



(12)

EUROPEAN PATENT APPLICATION

- (43)

Date of publication:
20.11.2024 Bulletin 2024/47
- (51)

International Patent Classification (IPC):
F28D 9/00 (2006.01)
- (21)

Application number: 23173645.5
- (52)

Cooperative Patent Classification (CPC):
F28D 9/005; F28D 9/0093; F28F 2280/04
- (22)

Date of filing: 16.05.2023

- | | |
|--|---|
| <div>(84)</div> <div>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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN</div> | <div>(71)</div> <div>Applicant: Danfoss A/S
6430 Nordborg (DK)</div> <div>(72)</div> <div>Inventor: Debevč, Martin
6430 Nordborg (DK)</div> <div>(74)</div> <div>Representative: Keil & Schaafhausen
Patentanwälte PartGmbB
Bockenheimer Landstraße 25
60325 Frankfurt am Main (DE)</div> |
|--|---|

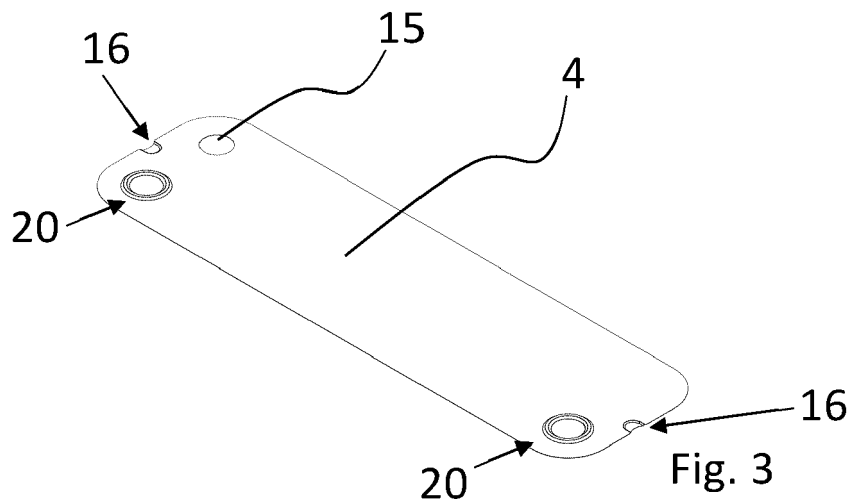
(54)

SEPARATING PLATE

- (57)

The present invention relates to a separating plate (4) configured to separate a first stack of heat exchanger plates (5) from a second stack of heat exchanger plates (7), wherein the separating plate (4) comprises a planar direction and a thickness direction, wherein the separating plate (4) comprises a fluidic recess (15).
- The underlying problem is to provide a separating plate (4) which is easy to assemble.

This problem is solved by a separating plate (4) which comprises at least one positioning geometry 16 which is configured to position the separating plate (4) relative to a heat exchanger plate (6, 8).



Description

[0001] The present invention relates to a separating plate which is configured to separate a first stack of heat exchanger plates from a second stack of heat exchanger plates, wherein the separating plate comprises a planar direction and a thickness direction, wherein the separating plate comprises a fluidic recess.

[0002] Further, this invention relates to a heat exchanger comprising a first stack of heat exchanger plates and a second stack of heat exchanger plates.

[0003] EP 3 385 653 B1 describes a heat exchanger comprising a top plate and a bottom plate as well as a plurality of structured plates arranged between the top plate and the bottom plate, wherein adjacent structured plates cooperate in form of primary fluid channels and secondary fluid channels between neighbouring structured plates, wherein the heat exchanger comprises at least two stacks of structured plates, wherein the structured plates form different primary fluid channels and secondary fluid channels. Between the pair of adjacent stacks of structured plates, a structureless separated plate is arranged, wherein the at least one transition plate is arranged on one side of the structureless separating plate.

[0004] The above-described separating plate separates a first stack of heat exchanger plates from a second stack of heat exchanger plates. The first stack of heat exchanger plates is formed to comprise a first and a second fluidic channel, while the second stack of heat exchanger plates is formed to comprise a third and fourth fluidic channel. The second and third fluidic channels are connected through the fluidic recess of the separating plate. Thus, fluids transferred through the first and fourth fluidic channels can be heated or cooled by a fluid transferred through the second and third fluidic channel.

