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(54) **GASKET FIXATION TO HEAT TRANSFER PLATE**

(57) The present invention relates to a click-on tap of a gasket for a stacked plate heat exchanger. The gasket comprises a main portion adapted to be positioned in a gasket groove formed in a heat transfer plate that encloses a heat exchanging area, said heat transfer plate further comprising a pattern of tops and valleys positioned at an outer edge region at the outer circumference of the gasket groove, and where the gasket comprises a click-on tap adapted to be positioned within a valley.

The present invention further relates to the method of attaching the gasket.

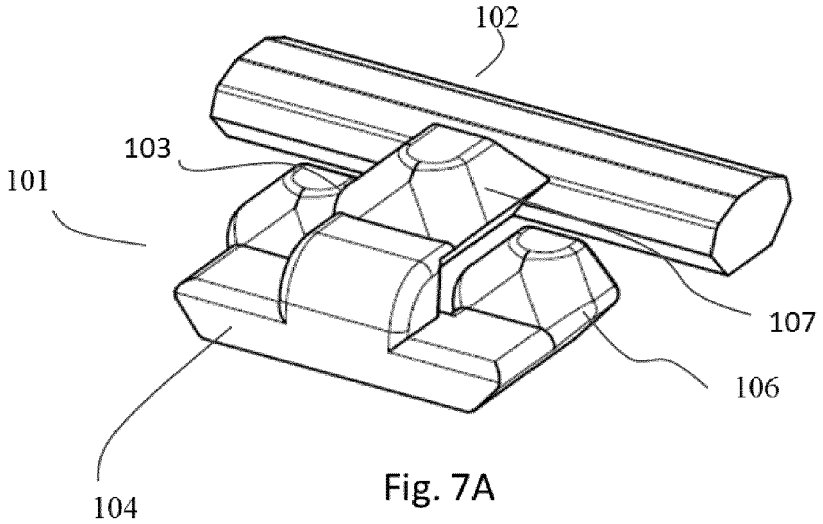


Fig. 7A

EP 3 640 576 A1

Description

BACKGROUND

[0001] In heat exchangers formed of a plural of stacked heat transfer plates formed with two pairs of openings, and with gaskets positioned in gasket grooves to seal respectively the heat exchanging area from the externals, and from one set of the pair of openings.

[0002] If the gasket is not correctly positioned, or in general is being misaligned due to the pressures of the fluids flowing in the flow paths formed between pairs of the stacked heat transfer plates, then leakage may occur.

[0003] The object of the present invention is to introduce a gasket and a gasket fixing method to ensure a correct and secure positioning, and further that could be used in existing standard heat transfer plates, that thus would not require modification that could affect the stability of the heat exchanger, the heat transfer plates and the gasket positioning.

SUMMARY OF THE INVENTION

[0004] The objects are solved according to the solutions as indicated in the claims.

[0005] This includes introducing a gasket comprising a main portion adapted to be positioned in a gasket groove formed in a heat transfer plate that encloses a heat exchanging area, said heat transfer plate further comprising a pattern of tops and valleys positioned at an outer edge region at the outer circumference of the gasket groove, and where the gasket comprises a click-on tap adapted to be positioned within a valley. Since most heat transfer plates are formed with such a pattern of tops and valleys at the ridge to form a strong connection to respective upper and lower connected neighbouring heat transfer plates in edge area. With the present embodiment the click-on simply utilizes the already present valley.

[0006] In an embodiment the click-on tap is positioned purely at an upper part of said main portion of the gasket, such as at the upper half, or the upper third, or the upper fourth.

[0007] In an embodiment said click-on tap comprise a first portion projecting from said main portion and being formed with a shape or recess at its lower surface adapted to fit over a projection formed in the edge region, and a second portion adapted to reach out of outer edge region.

[0008] In an embodiment said projection is a wall section connecting two of the tops, said wall section further separating the gasket groove from the valley between said two tops.

[0009] Some heat transfer plates are with such wall sections which both induces rigidness of the heat transfer plate in edge region, but also forms a continuous outer wall section of the gasket groove against which the gasket can lean and forms a barrier against the gasket being pushed outwards. In the embodiment there thus is no requirement for modification in that the first portion simply extend over the wall section.

