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(54) PLATE KIND HEAT EXCHANGER WITH END PLATES

PLATTENWÄRMETAUSCHER MIT ENDPLATTEN

ÉCHANGEUR DE CHALEUR À PLAQUES COMPORTANT DES PLAQUES D'EXTRÉMITÉ

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Description

BACKGROUND

[0001] A typical construction of a plate heat exchanger comprises a plurality of heat transfer plate stacked on top of each other. The heat transfer plates are formed with patterns such that flow paths are formed between each set of neighboring heat transfer plates. Openings and are formed in the heat transfer plates to form inlets and outlets for fluids to these flow paths. The plates are positioned between end plates, which end plates to same material and weight often are relatively thin, e.g. of the same thickness as the heat transfer plates, or only slightly thicker.

[0002] The heat transfer plates are brazed or welded together at the connections, just as respectively the upper and lower heat transfer plates are brazed or connected to the respective upper and lower end plate.

[0003] One prior publication, WO 97/15798, discloses a plate heat exchanger, where a first end plate is connected to a stack first side outermost heat transfer plate of a stack of heat transfer plates, and a second end plate is connected to the stack second side outermost heat transfer plate, where with a blank area aligned with the first inlet where the second side outermost heat transfer plate is formed with a contacting projection connected and brazed or welded the inner surface of the second end plate.

[0004] Especially in the opening areas the pressures are high, and due to the relatively thin thickness the endplates tend to deform at high pressures, possible breaking or breaking in the connection to the neighboring heat transfer plates, possible leading to leaks.

[0005] The present invention is aimed to reducing assembly complexity of the typical plate heat exchanger and at the same time improving the mechanical strength by reducing level of deformations on the area around the openings/portholes at the second end plate.

SUMMARY OF THE INVENTION

[0006] The problems are solved according to the invention as is described in the claims.

[0007] This includes introducing a plate heat exchanger including a stack of patterned heat transfer plates connected to each other by brazing or welding and defining a first side and second side, were patterns of the connected neighbouring heat transfer plates forms respectively a first flow path and second flow path on the opposing sides of a heat transfer plate, said heat transfer plates comprising aligned first pair of port holes forming respectively first inlet and first outlet for a first fluid to be distributed to said first flow path, where a first end plate is connected to the stack first side outermost heat transfer plate with a first opening aligned to the first inlet, and a second end plate is connected to the stack second side outermost heat transfer plate with a blank area aligned with the first inlet, where the second side outermost heat transfer plate is formed with a contacting projection connected and brazed or welded the inner surface of the second end plate.

[0008] The blank area is curving in an outwards direction relative to the stack and may be dome shaped.

[0009] In an embodiment the second side outermost heat transfer plate is formed as a blank section where aligned with the second end plate blank area, and is curving in an outwards direction relative to the stack and connected by brazing or welding to the inner surface of the blank section of said second end plate, where the second side outermost heat transfer plate blank section may be dome shaped.

[0010] By 'aligned with' means they at least partly overlap.

[0011] In an embodiment heat transfer plate blank section projects outwards relative to the stack and has a flat top surface connected by brazing or welding to the blank area.

[0012] In an embodiment the heat transfer plate blank section projects outwards relative to the stack and has a flat top surface connected by brazing or welding to the circumference of the blank area.

[0013] In an embodiment a projection is formed as a circular projection contacting the second end plate at an area encircling the blank area.

[0014] In an embodiment the projection has a rounded top surface.

[0015] In an embodiment the projection has a flat top surface.

FIGURES

[0016]

Fig. 1 Side view of a stacked plate kind heat exchanger with upper and lower end plates and inlets and outlets.

Fig. 2 Illustrate several end plates and heat transfer plates to be stacked.

Fig. 3 Illustrate an embodiment of reinforcement connection in the inlet area not covered by the claims but relevant to the invention.

Fig. 4 Illustrate an embodiment of reinforcement connection in the inlet area.

Fig. 5 Illustrate an embodiment of reinforcement connection in the inlet area.