[0005] The planar direction is oriented perpendicular to the thickness direction of the separating plate, wherein the thickness direction is oriented pointing from planar face to the other planar face.

[0006] The problem underlying this invention is to provide a separating plate which allows an easy assembly.

[0007] This problem is solved by the features of claims 1 and 9.

[0008] The separating plate comprises at least one positioning geometry, which is configured to position the separating plate relative to a heat exchanger plate. The at least one positioning geometry allows an easy positioning of the separating plate for at least one neighbouring heat exchanger plates of the first and/or second stacks. The at least one positioning geometry is configured to match an equivalent positioning geometry of a respective heat exchanger plate forming the first stack of heat exchanger plates and/or the second stack of heat exchanger plates, for example. Thus, the positioning geometries of the first stack of heat exchanger plates and/or the second stack of heat exchanger plates and the separating plate interact with each other during the mounting

process, allowing an easy assembly.

[0009] In an embodiment, the at least one positioning geometry has a protrusion configured to interact with an indentation of the heat exchanger plate. For example, the at least one positioning geometry protrudes in the thickness direction of the separating plate. Further, for example, the at least one positioning geometry is adapted to match an indentation of the heat exchanger plate. This allows an easy assembly of the separating plate, since the at least one positioning geometry and the indentation are able to interlock with each other such that a relative movement perpendicular to a thickness direction is limited respectively restricted.

[0010] In an embodiment, the at least one positioning geometry comprises a notch, which is recessed relative to an edge of the separating plate. For example, the notch can be recessed in the planar direction inwards to the separating plate forming a recess or alike. This notch allows an easy handling of the separating plate during the mounting operations. Further, the notch allows an easy visual inspection of a correct assembly. Furthermore, the notch allows a fluidic path in an assembled heat exchanger, wherein fluid can pass through the notch, allowing an easy visual inspection of leakages of the heat exchanger.

[0011] In an embodiment, at least one positioning geometry is arranged on a first edge of the separating plate while another positioning geometry is arranged on a second edge of the separating plate, wherein the first and second edges are arranged opposing to each other. For example, the at least one and another positioning geometry can be formed symmetrically. Furthermore, the at least two positioning geometries of the first and second edge of the separating plate allow a good positioning, since two positioning geometries result in a distinct positioning with regard to a plate arrangement.

[0012] In a preferred embodiment the at least one positioning geometry is a first positioning geometry configured to position the separating plate relative to a first heat exchanger plate, wherein the separating plate comprises at least a second positioning geometry configured to position a second heat exchanger plate relative to the separating plate. The first heat exchanger plate is part of the first stack of the heat exchanger plates, while the second heat exchanger plate is part of the second stack of heat exchanger plates. Using the first positioning geometry and the second positioning geometry allows an easy positioning of the separating plate relative to the respective heat exchanger plates.

[0013] In an embodiment, the at least one second positioning geometry comprises at least one indentation and/or protrusion. For example, the second positioning geometry might comprise one indentation. In another example, the at least one second positioning geometry might comprise a combination of indentations and protrusions. In either case, the indentation and/or protrusion are formed in the thickness direction of the separating plate. This indentation and/or protrusion arrangement

can be configured according to a matching geometry of the second heat exchanger plate. This allows an easy installation of the separating plate respectively the second heat exchanger plate relative to the separating plate.

[0014] In an embodiment, the at least one indentation and/or protrusion of the at least one second position geometry is annular. An annular indentation and/or protrusion results in a rigid separating plate, which is easy to handle. The annular indentation and/or protrusion can also be formed in a circular manner. This allows an easy assembly of the separating plate relatively to the second heat exchanger plate.

[0015] In an embodiment, the at least one second positioning geometry is configured to interact with a second type of heat exchanger plate, wherein the second type of heat exchanger plate is different from the first type of heat exchanger plate. The adaption of the second positioning geometry allows an easy positioning of the separating plate relatively to a second type of heat exchanger plate which is configured to be arranged next to the separating plate. This allows that different types of heat exchangers, for example single wall and double wall heat exchangers, can be arranged next to each other being separated by the separating plate, while the different types of heat exchangers share one fluid channel each. Thus, a single wall heat exchanger stack and a double wall heat exchanger stack can be connected using a separating plate according to the present invention. For example, in a double wall heat exchanger stack, both fluidic channels are separated by two walls, while in a single wall heat exchanger stack, both fluidic channels are separated by only one heat exchanger plate. This allows a good flexibility of configuring a heat exchanger since different heat exchanger plates can be connected using a separating plate. Alternatively, the first type of heat exchanger plates and the second type of heat exchanger plates might be structured differently or being formed of different materials.