[0010] In an embodiment said click-on tap comprise a first portion projecting from said main portion and being formed with an upper projection at its upper surface adapted to fit into a projection formed in the edge region of an upper connected heat transfer plate, and a second portion adapted to reach out of outer edge region.

[0011] In an embodiment, said second portion comprise a part reaching around and under the end face of the heat transfer plate.

[0012] In an embodiment the end face between two neighbouring tops is closed where the part further reaches up at the inner side of the closed end face (54) into the inside chamber (55) formed under the top (51).

[0013] In an embodiment, said second portion comprise two parts reaching into the inside chambers of the two neighbouring tops of a valley, where said first portion is positioned within said valley.

[0014] An embodiment relates to a heat transfer plate formed with patterns such that flow paths are formed between each set of neighbouring heat transfer plates defining heat exchanging areas, and with openings to form inlets and outlets for fluids to the flow paths, and a gasket groove formed enclosing said heat exchanging area, said heat transfer plate further comprising a pattern of tops and valleys positioned at an outer edge region at the outer circumference of the gasket groove, and wherein the end face between two neighbouring tops is closed, and wherein said heat transfer plate is adapted to receive a gasket according to any of the previous embodiments.

[0015] In an embodiment of said heat transfer plate, said closed end face is formed by shaping the material forming the heat transfer plate.

[0016] The present invention further introduces a method to fix the gasket as indicated in the claims.

[0017] This includes method of fixing a gasket on a heat transfer plate, wherein said heat transfer plate comprises a gasket groove formed in a heat transfer plate that encloses a heat exchanging area, and a pattern of tops and valleys positioned at an outer edge at the outer circumference of the gasket groove, and where the method includes the step of positioning the main portion in the gasket groove, and where
said gasket comprises a main portion and a click-on tap, where said click-on tap comprise a first portion projecting from said main portion and a second portion adapted to reach out of outer edge region, said method being to position said main portion in said gasket groove such that said first portion aligns with a valley, position said first portion in said valley, and through the elasticity of said gasket material, drag a part of said second portion around and under the end face of the heat transfer plate.

[0018] In an embodiment a wall section is formed in said edge region connecting two of the tops, said wall section further separating the gasket groove from the valley between said two tops, wherein said method includes

a step of positioning said first portion over said wall section.

[0019] In an embodiment, said end face between two neighbouring tops is closed, and where the method further comprises a step of dragging the part under said end face to position said part at the inner side of the closed end face into the inside chamber formed under the top.

FIGURES

[0020]

Fig. 1 Side view of a standard heat exchanger formed of stacked heat transfer plates.

Fig. 2 Top view of three heat transfer plates on top of each other.

Fig. 3 Top view illustrating an embodiment of the click-on tap of the present invention connected to an edge portion of a heat transfer plate.

Fig. 4 Illustration of a section edge portion of a heat transfer plate and gasket with click-on tap according to an embodiment of the present invention.

Fig. 5 Front view of three stacked heat transfer plates with a click-on tap extending out of the edge portion and connected to the plates according to an embodiment of the present invention.

Figs. 6A, B Side views of a cross section of the three stacked heat transfer plates of fig. 5, showing the gasket and the click-on tap.

Figs. 7A, B Views of a click-on tap according to a further embodiment of the present invention.

Fig. 8 Side view of a cross section of three stacked heat transfer plates with the click-on tap of figs. 7A, B.

Fig. 9 A click-on tap according to a further embodiment of the present invention including a plural of first portions.

DETAILED DESCRIPTION OF THE INVENTION

[0021] It should be understood, that the detailed description and specific examples, while indicating embodiments 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.

[0022] FIG. 1 is a sideview of a typical construction of a plate heat exchanger (1). The plate heat exchanger (1) comprises a plurality of heat transfer plates (10) stacked on top of each other. Inlets and outlets (2, 3) is connected, and the stack of heat transfer plates (10) may be positioned between top (4) and bottom (5) plates.