Fig. 6 Illustrate an embodiment of reinforcement connection in the inlet area.

DETAILED DESCRIPTION OF THE INVENTION

[0017] It should be understood, that the detailed description and specific examples, while indicating embod-

iments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

[0018] Fig. 1 is a side view illustrates a typical plate heat exchanger (100) including a stack (110) of patterned heat transfer plates (1) connected to each other by brazing or welding.

[0019] A first end plate (10) is connected to the stack (110) first side and a second end plate (11) to the stack (110) second side. In the illustration port connections (50) is connected to the first end plate (10) connecting the flow paths formed between the heat transfer plates (1) in the stack to a heating system fluid flow conduits or pipes. In the illustration seen from the side only two such port connections (50) is shown, and both in the first end plate (10). As seen in fig. 2 there usually are four such port connections (50), and in other embodiment some could be in the first end plate (10), and others in the second end plate (11).

[0020] Fig. 2 illustrate the same heat exchanger (100) having 6 heat transfer plates (1, 1a, 1b), though any number would apply, and usually it comprised significantly more heat transfer plates (1) than the illustration.

[0021] The heat transfer plates (1, 1a, 1b) are formed as thin sheets shaped with patterns (5), such as the illustrated chevron shaped corrugations. However, any other form of pattern (5) would also apply. Every second heat transfer plate (1, 1a, 1b) either may formed with different patterns (5), or may simply be rotated relative the other plates, such that the patterns (5) only cross each other forming respectively a first flow path and second flow path on the opposing sides of a heat transfer plate (1, 1a, 1b). The crossed patterns (5) then forms heat transferring regions.

[0022] The heat transfer plates (1, 1a, 1b) and first (10) and second (11) end plates are brazed or welded at the rims to seal the flow paths from the externals, and optionally at some, or all, of the other connection points.

[0023] At least some of the heat transfer plates (1, 1a, 1b) comprises a first pair of openings (20, 21) and a second pair of openings (22, 23) - one of which not visible in the figure. The openings (20, 21, 22, 23) are aligned to the corresponding openings of the neighbouring heat transfer plates (1, 1a, 1b) such that the e.g. the aligned first pair of openings (20, 21) forms a first inlet (20a) and first outlet (21a) for the first flow paths respectively (illustrated in fig. 1), and the aligned second pair of openings (22, 23) forms a second inlet and second outlet for the first flow paths respectively (not illustrated).

[0024] The first end plate (10) is connected to the first side outermost heat transfer plate (1a) with first connection opening (30) aligned to the first inlet (20a), and a second end plate (11) is connected to the stack (110) second side outermost heat transfer plate (1b) with a blank area (12) aligned with the first inlet (20a). The blank area (12) could be shaped relative to the bulk of the second end plate (11) or could simple just be the flat part of the second end plate (11) aligning with the first inlet (20a).

[0025] Further in the illustrated example second openings (31) aligns with the first inlet (21a), third openings (32) aligns with second inlet and fourth opening (33) aligns with second outlet. In other embodiments other of the openings. In other embodiments some of the openings (30, 31, 32, 33) are formed in the second end plate (11), the corresponding blank areas (12) thus being in the first end plate (10). Further, in some other embodiments the respectively first and second pairs, and first and second inlets and outlets are arranged differently.

[0026] The port connections (50) are connected to the first end plate (10) (respectively second end plate (11)) and the openings (30, 31, 32, 33).

[0027] Fig. 3 illustrate a first reinforcement configuration relevant to the present invention, showing the area around the first inlet (20a) in the area of the second side outermost heat transfer plate (1b) and second end plate (11). In the embodiment second side outermost heat transfer plate (1b) is formed with a blank section (2), meaning it does not form any opening (20). The blank section (2) forms a flat top surface (2b) of a projection (3) formed in the second side outermost heat transfer plate (1b) in an outwards direction relative to the stack (110), where said flat top surface (2b) is connected by brazing or welding to the blank area (12) of the second end plate (11), which is seen to be flat. A sealing area (120) is illustrated between the second side outermost heat transfer plate (1b) and its neighbouring plate (1) in the inlet area (20a). The first flow path F1 and second flow path F2 is illustrated between neighbouring heat transfer plates (1, 1b), but the area E between the inner surface of the second end plate (11) and outer surface of the second outer most heat transfer plate (1b) is empty.

