(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 233 873 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.09.2010 Bulletin 2010/39

(51) Int Cl.:
F28D 9/00 *(2006.01)* ***F28F 3/04*** *(2006.01)*
F28F 3/08 *(2006.01)*

(21) Application number: **10155028.3**

(22) Date of filing: **01.03.2010**

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA ME RS

(30) Priority: **12.03.2009 TR 200901954**

(71) Applicant: **Robert Bosch GmbH**
70442 Stuttgart (DE)

(72) Inventors:
- **Cetin, Goekce**
  35040 Izmir (TR)
- **Oezboga, Halil Ufuk**
  Manisa (TR)

Remarks:
A request for correction of fig.5b has been filed pursuant to Rule 139 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

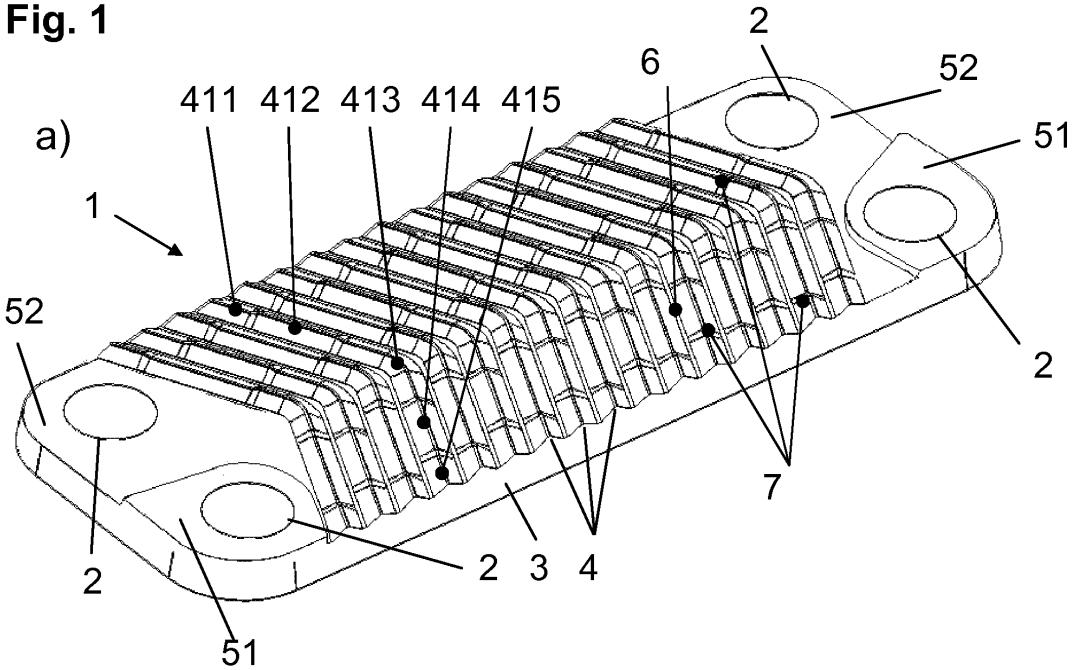
(54) **Plate Heat Exchanger**

(57) The invention relates to a plate exchanger providing heat exchange between at least two fluids (A and B). Such plate heat exchanger consists of more than one exchanger plates wavy profile structure of which has been arranged in fishbone shape and the said curves provides a flowing turbulence during flowing of at least two fluids (A and B) through plate heat exchanger.

The main purpose of the invention is to disclose a plate heat exchanger which increase the current heat transfer area between the channels where at least two different fluids (A and B) passes and increase the turbulence in the flowing channels where the cooling (heat taking) fluid passes, at least at the same rate provided by the existing art, with the feature of same size and at least of the same strength.

The plate heat exchanger of the invention is **characterized in that** the curves forming the profile of the exchanger plates have at least two different heights along the longitudinal axis.

Fig. 1



EP 2 233 873 A1

Description

[0001] The invention relates to a plate exchanger providing heat exchange of at least two fluids (A and B) as described under Claim 1. Such plate exchanger normally consists of two fluid chambers for two fluids (A and B). This exchanger consists of at least three, normally twelve and more exchangers forming a plate package. Exchanger plates are sequenced successively within the said plate package and the two exchanger plates next to each other determine the borders of fluid channels between them. Alternatively at least two fluids (A and B) pass through fluid channels following each other in the plate package. Exchanger plates normally consists of four holes, namely inlet, passage and/or outlet directing the fluids (A and B) to independent fluid channels. Geometric structure of different exchanger plates in the outside side and/or medium of a plate package vary depending on design of the exchanger and connection status of the pipes where the fluid passes. Exchanger plates has a wavy profile and this profile shape consists of curves arranged in the form of fishbone and raised in general and providing occurrence of a turbulence during flowing of at least two fluids (A and B) flowing through the plate exchanger. Fishbone model can also be in arrow shape or V-shape and V-shape curves located successively as it is herein spread almost all areas of the exchanger plates. Exchanger plates are generally made of stainless steel sheet by use of pressing or deep extraction process.

[0002] During mounting of plate packages, exchanger plates should be located in a manner directions of fishbone like profiles are opposite, Thus, a three-dimensional turbulence flowing is provided in a highly complex structure in the flowing channel, the degree of the turbulence determines the rate of reaching balance of temperature in the fluid flowing in the fluid channel and therefore the efficiency of the plate exchanger. The exchanger plates adjacent to each other contact each other at the top parts of the curves. During mounting made in opposite direction, point contact surfaces occur between curves overlapping of plates adjacent to each other.