[0016] Furthermore, the above problem is solved by a heat exchanger comprising a first stack of heat exchanger plates in the second stack of heat exchanger plates wherein a separated plate according to any of claims 1 to 8 is arranged between the two stacks.

[0017] In the following the present invention is described in combination with the drawings. Herein shows:

Fig. 1 a schematic drawing of fluid channels of the heat exchanger;

Fig. 2 a schematic close-up of the separating plate, first heat exchanger plate and second heat exchanger plate;

Fig. 3 a schematic view of the separating plate;

Fig. 4 a schematic side view of a heat exchanger;

Fig. 5 a schematic top view of a heat exchanger.

[0018] Fig. 1 shows an explosion view of a heat exchanger 1 having a top plate 2 and a bottom plate 3 and a separating plate 4. Between the top plate 2 and the separating plate 4 a first stack 5 of first heat exchanger plates 6 are arranged. Between the separating plate 4 and the bottom plate 3 a second stack 7 of second heat exchanger plates 8 are located. The top plate 2 comprises a first inlet 9, a second inlet 10 and a second outlet 12. The bottom plate 3 comprises a first outlet 11, a third inlet 13 and a third outlet 14. The first inlet 9 of the top plate 2 is connected through a fluidic recess 15 of the separating plate 4 to the first outlet 11 of the bottom plate 3. A first fluidic channel is formed from the first inlet 9 to the first outlet 11, wherein this fluidic channel is formed within the first stack 5 and within the second stack 7. The second inlet 10 and the second outlet 12 of the top plate 2 form a second fluidic circuit, which is arranged within the first stack 5. Within the second stack 7, there is a third fluidic channel, wherein fluid is introduced through the third inlet 13 and outlet through the third outlet 14.

[0019] Fig. 2 shows a schematic view of the first heat exchanger plate 6, the separating plate 4 and the second heat exchanger plate 8. The separating plate 4 comprises a first positioning geometry 16 which comprises a notch 17 and a protrusion 18. The protrusion 18 is configured to interact with an indentation 19 of the first heat exchanger plate 6. The notch 17 is recessed in a planar direction towards a middle of the separating plate 4. The planar direction is perpendicular to a thickness direction. The protrusion 18 and indentation 19 are formed in the thickness direction of the separating plate 4. The first positioning geometry 16 of the separating plate is configured to match the indentation 19 of the first heat exchanger plate in an assembled manner. The separating plate 4 comprises further a second positioning geometry 20 which comprises a circular protrusion 21 and an annular indentation 22. The second positioning geometry 20 is configured to interact with a corresponding matching geometry 23 of the second heat exchanger plate 8. The above-described geometries of the separating plate 4, the first heat exchanger plate 6 and the second heat exchanger plate 8 are arranged in a first end section of the respective plates. In a second end section opposite to the first end section of the respective plates 4, 6, 8 the above-described geometries are duplicated in a symmetrical manner.

[0020] Fig. 3 depicts the separating plate 4 by itself. The separating plate 4 comprises two first positioning geometries 16, two second positioning geometries 20 and a fluidic recess 15. The first positioning geometries 16 are arranged on outer edges of the separating plate 4, wherein the edges are arranged opposing to each other. The second positioning geometries 20 are arranged in different end areas of the separating plate 4. Each of the positioning geometries 16, 20 are adapted to match the position of corresponding geometries of the first and/or second heat exchanger plates 6, 8.