[0028] Fig. 4 is a similar illustration to fig. 3, showing a second reinforcement embodiment, where the blank area (12) is curving in an outwards direction relative to the stack (110). In this embodiment the projection (3) is formed as in the embodiment of fig. 3, only such that it's top surface (2b) is larger than the curvy blank area (12), thus being connected to its circumference. The rest of the flat top surface (2b) thus 'covering' the blank area (12) in the plane of the bulk of the second end plate (11). In one embodiment the curvy blank area (12) is dome shaped.

[0029] Fig. 5 is a similar illustration to fig. 4, showing a third reinforcement embodiment, where the projection (3) in a circular shape with a top surface (2b) with a diameter which is larger than the curvy blank area (12), thus being connected the second end plate (11) in an area encircling the blank area (12).

[0030] Fig. 6 is a fourth reinforcement embodiment similar to illustrations of figs. 4 and 5, with a curvy or dome shaped blank area (12), but where the projection (3) has curvy shape with a top surface (2b) curving in an outwards direction relative to the stack (110) and connected by brazing or welding to the second end plate (11) blank area (12).

Claims

1. A plate heat exchanger (100) including a stack (110) of patterned (5) heat transfer plates (1) connected to each other by brazing or welding and defining a first side and second side, were patterns (5) of the connected neighbouring heat transfer plates (1) forms respectively a first flow path and second flow path on the opposing sides of a heat transfer plate (1), said heat transfer plates (1) comprising aligned first pair of port holes (20, 21) forming respectively first inlet (20a) and first outlet (21a) for a first fluid to be distributed to said first flow path, where a first end plate (10) is connected to the stack (110) first side outermost heat transfer plate (1a) with a first opening (30) aligned to the first inlet (20a), and a second end plate (11) is connected to the stack (110) second side outermost heat transfer plate (1b) with a blank area (12) aligned with the first inlet (20a), where the second side outermost heat transfer plate (1b) is formed with a contacting projection (3) connected and brazed or welded to the inner surface of the second end plate (11), **characterized in that** the blank area (12) is curving in an outwards direction relative to the stack (110).

2. A plate heat exchanger (100) as in claim 1, where the blank area (12) is dome shaped.

3. A plate heat exchanger (100) is in claim 1 or 2, where the second side outermost heat transfer plate (1b) is formed as a blank section (2) where aligned with the second end plate (11) blank area (12),and is curving in an outwards direction relative to the stack (110) and connected by brazing or welding to the inner surface of the blank area (12) of said second end plate (11).

4. A plate heat exchanger (100) as in claim 3, where the second side outermost heat transfer plate (1b) blank section (2) is dome shaped.

5. A plate heat exchanger (100) as in any of claims 1-2, wherein heat transfer plate (1b) formed as a blank section (2) where aligned with the second end plate (11) blank area (12), and where said blank section (2) projects outwards relative to the stack (110) and has a flat top surface (2a) connected by brazing or welding to the blank area (12).

6. A plate heat exchanger (100) as in any of claims 1-2, wherein heat transfer plate (1b) is formed as a blank section (2) where aligned with the second end plate (11) blank area (12), where said blank section (2) projects outwards relative to the stack (110) and has a flat top surface (2a) connected by brazing or welding to the circumference of the blank area (12).

7. A plate heat exchanger (100) as in any of claims 1-2, wherein a projection (3) is formed as a circular projection contacting the second end plate (11) at an area encircling the blank area (12).