[0003] In a solder plate exchanger design, the plates are soldered to each other on the contact or contact surfaces, and this operation provides the exchanger with a superior strength. In addition, exchanger plates are also soldered to each other on outer edges and thus flowing channels are closed to outside. since the same fluid (A or B) flows on both sides on the soldered contact surfaces and therefore, there is no heat difference therein, heat transfer from one fluid to the other on such surfaces does not occur. For that reason, heat transfer surface existing theoretically decreases at an amount equal to sum of contact surfaces. As the curves have the same cross-section, cross-sections of fluid channels are also the same. As a result, the pressure loss occurring along both fluid chambers in volume flow rates of equal size are equal. Such plate exchangers are called symmetric.

[0004] Patent application no. EP 1 630 510 B1 discloses a plate heat exchanger comprising at least two separate flow paths for primary and secondary fluids to exchange heat, the said two flow paths being substantially defined by heat exchanger plates interconnected by soldering provided with a herring bone pattern of ridges and depressions (curves) and offering different pressure drops at equal mass flows of the two fluids In other words, the curves of the said heat exchanger plates have two different height measures. Thus, after a lower curve comes either a lower curve or a higher curve. The design aims to decrease the number of contact surfaces between the neighbouring heat exchanger plates and thus increase the effective heat transfer area for the same exchange magnitude. In addition, during constructive design of this type of exchanger the pressure loss occurring along both flow chambers vary independent of volume flow rates of the fluids by help of the described profile structure. Such plate exchangers are called asymmetric.

[0005] The main purpose of the invention is to disclose a plate heat exchanger which increase the current heat transfer area and increase the turbulence in the flowing channels where the cooling (heat taking) fluid passes, at least at the same rate provided by the existing art, provided that it is of the same size and at least of the same strength.

[0006] Under the frame, the purpose is achieved by help of embodiments of the characteristics described under claim 1. Other beneficial embodiments of the invention are described under sub-claims. The plate heat exchanger of the invention is **characterized in that** the curves arranged in fish bone shape in general and forming the profile of the exchanger plates have at least two different heights along the longitudinal axis. The height here is measured vertically plane determined by surfaces of fixed height where V-shape curves forming fishbone in the exchanger plate are interconnected. Approximately V shape curves of the exchanger plate consist of curve sections following each other along the longitudinal axis, and height measure of each curve section here is fixed and this height is different from height of the next section of the same curve. In such embodiment, the sections of a curve succeeding each other are formed by means of at least two different height gradually and as a result, low and high curve sections are provided.

[0007] The curves forming profile of an exchanger plate and arranged in fishbone shape consist of more than one and preferably, three or five or seven sections.

[0008] Particularly, in a beneficial embodiment of the invention, the curve sections of an exchanger plate directly neighbouring each other at the same level are located by sliding in the height measure. Curve sections of the neighbouring each other of the same level with each other here refers to first, second or third curve sections etc.

[0009] Thus, while one line of curves following each other in an exchanger plate contains firstly one low curve section, then one high curve after it and then one low curve section after it etc. in longitudinal direction of the

first, second, third, fifth curve etc., the direct neighbouring second, fourth, sixth curve etc. of the same exchanger plate longitudinally contain firstly one high curve section, then one low section after it and one high curve after it.

[0010] The passage between succeeding curve sections of a curve can be formed in a passage zone consisting of flat or cavity surfaces providing connection of border lines of the curve sections. since the curves directly neighbouring each other are located in a separate manner in respect to height measures, a cross-section A-A taken vertically to the curve sections of neighbouring curves attached to each other in more than one has an appearance different from Cross-section B-B taken in direction vertical to curve sections neighbouring the said Cross-section A-A.

[0011] In this invention the number of contact points between neighbouring plates is decreased and area of heat transfer occurring in the equal exchanger volume is increased. Thus, exchanger efficiency depending on structural volume also increases. This change is realized in a manner the mechanical strength of the plate exchanger remains at least the same, because more sensitive and multidirectional profile of exchanger plates increases bending and torsion torque moment measures that can be met by the plates. a change of the same type in the profile shape increases the turbulence occurring in the fluid channels where the cooling 8heat taking) fluid passes at least in the amount of the one in existing art and this widens the heat transfer area and also efficiency of the exchanger.

[0012] The drawings show several illustrative embodiments of the invention and consist of five figures:

Figure 1. shows two perspective views of two neighbouring exchanger plates of a plate exchanger.

Figure 2. shows top view of two neighbouring exchanger plates of a plate exchanger.

Figure 3. shows four longitudinal (4-I,4-II,4'-I and 4'-II) cross-sections taken along two neighbouring exchanger plates indicated in figure 2 and different embodiment samples.

Figure 4. shows top view displaying hidden edges (terminal forms) of a plate package (also showing curve forms in the plates forming this plate package).

Figure 5. shows two cross-sections (A-A and B-B) taken along curves of four neighbouring exchanger plates of an exchanger package of figure 4.