[0021] Fig. 4 depicts a heat exchanger 1 having the

top plate 2 and the bottom plate 3, wherein between the top plate 2 and the bottom plate 3 the first stack 5 of first heat exchanger plates 5, the separating plate 4 and the second stack 7 of second heat exchanger plates 8 are arranged. The heat exchanger 1 comprises several inlets and outlets, wherein Fig. 4 shows the first inlet 9, the second inlet 10, the first outlet 11 and the third outlet 14. The first inlet 9 and the second inlet 10 are arranged on the top plate 2, wherein the top plate 2 comprises the in Fig. 4 not depicted second outlet 12. The bottom plate 3 comprises the first outlet 11, the third outlet 14 and an in Fig. 4 not depicted third inlet 13. The first stack 5 is formed of multiple first heat exchanger plates 5, wherein the first stack 5 is a single wall heat exchanger stack or a double wall heat exchanger stack. The second stack 7 is formed of multiple second heat exchanger plates 8, wherein the second stack 7 is a single wall or a double wall heat exchanger.

[0022] Fig. 5 shows a schematic top view of the heat exchanger 1 showing the top plate 2. The top plate 2 comprises the first inlet 9, the second inlet 10 and the second outlet 12.

[0023] The notch 17 is formed, such that it is recessed towards a middle section of the separating plate 4. In an assembled manner, this arrangement allows a visual inspection if the heat exchanger is assembled correctly. Furthermore, in an assembled manner leakage can be detected through the notch 17.

[0024] The second positioning geometries 20 are formed in an annular form. Alternatively, different forms e.g. elliptical shapes, rectangular shapes, triangular shapes or alike are also possible.

[0025] The first heat exchanger plate 6 and the second heat exchanger plate 8 can be formed differently from each other such that the first heat exchanger stack 5 and the second heat exchanger stack 7 are also formed differently. For example, the first heat exchanger stack 5 might be formed to be a double wall heat exchanger stack, wherein fluidic channels are separated by only one wall respectively plate, wherein the second heat exchanger stack 7 might be formed as a single wall heat exchanger stack, wherein the fluidic channels are separated from each other by two walls respectively plates. Thus, the heat exchanger might be formed to be built by two different types of heat exchangers wherein both heat exchanger stacks share one fluidic channel.

[0026] A first fluidic channel is arranged within the first heat exchanger stack 5 and the second heat exchanger stack 7. The first fluidic channel enters the heat exchanger 1 through the first inlet 9 passes through the fluidic recess 15 and exits the heat exchanger 1 through the first outlet 11. A second fluidic channel is arranged within the first stack 5, enters the heat exchanger 1 through the second inlet 10 and exits the heat exchanger 1 through the second outlet 12. A third fluidic channel is arranged within the second stack 7, enters the heat exchanger 1 through the third inlet 13 and exits the heat exchanger 1 through the third outlet 14.

Reference numbers

[0027]

5	1	Heat exchanger
	2	Top plate
	3	Bottom plate
	4	Separating plate
	5	First stack
10	6	First heat exchanger plates
	7	Second stack
	8	Second heat exchanger plates
	9	First inlet
	10	Second inlet
15	11	First outlet
	12	Second outlet
	13	Third outlet
	14	Third Inlet
	15	Fluidic recess
20	16	First positioning geometry
	17	Notch
	18	Protrusion
	19	Indentation
	20	Second positioning geometry
25	21	Indentation
	22	Protrusion
	23	Matching geometry

30 Claims

1. Separating plate (4) configured to separate a first stack of heat exchanger plates (5) from a second stack of heat exchanger plates (7), wherein the separating plate comprises a planar direction and a thickness direction, wherein the separating plate (4) comprises a fluidic recess (15), **characterized in that** the separating plate (4) comprises at least one positioning geometry (16) configured to position the separating plate (4) relative to a heat exchanger plate.
2. Separating plate (4) according to claim 1, **characterized in that** the at least one positioning geometry (16) is a protrusion (18) configured to interact with an indentation of a heat exchanger plate (6).
3. Separating plate according to claim 1 or 2, **characterized in that** the at least one positioning geometry (16) comprises a notch (17), which is recessed relative to an edge of the separating plate (4).
4. Separating plate according to any of claims 1 to 3, **characterized in that** at least one positioning geometry (16) is arranged on a first edge of the separating plate (4) while at least another positioning geometry is arranged on a second edge of the separating plate (4), wherein the first and second edges

are arranged opposing to each other.