[0023] Fig. 2 illustrates the heat transfer plates (10), which are formed with patterns (not shown in any of the figures) such that flow paths are formed between each set of neighbouring heat transfer plates (10) defining heat exchanging areas (11). Openings (20) and (21) are formed in the heat transfer plates (10) to connected to the inlets and outlets (2, 3)) for fluids to these flow paths. Gaskets (100) are positioned between the heat transfer plates (10) in gasket grooves (40) formed in the heat transfer plates (10). The gasket (100) is arranged at an edge portion of the heat transfer plate (10) to seal the flow paths and at an area around the openings (20, 21) to seal pairs of the openings, such that only two of them (20) have flow access to the flow path formed at one side of the heat transfer plate, while the other two (21) are sealed therefrom.

[0024] Enclosed by the gasket (100) is the heat exchanging area (11), where a hotter fluid in the flow paths at the one side of a heat transfer plate (10) to the colder fluid in the flow paths at the opposite side, these flow paths being sealed from each other.

[0025] At the outer edge region (50) of the heat transfer plates (10) pattern(s) (51, 52) are formed, such as corrugated pattern(s), comprising a pattern of tops (51) and valleys (52).

[0026] Fig. 3 illustrates a section of the gasket (100) with a main portion (102) positioned in the gasket groove (40), and further showing a section of an outer edge region (50) of the heat transfer plate (10). The figure illustrates an embodiment of the present invention, where a click-on tap (101) extends from said main portion (102).

[0027] The click-on tap (101) comprise a first portion (103) projecting from said main portion (102) and positioned within a valley (52), and a second portion (104) adapted to reach out of outer edge region (50).

[0028] At least the valley (52) where the first portion (103) is positioned in the outer edge region (50) is formed a projection (53) projecting against the first portion (103) that thereby reaches from the main portion (102), over said projection (53) and continuing to the second portion (104). In an embodiment part of the main portion (102) thus rests on the projection (53) and part on the bottom of the valley (52).

[0029] In one embodiment the projection (53) is a wall section connecting two of the tops (51), said wall section (53) further separating the gasket groove (40) from the valley (52) between said two tops (51). This is a classic construction of heat transfer plates (10), where such a 'comb'-shaped outer edge region (50) is formed having an inner side being the outer surface of the gasket groove (40) and preventing the gasket from being pushed out due to the fluid pressures. The present gasket (100) thus also could be used in such standard transfer plates (10)

without having to modify them in any manner, or to make specially designed patterns in the outer edge region (50) for the positioning and attachment of click-on taps (101).

[0030] Illustrated is also the second portion (104) comprising a part (106) reaching around and under the end face (12) of the heat transfer plate (10). In the illustrated embodiment said second portion (104) comprise two parts (106) reaching into the inside chambers (55) of the two neighbouring tops (51) of a valley (52), said first portion (103) positioned within said valley (52). In an embodiment a plural of such click-on taps (101) is position at some intervals through the whole circumference of the gasket (100), thus securing it to all sides of the heat transfer plate (10).

[0031] In the illustrated embodiment the second portion (104) is seen to comprise two parts (106) reaching into the inside chambers (55) formed under the two neighbouring tops (51) of a valley (52), said first portion (103) positioned within said valley (52).

[0032] Fig. 4 shows essentially the same as fig. 3, but in a different view and disclosing closed end faces (54) between two neighbouring tops (51), the end faces (56) between neighbouring valleys (52) still being open. The parts (106) of the gaskets then further is shaped not only such that they are positioned in the chambers (55), but also reaches up at the inner side surface wall of the closed end face (54).

[0033] Shown is also the first portion (103) comprising a shape or recess (105) at its lower surface adapted to fit over a projection (53) formed in the edge region (50).

[0034] Fig. 5 shows a front view of a section of three heat transfer plates (10) stacked on top of each other, such that a valley (52) of an upper plate (10) connects to a top (51) of a lower plate etc. The front view of the first portion (103) of the gasket (100) is seen protruding out of the opening of a valley (52), and the second portion (104) extending along the end faces (12) of the heat transfer plates (12) and having the parts (106) reaching into the back sides of the closed end faces (54) of the tops (51) and up along its inner surfaces. In an embodiment that not illustrated, the second portions (104) also have parts reaching up along the outer surface of the closed end faces (54). In both cases the parts (106) and (104) may be in contact with the closed end face (54) surfaces.

[0035] When a valley (52) of an upper plate (10) connects to a top (51) of a lower plate, there will be access to the inner chambers (55) through the outer openings formed by the lower valley (52). The portions (106) is positioned through these openings and into the inner chambers (55) of the upper tops (51).