[0013] Figure 1 shows two perspective views of two neighbouring exchanger plates (1 and 1') of a plate exchanger. The figure shows four holes (2) for inlet, passage and/or outlet of the fluids conducting heat exchange, edge (3) curved at conical angle and hole surrounding surfaces (51 and 52). The neighbouring exchanger plates (1 and 1') can be combined into a plate package by help of zones where this edge (3) and hole surrounding surfaces (51 and 52) contact each other. The said exchanger plates are preferably soldered. In addition, wavy curves (4 and 4') of fish bone shape are seen wherein in the said curves (4 and 4') form the profile of exchanger plates (1 and 1'). The said curves (4 and 4') are illustratively divided into five curve sections (411, 412, 413, 414, 415 in figure 1a and 411', 412', 413', 414', 415' in figure 1b) following each other longitudinally along the axis. The curves are preferably divided into five curve sections. The height measure of each curve section (411, 412, 413, 414, 415 and 411', 412', 413', 414', 415') is constant within itself and the said height measure is different from the height measure of the next section of the same curve (4 and 4'). Thus, gradually arranged low and high curve sections (411, 412, 413, 414, 415 and 411', 412', 413', 414', 415') are provided. The said curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425 and 411', 412', 413', 414', 415' and 421', 422', 423', 424', 425') following each other are interconnected by means of a passage zone (7) composed of flat or cavity surfaces. Furthermore, curves (4 and 4') of each plate (1 and 1') are interconnected by means of flat or cavity surfaces determining lower (6) or top (6') levels of the fishbone zone. In this embodiment, the low (6) border (in respect to figure) of fishbone zone shown in the figure 1a is of the same level as the hole (2) surrounding low surface (52) while top (6') border (in respect to the figure) of the fish bone shown in figure 1b is of the same level as the hole (2) surrounding high surface (51).

[0014] Figure 2a and 2b shows top view of two neighbouring exchanger plates (1 and 1') according to Figure 1a and 1b. It also contains four holes (2) for inlet, passage and/or outlet of the fluids. The figure also shows fishbone zones formed by curves (4 and 4') arranged in V shape. The probable contour lines of neighbouring two curves (41, 42 and 41', 42') in each neighbouring plate (1 and 1') are described in details according to cross-sections 4-I, 4-II, 4'-I and 4'-II for better understanding of the invention.

[0015] Figures 3a, 3b and 3c show four probable projections of curves (4 and 4') onto the neighbouring exchanger plates (1 and 1'). Subject to the cross-sections (4-I, 4-II) shown with emphasizing in Figure 2, Figures 3a-1 and 3a-2 shows longitudinal cross-sections of two neighbouring curves (41 and 42) of a heat exchanger plate (1) of Figure 1 and Figure 2 and five curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425) each arranged gradually. Subject to the cross-sections (4-I, 4-II) shown in Figure 2, Figures 3a-3 and 3a-4 shows longitudinal cross-sections of two neighbouring curves (41' and 42') of a heat exchanger plate (1) of Figure 1 and Figure 2 and five curve sections (411', 412', 413', 414' and 415' and 421', 422', 423', 424', 425') each ar-

ranged gradually. The height of the curves has at least two different measurement value (H1 and H2) of each curve (41, 42 and 41', 42') along the longitudinal axis. The said measurement values are generally indicated as H. each measurement value may vary as H1, H2, H3... and height measurement value has been given according to surface determined by top (6) or low (6') surface levels of constant height remaining between curves (4 and 47) forming fishbone appearance in the exchange plates (1 and 1'). The curve sections (411, 421; 412, 422; 411', 421'; 412', 422';...) of the same level with each other of directly neighbouring curves (41, 42 and 41', 42') of a heat exchanger plate (1 and 1') are located by sliding according to height measurement values. Figure 3b shows a potentially different embodiment of the invention. Subject to the cross-sections (4-I, 4-II, 4'-I and 4'-II) shown in Figure 2, Figures 3b-1, 3b-2, 3b-3 and 3b-4 show longitudinal cross-sections of two neighbouring curves (41, 42 and 41', 42') of each heat exchanger plate (1 and 1') and curve sections (416, 417, 426, 427; 416 ', 417 ', 426 ', 427 ') forming the said curves. In this embodiment, height measurement value within each curve section (416, 417, 426, 427; 416 ', 417 ', 426 ', 427 ') varies between two different height measurement values (H1, H2). The height measurement values '(for 416 and 417, H2, for 426 and 427, H1, etc.) of two succeeding curve sections in the zones where they are interconnected are equal to each other. Figure 3c shows another potentially different embodiment of the invention. Subject to the cross-sections (4-I, 4-II, 4'-I and 4'-II) shown in Figure 2, Figures 3c-1, 3c-2, 3c-3 and 3c-4show longitudinal cross-sections of two neighbouring curves (41, 42 and 41', 42') of each heat exchanger plate (1 and 1')) and curve sections (418, 419, 4110, 4111, 428, 429, 4210, 4211; 418', 419', 4110',4111' 4110, 4111, 428', 429' 4210', 4211',) forming the said curves. In this embodiment, height measurement value within each curve section (418, 419, 418', 419',) varies between two different height measurement values (H1 and H2, H3 and H4). While the height measurement values (H2 and H3) of two succeeding curve sections (418 and 419, 4110 and 4111, 418' and 419', 4110' and 4111') in the zone where they are interconnected are different, the height measurement values (for 419 and 4110, 419' and 4110' , H4; for 429 and 4210, 429' and 4210' , H1) of some curve sections succeeding each other in zones where they are interconnected are identical.

[0016] Figure 4 shows top view of a plate package consisting of more than one neighbouring exchanger plates (1 and 1') shown in Figure 1 with hidden edge (terminal) forms. The figure shows the status where heat exchanger plates (1 and 1') of fishbone like profile (curves (4 and 4')) show opposite directions as in Figure 1, and thus curves (4 and 4') of neighbouring exchanger plates (1 and 1') contact each other in projection plane.