8. A plate heat exchanger (100) as in claim 7, wherein the projection (3) has a rounded top surface (2b).

9. A plate heat exchanger (100) as in claim 7, wherein the projection (3) has a flat top surface (2b).

Patentansprüche

1. Plattenwärmetauscher (100) mit einem Stapel (110) gemusterter (5) Wärmeübertragungsplatten (1), die mittels Hartlöten oder Verschweißen miteinander verbunden sind und eine erste Seite und eine zweite Seite definieren, wobei Muster (5) der verbundenen benachbarten Wärmeübertragungsplatten (1) jeweils einen ersten Strömungsweg und einen zweiten Strömungsweg auf den entgegengesetzten Seiten einer Wärmeübertragungsplatte (1) ausbilden, wobei die Wärmeübertragungsplatten (1) ein ausgerichtetes erstes Paar Anschlussbohrungen (20, 21) umfassen, die den ersten Einlass (20a) bzw. den ersten Auslass (21a) für ein zum ersten Strömungsweg zu verteilendes erstes Fluid ausbilden, wobei eine erste Endplatte (10) an einer äußersten Wärmeübertragungsplatte (1a) auf der ersten Seite mit einer mit dem ersten Einlass (20a) ausgerichteten ersten Öffnung (30) mit dem Stapel (110) verbunden ist und eine zweite Endplatte (11) an einer äußersten Wärmeübertragungsplatte (1b) auf der zweiten Seite mit einer mit dem ersten Einlass (20a) ausgerichteten Leerfläche (12) mit dem Stapel (110) verbunden ist, wobei die äußerste Wärmeübertragungsplatte (1b) auf der zweiten Seite mit einem Berührungsvorsprung (3) ausgebildet ist, der mit der Innenfläche der zweiten Endplatte (11) verbunden und hartgelötet oder verschweißt ist, **dadurch gekennzeichnet, dass** sich die Leerfläche (12) in Bezug zum Stapel (110) nach außen krümmt.

2. Plattenwärmetauscher (100) nach Anspruch 1, wobei die Leerfläche (12) kuppelförmig ist.

3. Plattenwärmetauscher (100) nach Anspruch 1 oder 2, wobei die äußerste Wärmeübertragungsplatte (1b) auf der zweiten Seite als Leerabschnitt (2) ausgebildet ist, wenn sie mit der Leerfläche (12) der zweiten Endplatte (11) ausgerichtet ist, und sich in Bezug zum Stapel (110) nach außen krümmt und mittels Hartlöten oder Verschweißen mit der Innenfläche der Leerfläche (12) der zweiten Endplatte (11) verbunden ist.

4. Plattenwärmetauscher (100) nach Anspruch 3, wo-

bei die Leerfläche (2) der äußersten Wärmeübertragungsplatte (1b) auf der zweiten Seite kuppelförmig ist.

5. Plattenwärmetauscher (100) nach einem der Ansprüche 1-2, wobei die Wärmeübertragungsplatte (1b) als Leerabschnitt (2) ausgebildet ist, wenn sie mit der Leerfläche (12) der zweiten Endplatte (11) ausgerichtet ist, und wobei der Leerabschnitt (2) in Bezug zum Stapel (110) nach außen vorsteht und eine plane Deckfläche (2a) aufweist, die mittels Hartlöten oder Verschweißen mit der Leerfläche (12) verbunden ist.

6. Plattenwärmetauscher (100) nach einem der Ansprüche 1-2, wobei die Wärmeübertragungsplatte (1b) als Leerabschnitt (2) ausgebildet ist, wenn sie mit der Leerfläche (12) der zweiten Endplatte (11) ausgerichtet ist, wobei der Leerabschnitt (2) in Bezug zum Stapel (110) nach außen vorsteht und eine plane Deckfläche (2a) aufweist, die mittels Hartlöten oder Verschweißen mit dem Umfang der Leerfläche (12) verbunden ist.

7. Plattenwärmetauscher (100) nach einem der Ansprüche 1-2, wobei ein Vorsprung (3) als kreisförmiger Vorsprung ausgebildet ist, der die zweite Endplatte (11) an einer Fläche berührt, die die Leerfläche (12) umgibt.