5. Separating plate according to any of claims 1 to 4, **characterized in that** the at least positioning geometry (16) is a first positioning geometry (16) configured to position the separating plate (4) relative to a first heat exchanger plate, wherein the separating plate (4) comprises at least a second positioning geometry (20) configured to position a second heat exchanger plate (8) relative to the separating plate (4).
5
10
6. Separating plate (4) according to claim 5, **characterized in that** the at least one second positioning geometry (20) comprises at least one indentation (22) and/or protrusion (21).
15
7. Separating plate according to claim 6, **characterized in that** the at least one indentation (22) and/or protrusion (21) of the at least one second positioning geometry (20) is annular.
20
8. Separating plate according to any of claims 5 to 7, **characterized in that** the at least one second positioning geometry (20) is configured to interact with a second type of heat exchanger plate (8), wherein the second type of heat exchanger plate (8) is different from the first type of heat exchanger plate (6).
25
9. Heat exchanger (1) comprising a first stack (5) of heat exchanger plates (6) and a second stack (7) of heat exchanger plates (8), **characterized in that** a separator plate (4) according to any of claims 1 to 8 is arranged between the two stacks (5, 7).
30

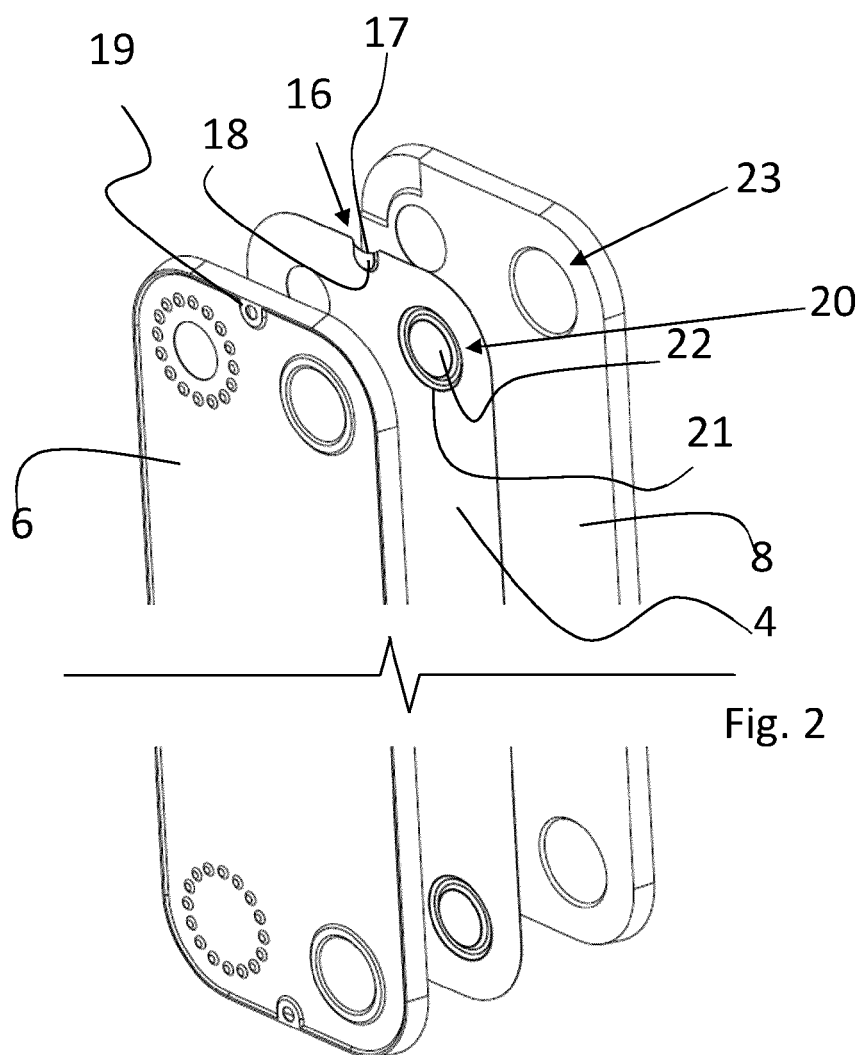
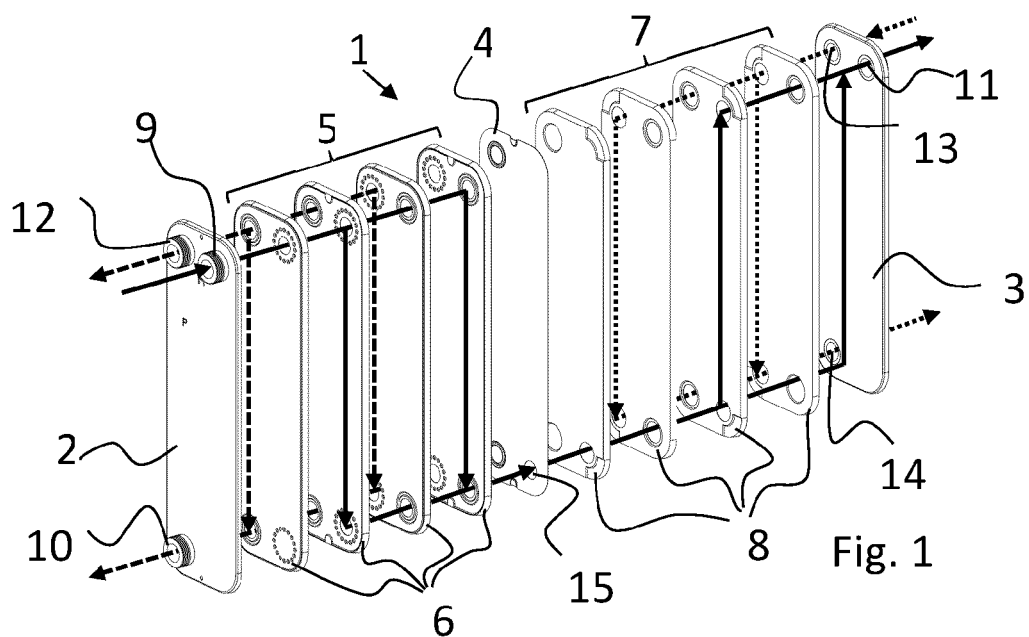
35