[0017] Figures 5a and 5b show two cross-sections parallel to each other passing through a plate package consisting of four exchanger plates (1 and 1') and indicated with A-A and B-B cross-section lines according to Figure 4. In both cross-sections (A-A and B-B) contours (S1 and S1') of exchanger plates (1 and 1') show difference. Limited flow channels (8 and 9) for fluids conducting heat exchange in neighbouring exchanger plates (1 and 1') are shown. For instance, the flowing channel (8) is a primary circuit flowing channel where a heater or heat giving fluid passes and flowing channel (9) forms the secondary flowing channel where cooler or heat taking fluid passes. The number of points (P1 and P2) where exchanger plates (1 and 1') contact each other where heater or heat giving fluid passes, by means of curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425 and 411', ', 412', 413', 414', 415' and 421', 422', 423', 424', 425') of different height measurement values in respect to each other in profile form, particularly neighbouring curves (41, 42 and 41', 42') is decreased when compared to number of existing art (see particularly Figure 5b). While the disclosed profile form decreases the turbulences occurring in secondary circuit flowing channel (9) at least up to the one of the existing art, the number of contact (soldering) points in the primary circuit flowing channel (8) is decreased and heat transfer surface is increased.

Claims

1. A plate heat exchanger providing heat transfer between at least two fluids (A and B) and having at least one flowing channel (8, 9) for each fluid (A and B) and containing at least two flowing chambers and at least three exchanger plate (1, 1') located successively and formed in profile shape in a manner to provide a plate package,

   • wherein flowing channels (8, 9) are formed between two neighbouring heat exchanger plates (1, 1') and which forms at least two flowing chambers following each other alternatively in plate package and

   • wherein profile structure of the heat exchanger plates (1, 1') are more than one and in general contains curves (4, 4') arranged in fishbone shape and it is ***characterized in that***;

   it consists of at least two different height measurement values (H1, H2) provided that it is measured from a plane determined by the surfaces forming low (6) and/or top (6') levels of the fishbone zone by means of connecting the curves '(4, 4') in each plate (1, 1') along the longitudinal axis of the curves (4, 4').

2. A plate heat exchanger according to claim 1 and it is ***characterized in that***

   curves (4, 4') of a heat exchanger plate (1, 1') are divided into more than one curve sections (411, 412, 413, 414, 415, 411', 412', 413', 414', 415') following each other along longitudinal axis, and that height

measurement values (H1, H2) in each curve section (411, 412, 413, 414, 415 and 411', 412', 413', 414', 415') is constant that height measures of successive curve sections (411 and 412, 412 and 413, 411' and 412', 412' and 413', etc.) of the curves (4, 4') are different from each other.

3. A plate heat exchanger according to claim 1 or 2 and it is ***characterized in that***
Successive sections (411, 412, 413, 414, 415 ; 411', 412', 413', 414', 415') of a curve (4, 4') is formed with two different height measurement values (H1 and H2) and that as a result, that low (411, 413, 415; 411', 413', 415') and high curve sections (412, 414; 412', 414') are formed alternatively.

4. A plate heat exchanger according to claim 1 and it is ***characterized in that***
curves (4, 4') of a heat exchanger plate (1, 1') are divided into more than one curve sections (416, 417, 426, 427, 416', 417', 426', 427') following each other along longitudinal axis,

- height measurement value within each curve section (416, 417; 426, 427; 416', 417'; 426', 427') varies in its own length and
- The height measurement values (for 416 and 417, H2, for 426 and 427, H1, for 416' and 417', H2, for 426' and 427', H1) of two succeeding curve sections (416, 417; 426, 427; 416', 417'; 426', 427') in the passing zones where they are interconnected are equal to each other.

5. A plate heat exchanger according to claim 1 and it is ***characterized in that***
curves (4, 4') of a heat exchanger plate (1, 1') are divided into more than one curve sections (418, 419, 4110, 4111, 418', 419', 4110', 4111') following each other along longitudinal axis,

- height measurement value within each curve section (418, 419, 4110, 4111, 418', 419', 4110', 4111') varies in its own length and
- the height measurement values of two succeeding curve sections (418 and 419, 4110 and 4111, 418' and 419', 4110' and 4111') in the zone where they are interconnected are identical (for 419 and 4110, 419' and 4110' , H4; for 429 and 4210, 429' and 4210', H1) or different (for 418 and 419, 4110 and 4111, 418' and 419', 4110' and 4111' , H2 and H3),

6. A plate heat exchanger according to claim 1 to claim 5 and it is ***characterized in that***
curves (4, 4') of a heat exchanger plate (1, 1') are divided into more than one, preferably three or five or seven curve sections (411, 412, 413, 414, 415 ; 411', 412', 413', 414', 415')

7. A plate heat exchanger according to claim 1 to claim 6 and it is ***characterized in that***
direct neighbouring curves (41,42; 41',42') of a heat exchanger plate (1, 1') are located in distance to each other in respect to height measures (H1 and H2) of curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425; 411', 412', 413', 414', 415' and 421', 422', 423', 424', 425'), of the same level to each other.

8. A plate heat exchanger according to claim 1 to claim 7 and it is ***characterized in that***
while at least one curve (41 , 41') of an exchanger plate (1, 1') contains firstly longitudinally (4-I, 4'-I) one low curve section (411, 411'), then one high curve (412, 412') after it and then one low curve section (413 , 413') after it etc. in longitudinal axis, a curve (42, 42') directly adjacent to this curve (41, 41') in the same exchanger plate (1, 1') longitudinally consist of firstly (4-II , 4'-II) one high curve section (421, 421'), , then one low section (422, 422') after it and one high curve (423, 423') etc. after it.

9. A plate heat exchanger according to claim 1 to claim 8 and it is ***characterized in that***
the curve sections (411, 412, 413, 414, 415 ; 421, 422, 423, 424, 425 ;411', 412', 413', 414', 415' ; 421', 422', 423', 424', 425') following each other are formed by means of a passage zone (7) composed of flat or cavity surfaces providing connection of border lines.