[0036] In addition to the portions (106) to be secured against movement in the outwards direction relative to the inner surfaces of the closed end faces (54), they also may be secured against movement in the inwards direction by the outer surface of the closed end face (54) of the lower top (51) connected to the valley (52) where the first portion (103) is positioned.

[0037] Figs. 6A and 6B illustrates the side views of the sections A-A and B-B from fig. 5. In fig. 6A the wall (53) forming barrier between the valley (52) and the gasket groove (40) seen in the middle of the three heat transfer plates (10), this also shown with the gasket (100) having a click-on tap (101) first portion (103) positioned over the wall (53) and to the bottom of the valley (52) to the second portion (104) reaching out of the open end face (56). In the illustrated embodiment the second portion (104) further contacts the outer surface of the closed end face (54) of the lower heat transfer plate (10), as also discussed previously.

[0038] In the present invention it is being exploited that when the valleys (52) of a lower heat transfer plate (10) connects to the tops (51) of a lower plate (10), then the tops (51) of the upper heat transfer plate (10) aligns with valleys (52) plates. This means the projections (53), or wall sections, always project into the open chamber (55) of the upper top (51), thus leaving access for the first portion (103).

[0039] Fig. 6B shows the position B-B of fig. 5 where part of the second portion (104) is seen and the portion (106) reaching into the chamber (55) up in contact with the inner surface of the closed end face (54).

[0040] The figures 4 and 6A also shows another feature of an embodiment, that the click-on tap (101) is positioned purely at an upper part of said main portion (102) of the gasket (100), such as at the upper half, or the upper third, or the upper fourth. This enables the lower part of the main portion (102) to rest against the outer of the surfaces (41) of the gasket groove (40), whereas the upper positioned first portion (103) thus reaches over the surface (41) which also is a part of the projection (53), and over the projection (or wall) (53).

[0041] In one embodiment the closed end face (54) is formed by shaping the material forming the heat transfer plate (10).

[0042] Figs. 7A and 7B illustrate a further feature of the click-on tap (101), being an upper projection (107) on the first portion (103) which could apply to any of the previous embodiment. The upper projection (107) then will reach into a projection formed in the upper connected heat transfer plate (10), which is not illustrated. This assists not only in fixing the gasket (100), but also by increasing the thickness of the first portion (103) making it more solid.

[0043] A further feature which may be present, is that the first portion (103) includes no shape or recess (105), but rather is flat. In one embodiment the first portion (103) is positioned over the projection, or wall section (53) adapting to its shape by its elasticity. This basically being the same embodiment as in fig. 3, only without a recess (105).

[0044] In an alternative embodiment, where this click-on tap (101) is positioned the heat transfer plate (10) thus will not have a projection, or wall section (53), but the associated valley (52) where it is positioned will be in direct connection to the gasket groove (40).

[0045] Fig. 8 is a side view of a cross section of three stacked heat transfer plates with the click-on tap of figs. 7A, B.

[0046] Fig. 9 illustrate a further embodiment, where the click-on tap (101) includes two (or even more) first portions (103) connected by one common second portion (104). When in position the respective two portions (103) of the figure will be positioned at each side of a top (51). In the illustrated embodiment, the first portions (103) are formed with recesses (105), but are without in alternative embodiments, or the one has a recess (105) whereas the other has not.

[0047] In one associated embodiment, the gasket (100) includes a mix of click-on taps (101) according to the different embodiments, and the heat transfer plate (10) is formed accordingly. This e.g. includes that some are formed as in fig. 3, whereas one or more of the others are formed as in figs. 7A, 7B and 8.

Claims

1. Gasket (100) comprising a main portion (102) adapted to be positioned in a gasket groove (40) formed in a heat transfer plate (10) that encloses a heat exchanging area (11), said heat transfer plate (10) further comprising a pattern of tops (51) and valleys (52) positioned at an outer edge region (50) at the outer circumference of the gasket groove (40), and where the gasket (100) comprises a click-on tap (101) adapted to be positioned within a valley (52).

2. Gasket (100) according to claim 1, wherein said click-on tap (101) is positioned purely at an upper part of said main portion (102) of the gasket (100), such as at the upper half, or the upper third, or the upper fourth.