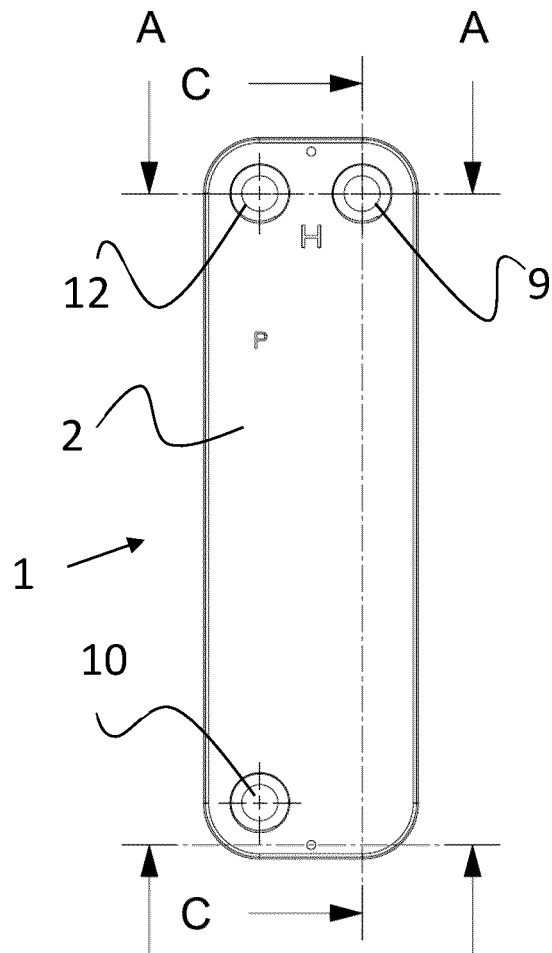
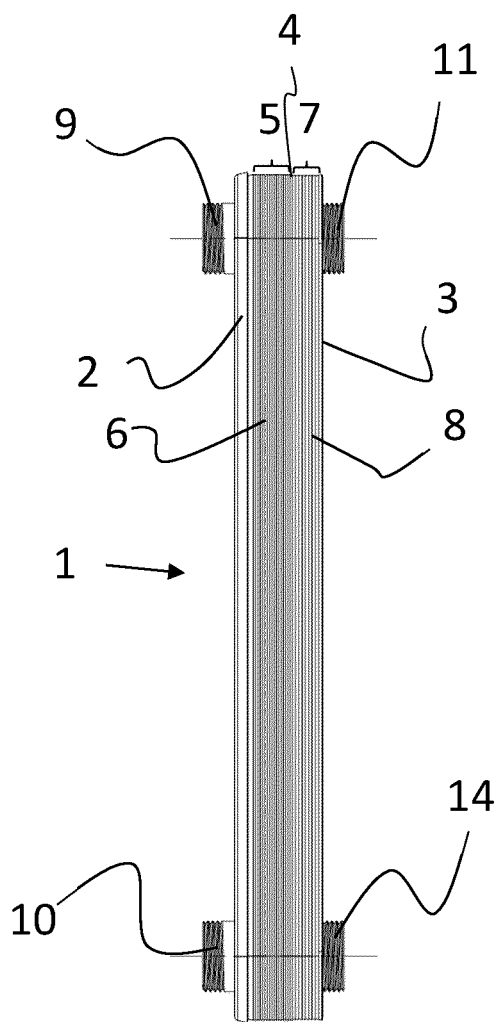
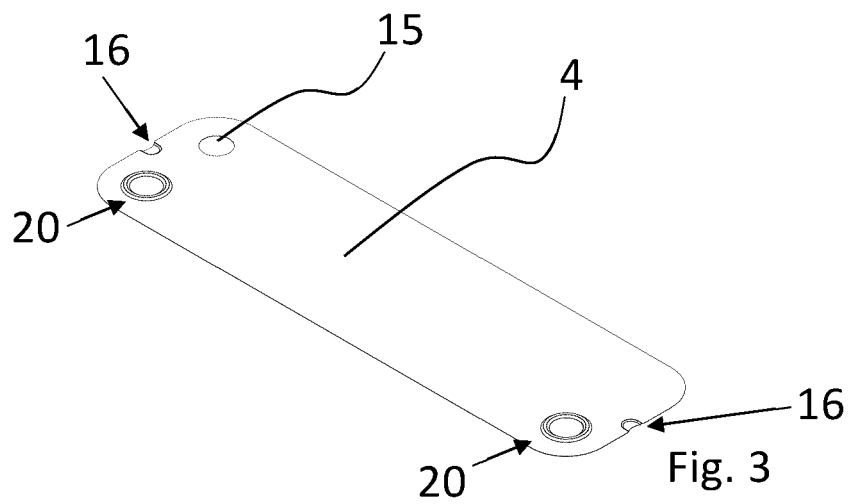
40