10. A plate heat exchanger according to claim 3 and claim 8 and it is ***characterized in that***
Contour lines (S1 and S1') of a cross-section (A-A) taken in vertical direction to the curve sections at contact (welding) points (P1) level in neighbouring heat exchanger plates (1, 1') of curves (41,42 ; 41', 42') in neighbouring positions because of low and high curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425 and 411', 412', 413', 414', 415' and 421', 422', 423', 424', 425') following each other, and the parallel cross-section (B-B) taken in vertical direction to curve sections in contact (welding) points (P2) adjacent to the said cross-section (A-A) are different.

11. A plate heat exchanger according to claim 3 and claim 8 and it is ***characterized in that***
Contour lines (S1 and S1') of a cross-section taken in vertical direction to the curve sections at contact (welding) points (P1. P2,..) level in neighbouring heat exchanger plates (1, 1') of curves (41,42 and 41', 42') in neighbouring positions because of low and high curve sections (411, 412, 413, 414, 415 and 421, 422, 423, 424, 425 and 411', 412', 413', 414', 415' and 421', 422', 423', 424', 425') following each other have at least two different contour appearance

in respect to each other.

Fig. 1

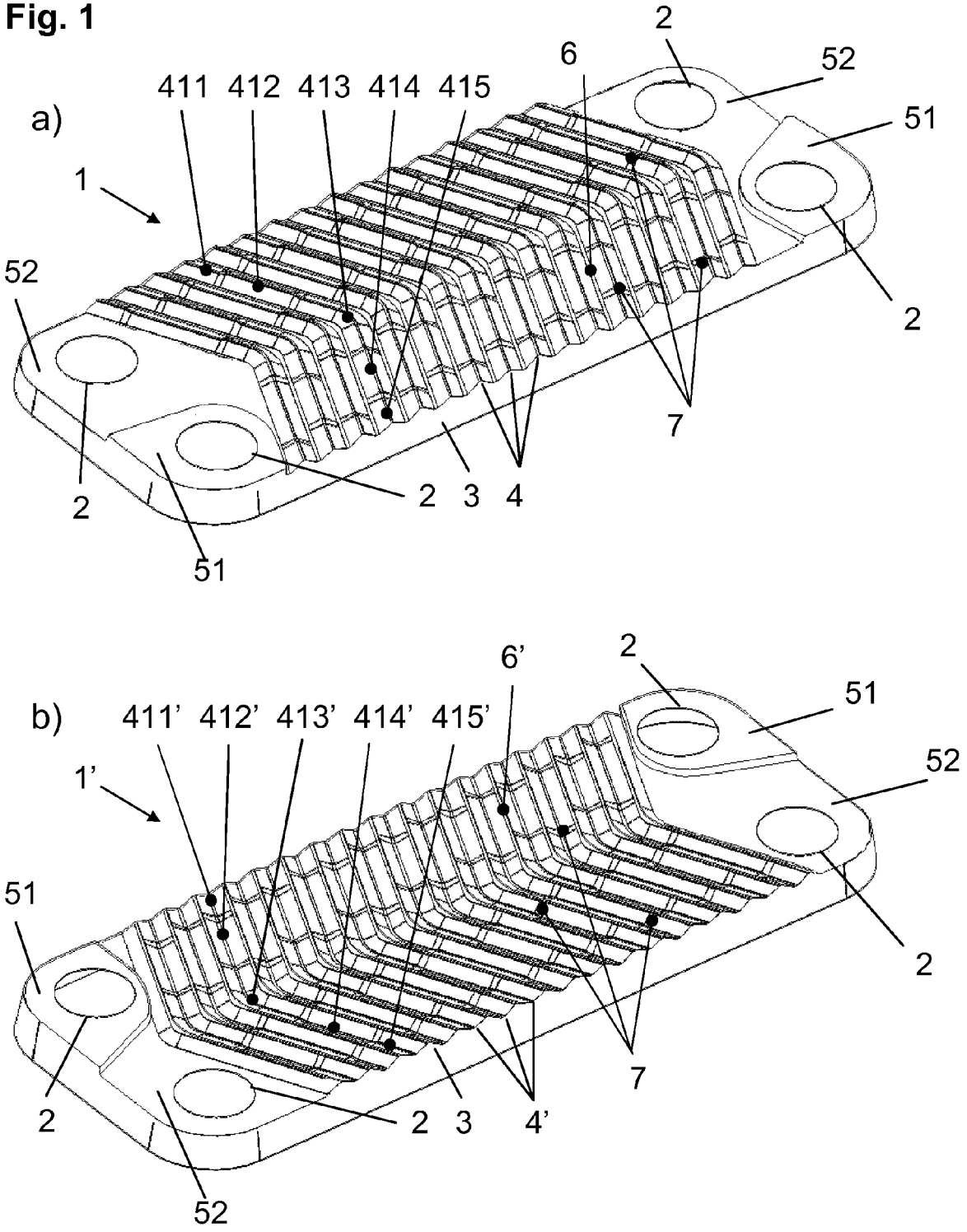

a)
411
412
413
414
415
1
2
6
52
51
52
2
7
2
3
4
2
51
b)
411'
412'
413'
414'
415'
1'
6'
2
51
52
51
2
7
2
3
4'
2
52