3. Gasket (100) according to claim 1 or 2, wherein said click-on tap (101) comprise a first portion (103) projecting from said main portion (102) and being formed with a shape or recess (105) at its lower surface adapted to fit over a projection (53) formed in the edge region (50), and a second portion (104) adapted to reach out of outer edge region (50).

4. Gasket (100) according to claim 3, wherein said projection (53) is a wall section connecting two of the tops (51), said wall section (53) further separating the gasket groove (40) from the valley (52) between said two tops (51).

5. Gasket (100) according to claim 1 or 2, wherein said click-on tap (101) comprise a first portion (103) projecting from said main portion (102) and being formed with an upper projection (107) at its upper surface adapted to fit into a projection formed in the edge region (50) of an upper connected heat transfer plate (10), and a second portion (104) adapted to reach out of outer edge region (50).

6. Gasket (100) according to claim 3, 4 or 5, wherein said second portion (104) comprise a part (106) reaching around and under the end face (12) of the heat transfer plate (10).

7. Gasket (100) according to claim 6, wherein the end face (12) between two neighbouring tops (51) is closed (54), and where the part (106) further reaches up at the inner side of the closed end face (54) into the inside chamber (55) formed under the top (51).

8. Gasket (100) according to claim 7, wherein said second portion (104) comprise two parts (106) reaching into the inside chambers (55) of the two neighbouring tops (51) of a valley (52), where said first portion (103) is positioned within said valley (52).

9. Heat transfer plate (10) formed with patterns such that flow paths are formed between each set of neighbouring heat transfer plates (10) defining heat exchanging areas (11), and with openings (20) and (21) to form inlets and outlets for fluids to the flow paths, and a gasket groove (40) formed enclosing said heat exchanging area (11), said heat transfer plate (10) further comprising a pattern of tops (51) and valleys (52) positioned at an outer edge region (50) at the outer circumference of the gasket groove (40), and wherein the end face (12) between two neighbouring tops (51) is closed (54), and wherein said heat transfer plate (10) is adapted to receive a gasket (100) according to any of the claims 1-8.

10. Heat transfer plate (10) according to claim 9, wherein said closed end face (54) is formed by shaping the material forming the heat transfer plate (10).

11. Heat exchanger (1) with the gasket (100) according to any of the claims 1-8, and/or formed of heat transfer plates (10) according to claim 9.

12. Method of fixing a gasket (100) on a heat transfer plate (10), wherein said heat transfer plate (10) comprises a gasket groove (40) formed in a heat transfer plate (10) that encloses a heat exchanging area (11), and a pattern of tops (51) and valleys (52) positioned at an outer edge region (50) at the outer circumference of the gasket groove (40), and where the method includes the step of positioning the main portion (102) in the gasket groove (40), and where said gasket (100) comprises a main portion (102) and a click-on tap (101), where said click-on tap (101) comprise a first portion (103) projecting from said main portion (102) and a second portion (104) adapted to reach out of outer edge region (50), said method being to position said main portion (102) in said gasket

groove (40) such that said first portion (103) aligns with a valley (52), position said first portion (103) in said valley (52), and through the elasticity of said gasket material, drag a part (106) of said second portion (104) around and under the end face (12) of the heat transfer plate (10).

13. Method according to claim 12, wherein a wall section (53) is formed in said edge region (50) connecting two of the tops (51), said wall section (53) further separating the gasket groove (40) from the valley (52) between said two tops (51), wherein said method includes a step of positioning said first portion (103) over said wall section (53).

14. Method according to claim 12 or 13, wherein said end face (12) between two neighbouring tops (51) is closed (54), and where the method further comprises a step of dragging the part (106) under said end face (12) to position said part ((106) at the inner side of the closed end face (54) into the inside chamber (55) formed under the top (51).

15. Method according to any of claims 12-14, used on any of the gaskets according to one of claims 1-8 and / or heat exchanger plates according to claims 9-11.