45

50

55







EUROPEAN SEARCH REPORT

Application Number

EP 23 17 3645

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	US 9 429 367 B2 (JOUANNY PHILIPPE [FR]; MARTINS CARLOS [FR] ET AL.) 30 August 2016 (2016-08-30) * figure 4 *	1, 9	INV. F28D9/005 F28D9/0093
Y	----- * figure 4 *	2-8	
X	KR 102 216 176 B1 (ESTRA AUTOMOTIVE SYSTEMS CO LTD [KR]) 16 February 2021 (2021-02-16) * figure 4 *	1, 9	
Y	----- US 2007/169916 A1 (WAND STEVEN M [US] ET AL) 26 July 2007 (2007-07-26) * figures 6, 7 *	2-8	
A	----- KR 2020 0065180 A (DOOWON CLIMATE CONTROL CO LTD [KR]) 9 June 2020 (2020-06-09) * figures 5, 6 *	1-9	

TECHNICAL FIELDS
SEARCHED (IPC)

F28D

The present search report has been drawn up for all claims

Place of search

Munich

Date of completion of the search

10 October 2023

Examiner

Vassoille, Bruno

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

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

EP 23 17 3645

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.

10-10-2023

10

15

20

25

30

35

40

45

50

55

ORM P0459

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 9429367	B2	30-08-2016	CN 102639953 A	15-08-2012
			EP 2483620 A1	08-08-2012
			FR 2950682 A1	01-04-2011
			JP 2013506809 A	28-02-2013
			US 2012234523 A1	20-09-2012
			WO 2011039186 A1	07-04-2011

KR 102216176	B1	16-02-2021	NONE	

US 2007169916	A1	26-07-2007	BR PI0700007 A	06-11-2007
			CN 101004329 A	25-07-2007
			EP 1811255 A2	25-07-2007
			JP 2007192534 A	02-08-2007
			US 2007169916 A1	26-07-2007

KR 20200065180	A	09-06-2020	NONE	

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

- EP 3385653 B1 [0003]