Fig. 2

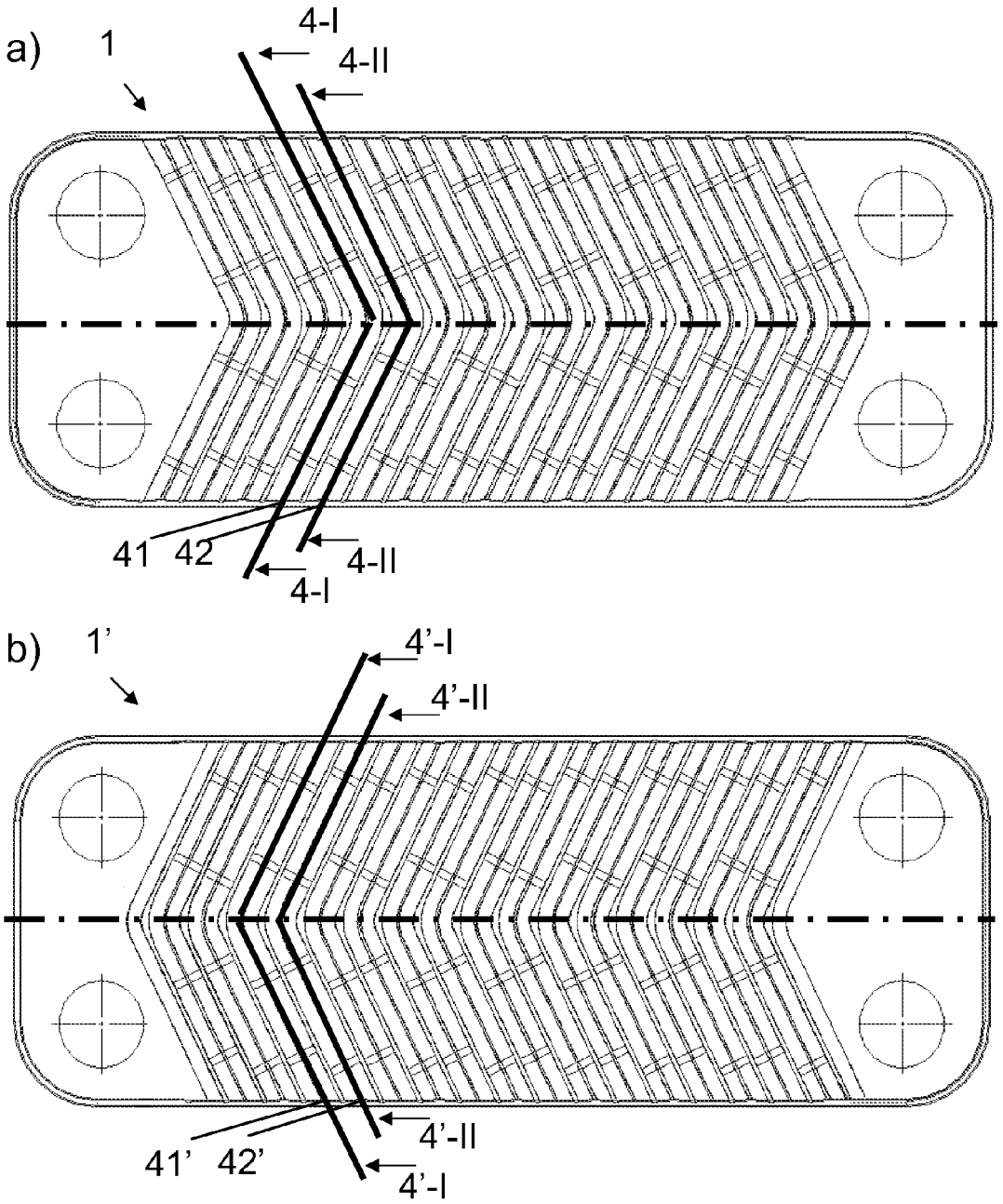


Fig. 3a

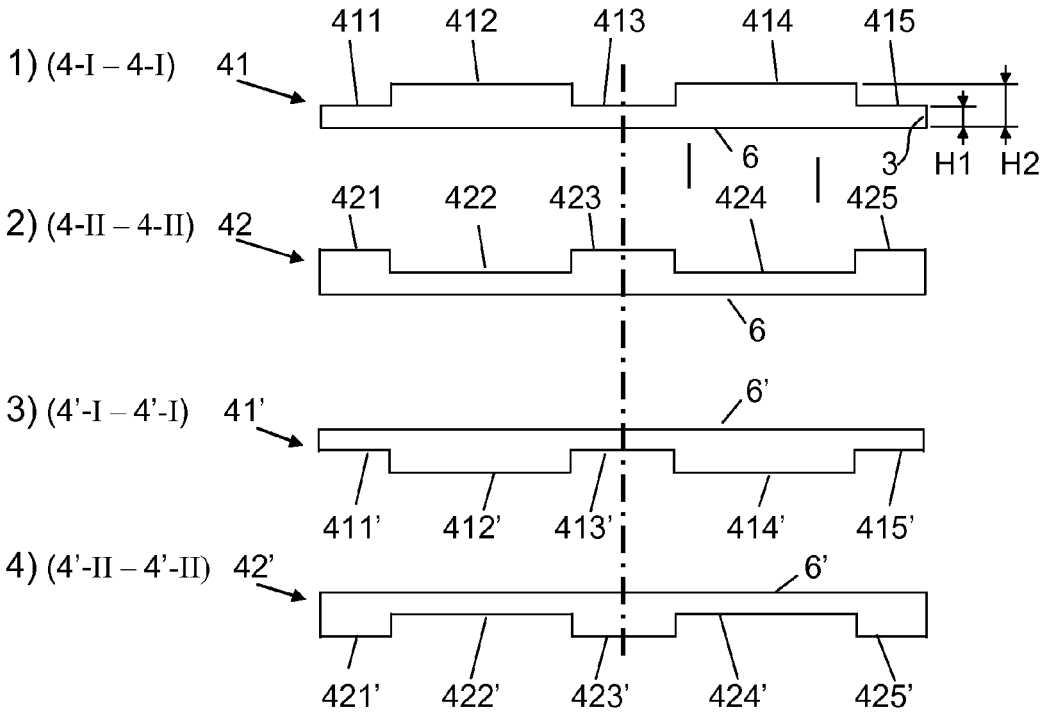

1) (4-I – 4-I)
41
411
412
413
414
415
6
3
H1
H2
2) (4-II – 4-II)
42
421
422
423
424
425
6
3) (4'-I – 4'-I)
41'
6'
411'
412'
413'
414'
415'
4) (4'-II – 4'-II)
42'
6'
421'
422'
423'
424'
425'

