the flow direction component of the water. Therefore, for example, the water in the header main body 11 can be more smoothly guided to the heat transfer pipe 2 in the above configuration, as compared to a case of adopting a configuration in which the heat transfer pipe 2 extends in a direction orthogonal to the first axis A1. As a result, separation or swirling in the flow of water is reduced, and the flow velocity of water in the header main body 11 and the heat transfer pipe 2 can be made uniform. Therefore, the possibility of occurrence of erosion or pitting inside the gas cooler 100 is reduced, and the durability of the gas cooler 100 can be improved.

[0025] Furthermore, in the above configuration, the inclination angle θ , which is the angle formed by the second axis A2 with respect to the reference axis Ac orthogonal to the first axis A1, is set to 10° to 45° . More preferably, the inclination angle θ is set to 20° to 35° with respect to the reference axis Ac. Most preferably, the inclination angle θ is set to 30° with respect to the reference axis Ac. According to this configuration, the water in the header main body 11 can be guided more smoothly toward the heat transfer pipe 2. As a result, separation or swirling in the flow of water is reduced, and the flow velocity of water in the header main body 11 and the heat transfer pipe 2 can be made uniform.

[0026] In addition, according to the above configuration, the burring portion 13 is provided at the insertion portion of the heat transfer pipe 2 on the outer peripheral surface of the header main body 11. That is, the heat transfer pipe 2 can be fixed to the header main body 11 by the burring portion 13. As a result, compared to a case in which the burring portion 13 is not formed, the depth of the penetrating portion of the transfer pipe 2, which is inserted from the outer peripheral surface of the header main body 11 into the header 1, can be reduced. If the depth of the penetrating portion of the heat transfer pipe

is too long, there is a possibility that the flow of water flowing in the header main body 11 will be disturbed by the end portion of the heat transfer pipe 2. As a result, separation or swirling occurs in the flow of water. However, according to the above configuration, such a possibility can be reduced because the insertion margin is small.

[0027] The first embodiment of the present invention has been described above with reference to FIGS. 1 to 3. Various changes or modifications can be made to the above-described configuration without departing from the scope of the present invention. For example, the aforementioned embodiment demonstrated an example in which the gas cooler 100 is applied to a water heater for heating water. However, the application target of the gas cooler 100 is not limited to a water heater, and the gas cooler 100 can also be applied to any device including an air conditioner or the like as long as the device performs a heat exchange between the fluids.

(Second Embodiment)

[0028] Subsequently, a second embodiment of the present invention will be described with reference to FIG. 4. In addition, components similar to those of the aforementioned first embodiment are denoted by the same code reference numerals, and a detailed description thereof will be omitted. As shown in FIG. 4, in a gas cooler 200 according to this embodiment, the inclination angles θ of the plurality of heat transfer pipes 2, that is, the angles formed by the second axis A2 of the heat transfer pipe 2 with respect to the first axis A1 are different from each other. In the following description, among the three heat transfer pipes 2 shown in FIG. 4, a heat transfer pipe 2 located furthest to the first side in the direction of the first axis A1 is referred to as a first heat transfer pipe 21, a heat transfer pipe 2 located furthest to the second side is referred to as a third heat transfer pipe 23, and a heat transfer pipe 2 located between them is referred to as a second heat transfer pipe 22. The first heat transfer pipe 21 extends along a second axis A21, and the second heat transfer pipe 22 extends along a second axis A22. The third heat transfer pipe 23 extends along a second axis A23. An angle (an inclination angle θ) formed by the second axis A21 with respect to the reference axis Ac is referred to as θ_1 , an angle (inclination angle) formed by the second axis A22 with respect to the reference axis Ac is referred to as θ_2 , and an angle (inclination angle) formed by the third axis with respect to the reference axis Ac is referred to as θ_3 . In the present embodiment, the inclination angles θ_1 , θ_2 and θ_3 satisfy the relationship shown in the following Equation (1).

$$\theta_1 < \theta_2 < \theta_3 \dots (1)$$

That is, as the heat transfer pipe 2 is located further to

the second side in the direction of the first axis A1, the inclination angle θ of the heat transfer pipe 2 increases. Although only three heat transfer pipes 2 are shown for simplification in the example of FIG. 4, even in a case in which four or more heat transfer pipes 2 are provided, each inclination angle θ is set to satisfy the relationship according to the above equation (1).