8. Plattenwärmetauscher (100) nach Anspruch 7, wobei der Vorsprung (3) eine abgerundete Deckfläche (2b) aufweist.

9. Plattenwärmetauscher (100) nach Anspruch 7, wobei der Vorsprung (3) eine plane Deckfläche (2b) aufweist.

Revendications

1. Échangeur de chaleur à plaques (100) comprenant un empilement (110) de plaques de transfert de chaleur (1) à motifs (5) reliées entre elles par brasage ou soudage et définissant un premier côté et un second côté, les motifs (5) des plaques de transfert de chaleur (1) voisines reliées entre elles formant respectivement une première voie d'écoulement et une seconde voie d'écoulement sur les côtés opposés d'une plaque de transfert de chaleur (1), lesdites plaques de transfert de chaleur (1) comprenant une première paire alignée d'orifices (20, 21) formant respectivement une première entrée (20a) et une première sortie (21a) pour un premier fluide à distribuer dans ladite première voie d'écoulement, une première plaque d'extrémité (10) étant reliée à une plaque de transfert de chaleur la plus extérieure de premier côté (1a) de l'empilement (110) avec une première ouverture (30) alignée sur la première entrée (20a), et une seconde plaque d'extrémité (11) étant reliée à une plaque de transfert de chaleur la plus extérieure de second côté (1b) de l'empilement (110) avec une zone vide (12) alignée sur la première entrée (20a), la plaque de transfert de chaleur la plus extérieure de second côté (1b) étant formée d'une saillie de contact (3) reliée et brasée ou soudée à la surface intérieure de la seconde plaque d'extrémité (11), **caractérisé en ce que** la zone vide (12) est incurvée vers l'extérieur par rapport à l'empilement (110).

2. Échangeur de chaleur à plaques (100) selon la revendication 1, la zone vide (12) étant en forme de dôme.

3. Échangeur de chaleur à plaques (100) selon la revendication 1 ou 2, la plaque de transfert de chaleur la plus extérieure de second côté (1b) étant formée d'une section vide (2), où elle est alignée avec la zone vide (12) de la seconde plaque d'extrémité (11), et courbée vers l'extérieur par rapport à l'empilement (110) et connectée par brasage ou soudage à la surface intérieure de la zone vide (12) de ladite seconde plaque d'extrémité (11).

4. Échangeur de chaleur à plaques (100) selon la revendication 3, la section vide (2) de la plaque de transfert de chaleur la plus extérieure de second côté (1b) étant en forme de dôme.

5. Échangeur de chaleur à plaques (100) selon l'une quelconque des revendications 1 et 2, la plaque de transfert de chaleur (1b) étant formée comme une section vide (2) où elle est aligné avec la zone vide (12) de la seconde plaque d'extrémité (11), et ladite section vide (2) faisant saillie vers l'extérieur par rapport à l'empilement (110) et ayant une surface supérieure plate (2a) reliée par brasage ou soudage à la zone vide (12).

6. Échangeur de chaleur à plaques (100) selon l'une quelconque des revendications 1 et 2, la plaque de transfert de chaleur (1b) étant formée comme une section vide (2) où elle est alignée avec la zone vide (12) de la seconde plaque d'extrémité (11), ladite section vide (2) faisant saillie vers l'extérieur par rapport à l'empilement (110) et ayant une surface supérieure plate (2a) reliée par brasage ou soudage à la circonférence de la zone vide (12).

7. Échangeur de chaleur à plaques (100) selon l'une quelconque des revendications 1 et 2, une saillie (3) étant formée comme une saillie circulaire en contact avec la seconde plaque d'extrémité (11) dans une zone encerclant la zone vide (12).

8. Échangeur de chaleur à plaques (100) selon la revendication 7, la saillie (3) ayant une surface supérieure arrondie (2b).

9. Échangeur de chaleur à plaques (100) selon la revendication 7, la saillie (3) ayant une surface supérieure plate (2b).