Fig. 3b

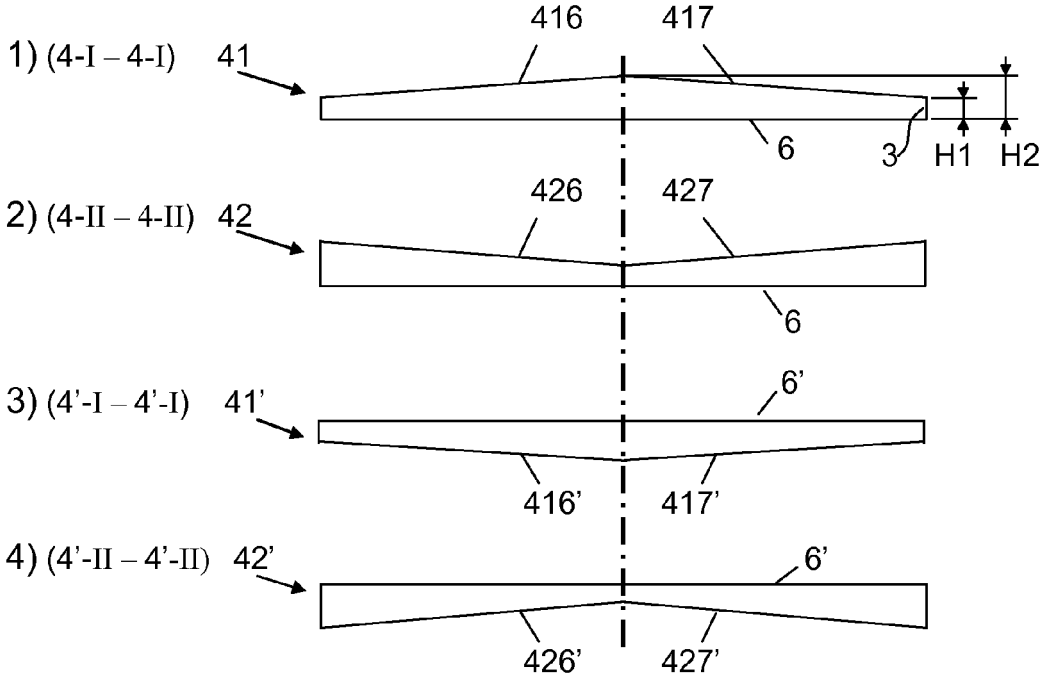

1) (4-I – 4-I)
41
416
417
6
3
H1
H2
2) (4-II – 4-II)
42
426
427
6
3) (4'-I – 4'-I)
41'
6'
416'
417'
4) (4'-II – 4'-II)
42'
6'
426'
427'

Fig. 3c

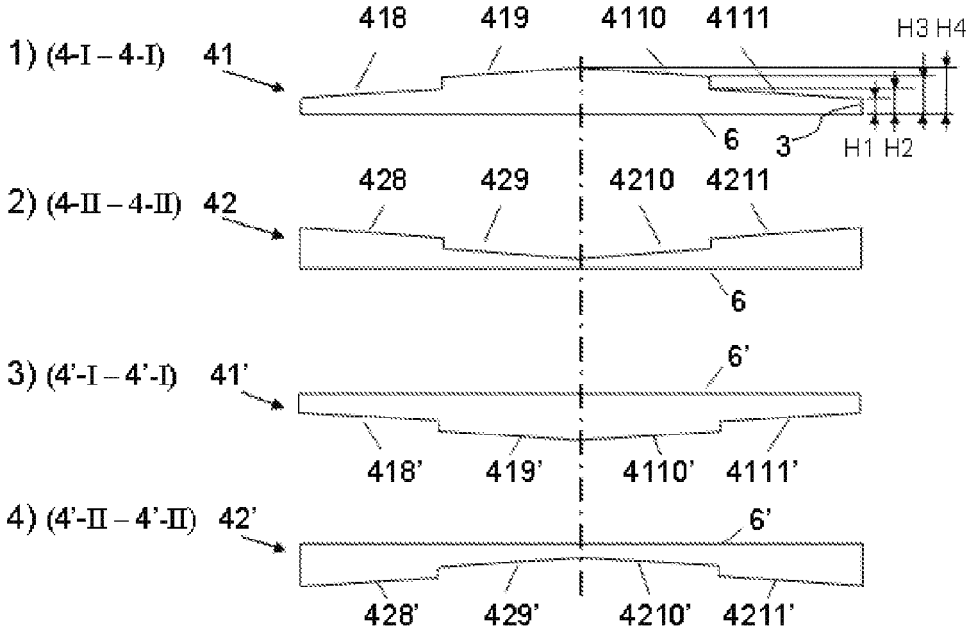

1) (4-I – 4-I) 41
418
419
4110
4111
H3 H4
6
3
H1 H2
2) (4-II – 4-III) 42
428
429
4210
4211
6
3) (4'-I – 4'-I) 41'
6'
418'
419'
4110'
4111'
4) (4'-II – 4'-II) 42'
6'
428'
429'
4210'
4211'