[0029] Here, the water flows in the header main body 11 (in the inlet side header 1A) from the second side toward the first side in the direction of the first axis A1. On the way, water flows into the plurality of heat transfer pipes 2 sequentially. That is, water having a higher flow velocity flows in, further toward the second side in the direction of the first axis A1 with respect to the heat transfer pipe 2. According to the above configuration, since the inclination angle θ increases further toward the second side in the direction of the first axis A1 with respect to the heat transfer pipe 2, water having a high flow velocity can be smoothly guided into the heat transfer pipe 2. That is, the possibility of an occurrence of disturbance in the water flow can be further reduced. As a result, separation or swirl in the flow of water is reduced, and the flow velocity of water in the header main body 11 and the heat transfer pipe 2 can be made uniform. Therefore, the possibility of occurrence of erosion or pitting inside the gas cooler 200 is reduced, and the durability of the gas cooler 200 can be further improved.

[0030] The second embodiment of the present invention has been described above with reference to FIG. 4. Various changes and modifications can be made to the above-described configuration without departing from the scope of the present invention. For example, the aforementioned embodiment demonstrated the example in which the gas cooler 200 is applied to a water heater for heating water. However, the application target of the gas cooler 200 is not limited to a water heater, and the gas cooler 200 can be applied to any device including an air conditioner or the like as long as the device performs a heat exchange between the fluids.

[0031] While preferred embodiments of the invention have been described and shown above, it should be understood that these are exemplary of the invention and are not to be considered as limiting. Additions, omissions, substitutions, and other modifications can be made without departing from the scope of the present invention. Accordingly, the invention is not to be considered as being limited by the foregoing description, and is only limited by the scope of the appended claims.

EXPLANATION OF REFERENCES

[0032]

- 1 Header
- 2 Heat transfer pipe
- 3 Gas circulation pipe
- 11 Header main body
- 12 Introduction portion

13 Burring portion		are installed on the header main body (11) so as to
14 Discharge portion		be aligned at intervals in the direction of the first axis
15 Insertion hole		(A1), and
21 First heat transfer pipe		as the heat transfer pipe (2) is located further to a
22 Second heat transfer pipe	5	second side in the direction of the first axis (A1), the
23 Third heat transfer pipe		inclination angle which is formed by the second axis
90 Water heat exchanger		(A2) with respect to the reference axis (Ac) orthog-
100, 200 Gas cooler		onal to the first axis (A1) increases.
1A Inlet side header		
1B Outlet side header	10	5. A gas cooler (100, 200) comprising:
A1 First axis		
A2 Second axis		the water heat exchanger (90) according to any
A21 Second axis		one of claims 1 to 3; and
A22 Second axis		a gas circulation pipe (3) which is in contact with
A23 Second axis	15	the outer peripheral surface of the heat transfer
Ac Reference axis		pipe (2) and through which gas flows.
θ Inclination angle		

Claims

20

1. A water heat exchanger (90) comprising:

a header (1) including a tubular header main body (11) extending in a direction of a first axis (A1) and through which water flows toward a first side in the direction of the first axis (A1); and a tubular heat transfer pipe (2) which is installed on the header main body (11) so as to be inserted from an outer peripheral surface of the header main body (11) into the header (1), and which extends along a second axis (A2) inclined so as to approach a second side in the direction of the first axis (A1) as it goes further from the outer peripheral surface of the header main body (11) outward.

2. The water heat exchanger (90) according to claim 1, wherein an inclination angle which is formed by the second axis (A2) with respect to a reference axis (Ac) orthogonal to the first axis (A1) is 10 to 45°.

3. The water heat exchanger (90) according to claim 1, wherein

the header (1) further includes an annular burring portion (13) in contact with an outer peripheral surface of the heat transfer pipe (2), the burring portion (13) is formed at a portion of the outer peripheral surface of the header main body (11) to which the heat transfer pipe (2) is to be inserted, and an inner peripheral surface of the burring portion (13) has a cylindrical surface shape extending around the second axis (A2).