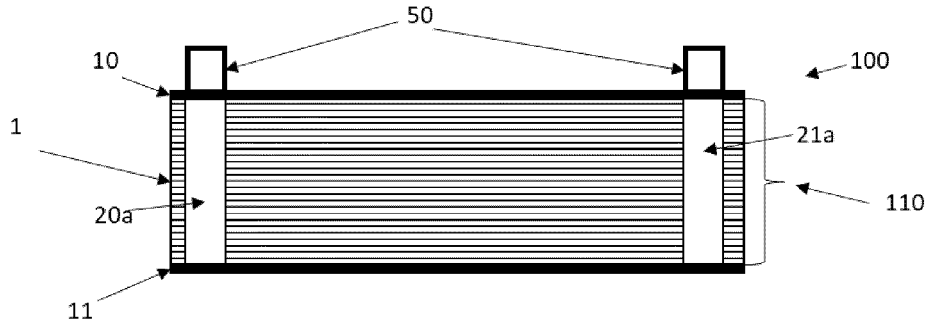
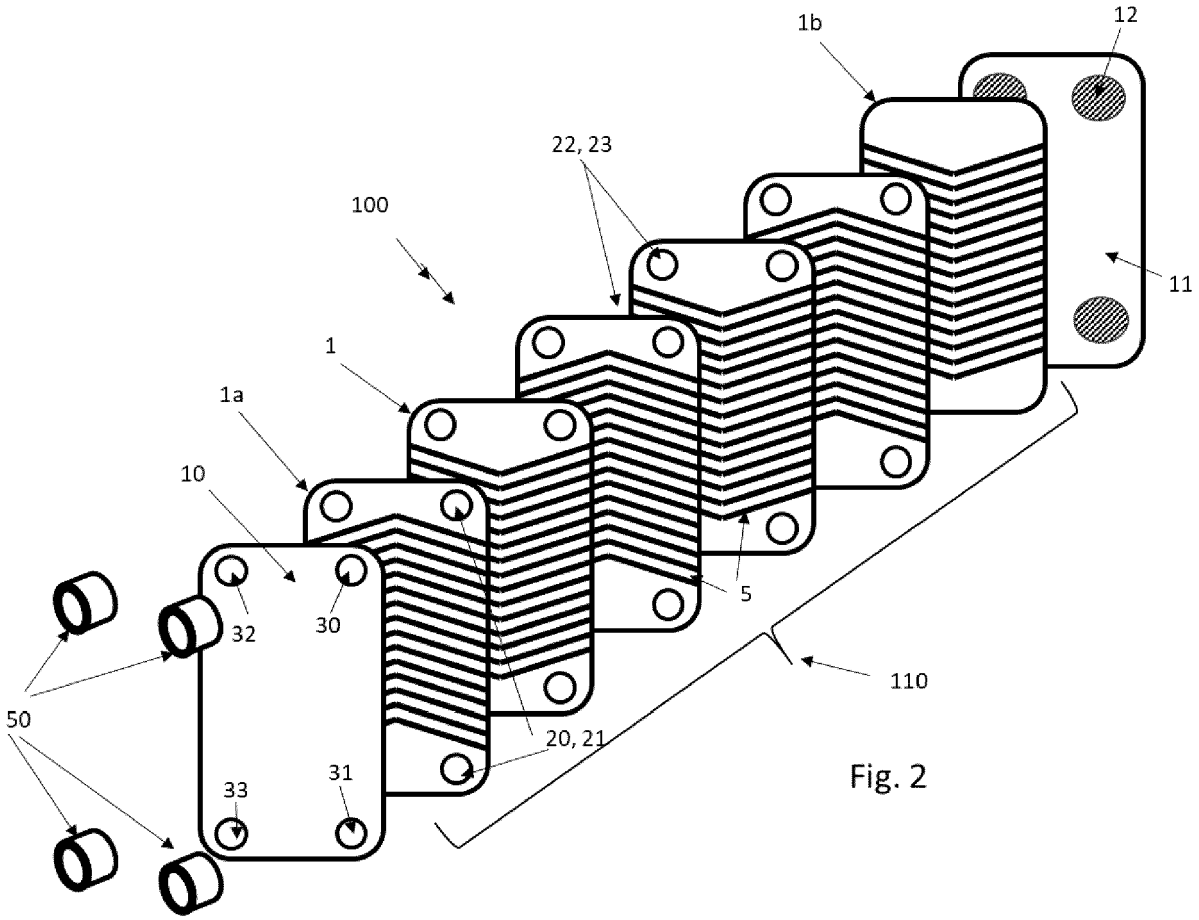