Fig. 4

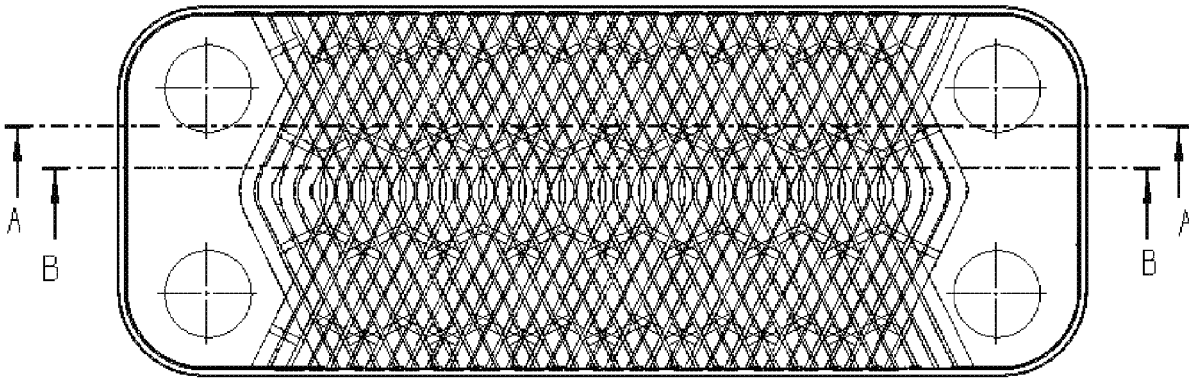

A
B
A
B

Fig. 5a (A-A)

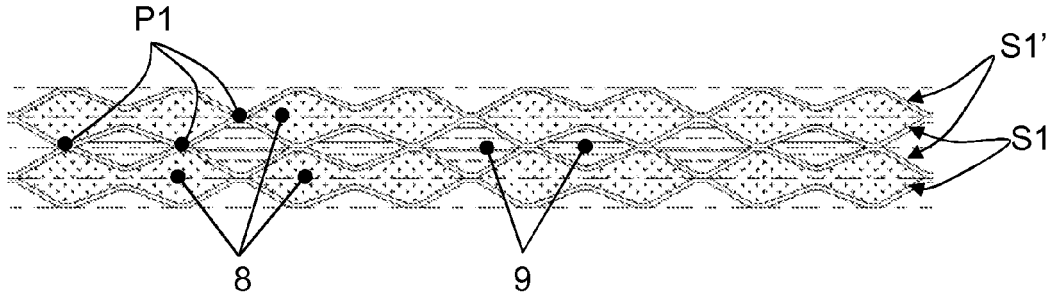
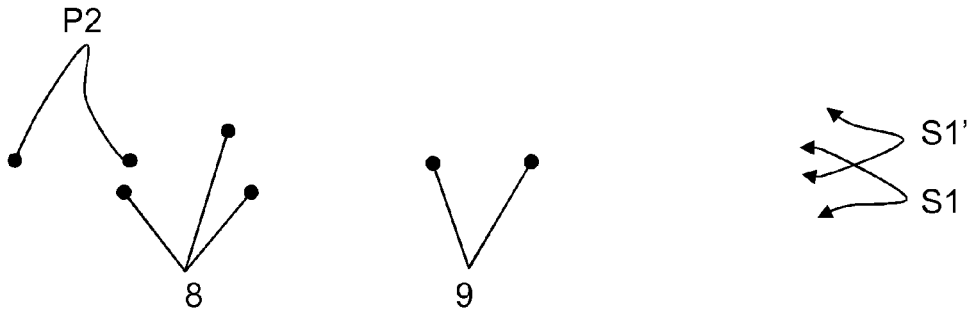


Fig. 5b (B-B)



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 15 5028

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	WO 93/00563 A1 (ALFA LAVAL THERMAL [SE]) 7 January 1993 (1993-01-07) * abstract; figures 2-5 *	1-11	INV. F28D9/00 F28F3/04 F28F3/08
X,P	WO 2009/112031 A2 (DANFOSS AS [DK]; EP TECHNOLOGY AB [SE]; PERSSON LARS [SE]) 17 September 2009 (2009-09-17) * figure 2 *	1-3,6-11	
A	JP 11 173771 A (DAIKIN IND LTD) 2 July 1999 (1999-07-02) * abstract *	1-11	
A,D	EP 1 630 510 A1 (SWEP INT AB [SE]) 1 March 2006 (2006-03-01) * abstract *	1-11	

TECHNICAL FIELDS SEARCHED (IPC)

F28D
F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 May 2010	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 10 15 5028

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.

27-05-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9300563 A1	07-01-1993	DE 69204166 D1	21-09-1995
		DE 69204166 T2	18-01-1996
		DK 591383 T3	25-09-1995
		EP 0591383 A1	13-04-1994
		JP 6508426 T	22-09-1994
		JP 3369170 B2	20-01-2003
		SE 468685 B	01-03-1993
		SE 9101928 A	25-12-1992
		US 5398751 A	21-03-1995
WO 2009112031 A2	17-09-2009	NONE	
JP 11173771 A	02-07-1999	JP 3147065 B2	19-03-2001
EP 1630510 A1	01-03-2006	AT 350639 T	15-01-2007
		AU 2005279446 A1	09-03-2006
		CN 101069058 A	07-11-2007
		DE 602004004114 T2	12-07-2007
		DK 1630510 T3	23-04-2007
		WO 2006024340 A1	09-03-2006
		ES 2279267 T3	16-08-2007
		JP 2008511811 T	17-04-2008
		KR 20070048707 A	09-05-2007
		PT 1630510 E	30-04-2007
		US 2008029257 A1	07-02-2008

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

- EP 1630510 B1 **[0004]**