4. The water heat exchanger (90) according to claim 1 or 2, wherein a plurality of the heat transfer pipes (2)

FIG. 1

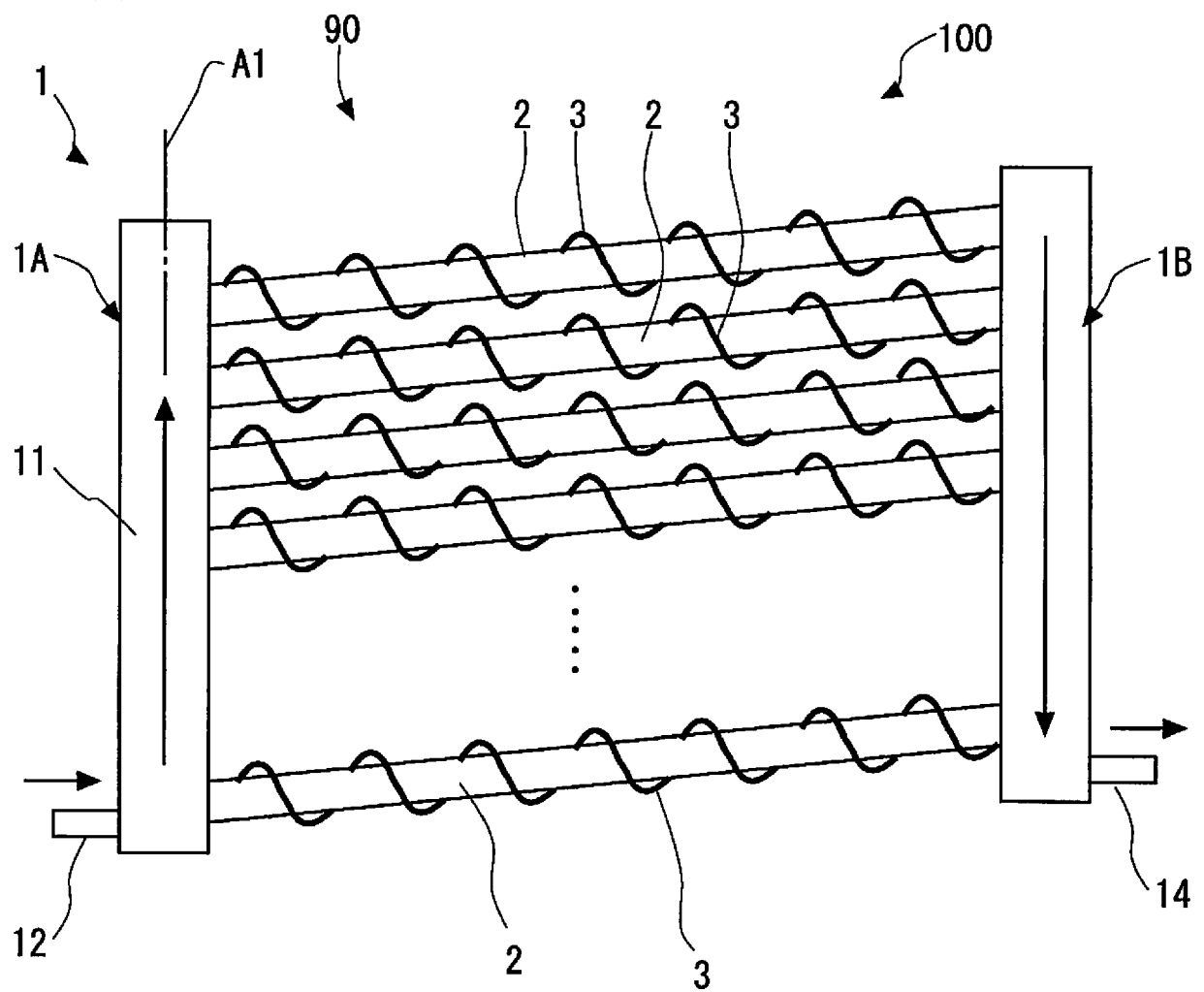


FIG. 2

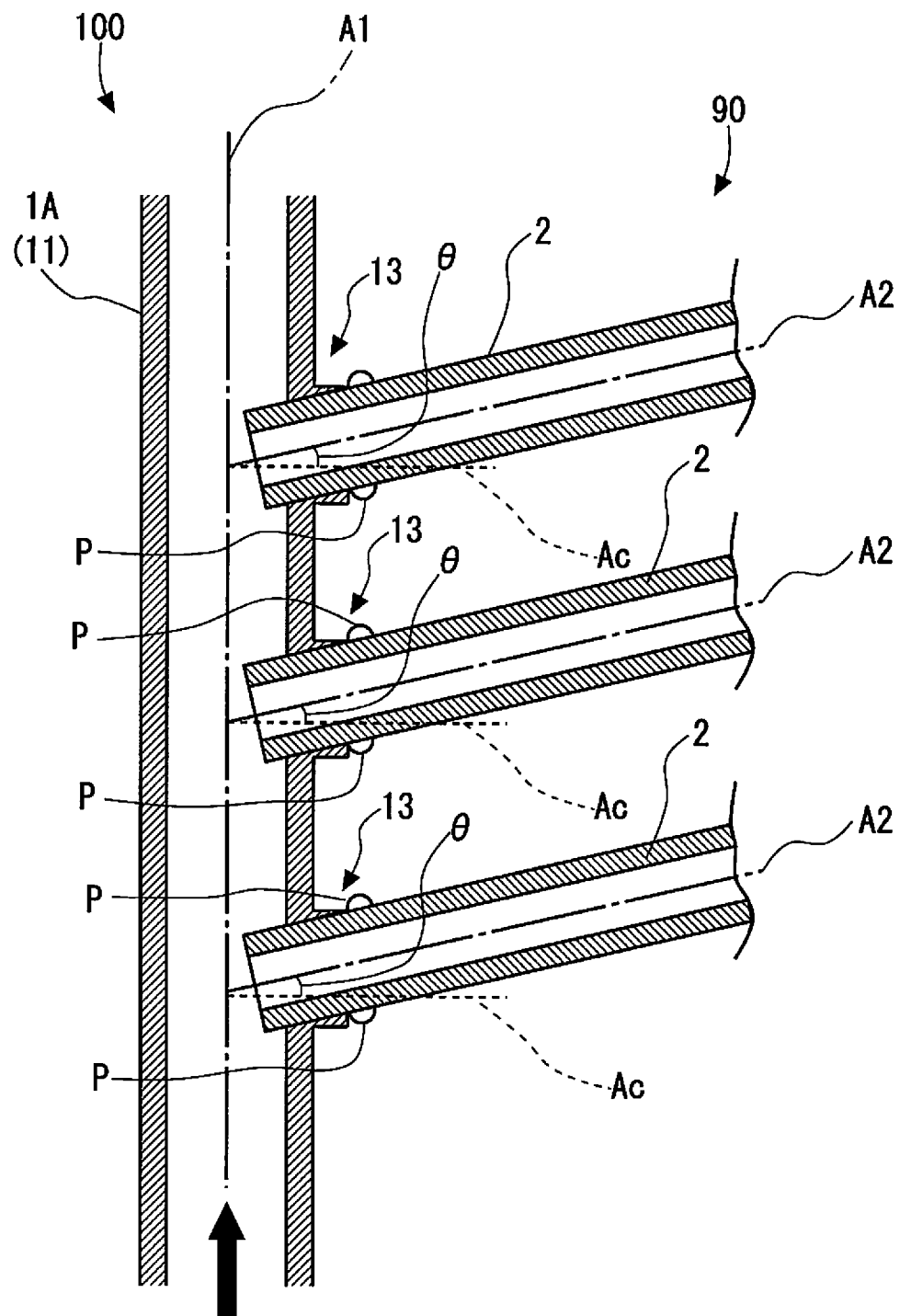