50
10
100
1
21a
110
20a
11

Fig. 1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1a
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5
32
30
110
50
20, 21
33
31

Fig. 2

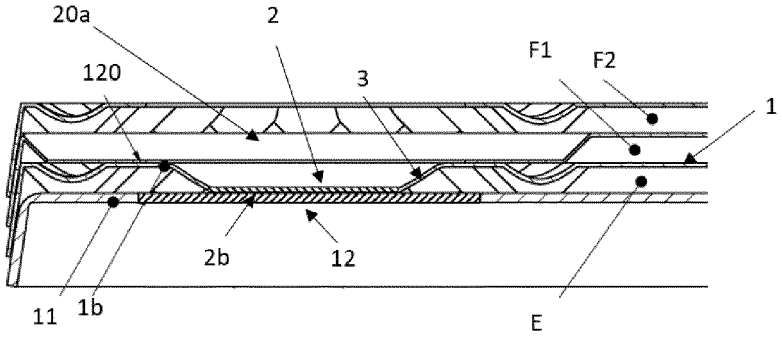

Fig. 3

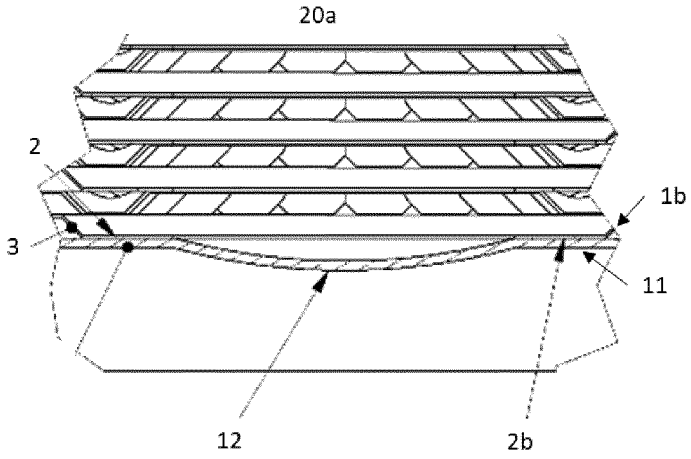

Fig. 4

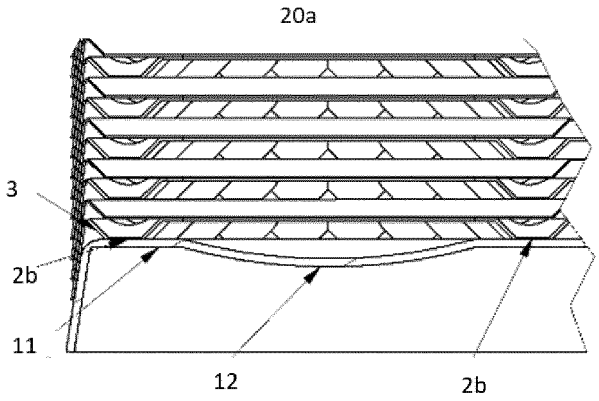

Fig. 5

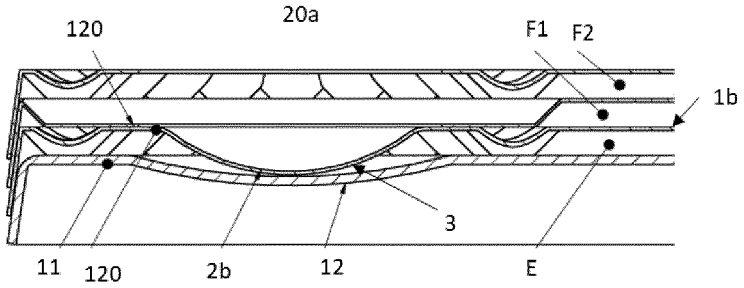

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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