FIG. 3

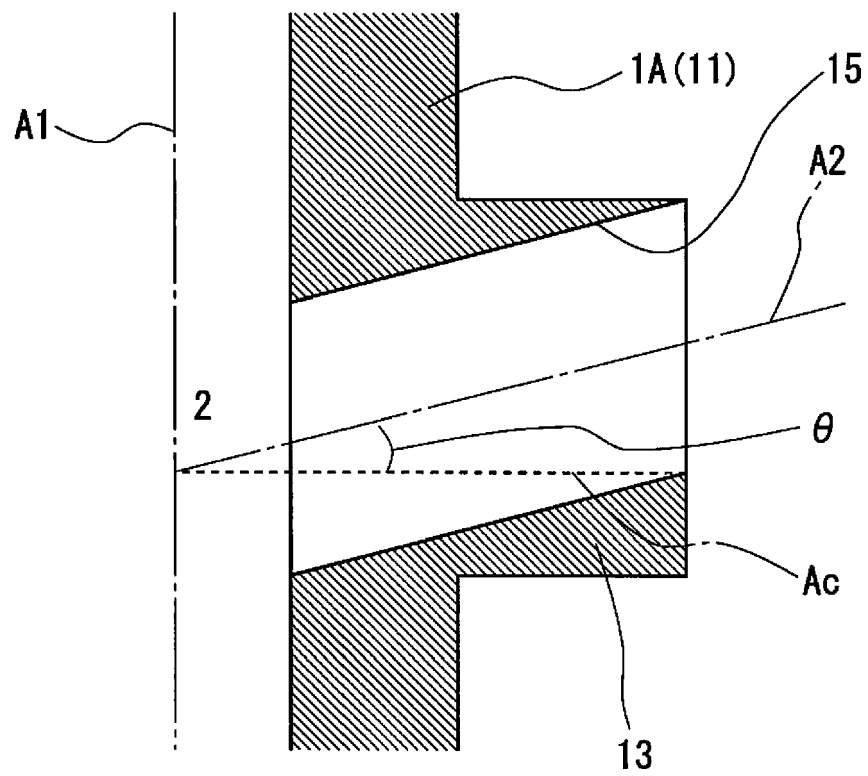
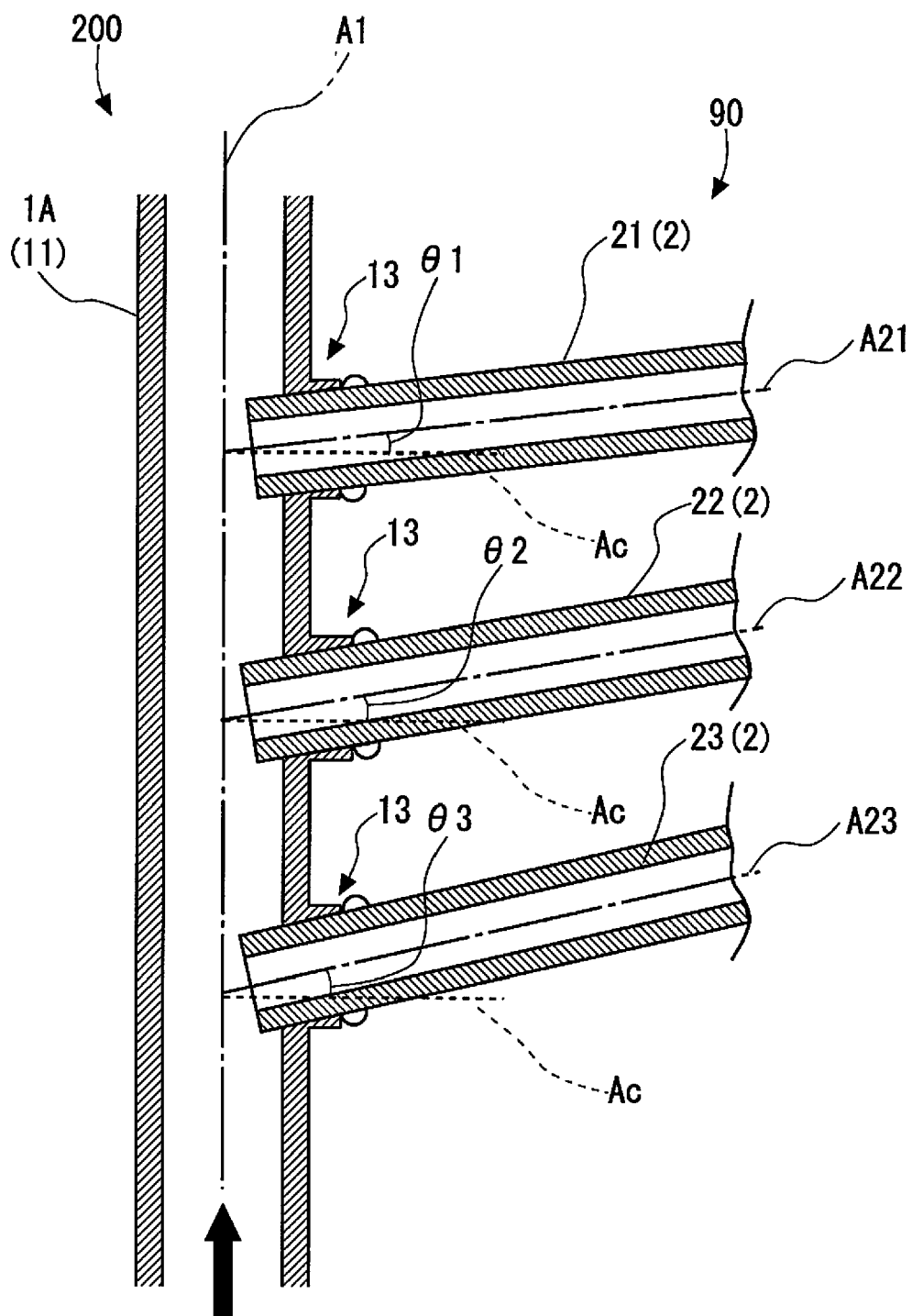


FIG. 4





EUROPEAN SEARCH REPORT

 Application Number
 EP 19 17 9799

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 107 990 758 A (GREE ELECTRIC APPLIANCES INC ZHUHAI) 4 May 2018 (2018-05-04)	1-3	INV. F28D1/053
Y	* paragraph [0093]; figures 18,20 *	5	
A	-----	4	
X	JP 2006 242458 A (DENSO CORP) 14 September 2006 (2006-09-14)	1-3	
Y	* figure 2 *	5	
A	-----	4	
X	US 2016/091231 A1 (ISHIKAWA MASANORI [JP] ET AL) 31 March 2016 (2016-03-31)	1,2	
	* paragraph [0059]; figure 7 *		

X	WO 2008/105760 A2 (CARRIER CORP [US]; TARAS MICHAEL F [US]; LIFSON ALEXANDER [US]) 4 September 2008 (2008-09-04)	1,2	
	* paragraph [0040]; figure 7 *		

X	US 4 815 296 A (AMIR NADAV [IL]) 28 March 1989 (1989-03-28)	1	TECHNICAL FIELDS SEARCHED (IPC)
	* figure 1 *		F28D
	-----		F28F
X	GB 853 265 A (EGON RUNTE) 2 November 1960 (1960-11-02)	1	
	* figure 5 *		

Y	EP 3 009 767 A1 (MITSUBISHI ELECTRIC CORP [JP]) 20 April 2016 (2016-04-20)	5	
	* figure 4 *		

Y	WO 2018/025391 A1 (MITSUBISHI ELECTRIC CORP) 8 February 2018 (2018-02-08)	5	
	* figure 2a *		

The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		18 October 2019	Bain, David
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 17 9799

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-10-2019

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 107990758 A	04-05-2018	NONE	
JP 2006242458 A	14-09-2006	NONE	
US 2016091231 A1	31-03-2016	NONE	
WO 2008105760 A2	04-09-2008	CN 101657689 A EP 2122289 A2 HK 1141078 A1 US 2010012307 A1 WO 2008105760 A2	24-02-2010 25-11-2009 21-06-2013 21-01-2010 04-09-2008
US 4815296 A	28-03-1989	AU 3128689 A IL 89590 A NZ 228325 A PH 26205 A SE 469242 B US 4815296 A	14-09-1989 31-08-1995 28-05-1991 18-03-1992 07-06-1993 28-03-1989
GB 853265 A	02-11-1960	NONE	
EP 3009767 A1	20-04-2016	EP 3009767 A1 JP 6075451 B2 JP W02014199479 A1 WO 2014199479 A1	20-04-2016 08-02-2017 23-02-2017 18-12-2014
WO 2018025391 A1	08-02-2018	EP 3495760 A1 JP W02018025391 A1 WO 2018025391 A1	12-06-2019 07-03-2019 08-02-2018

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2012021682 A [0002] [0003]