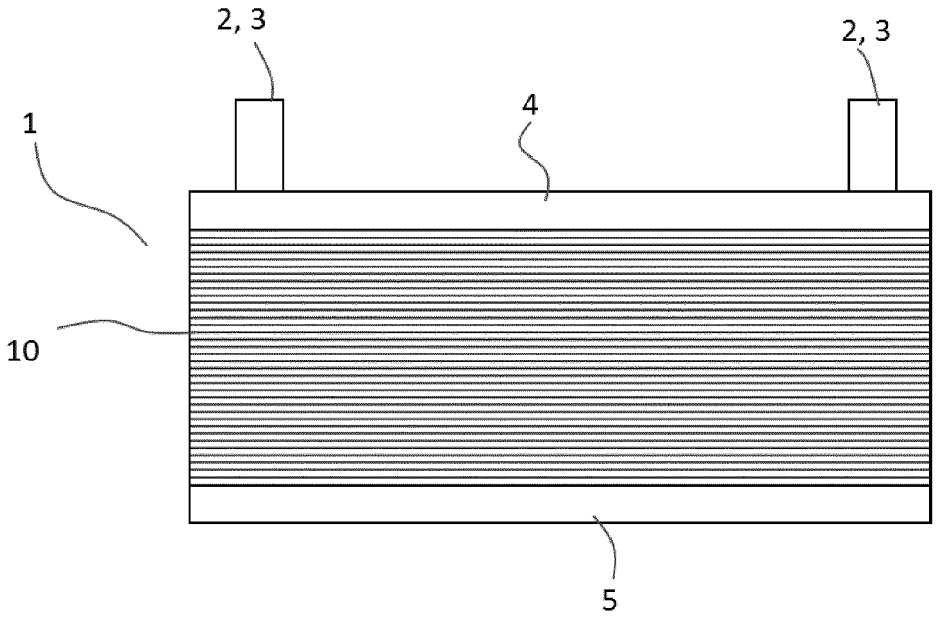


Fig. 1

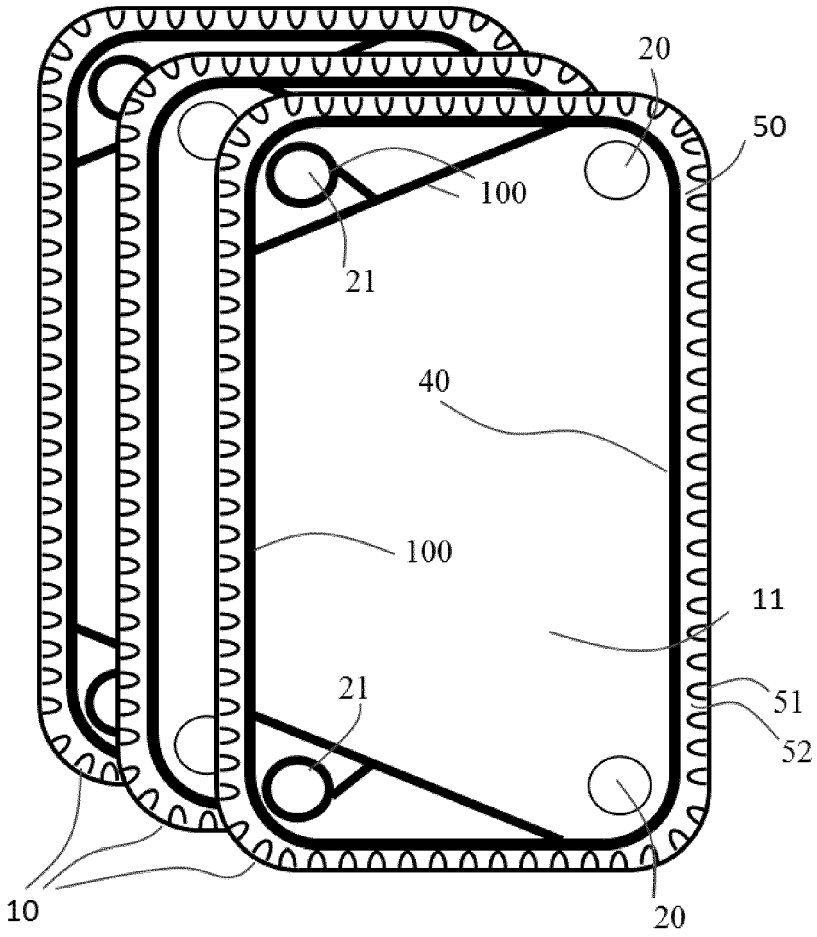


Fig. 2

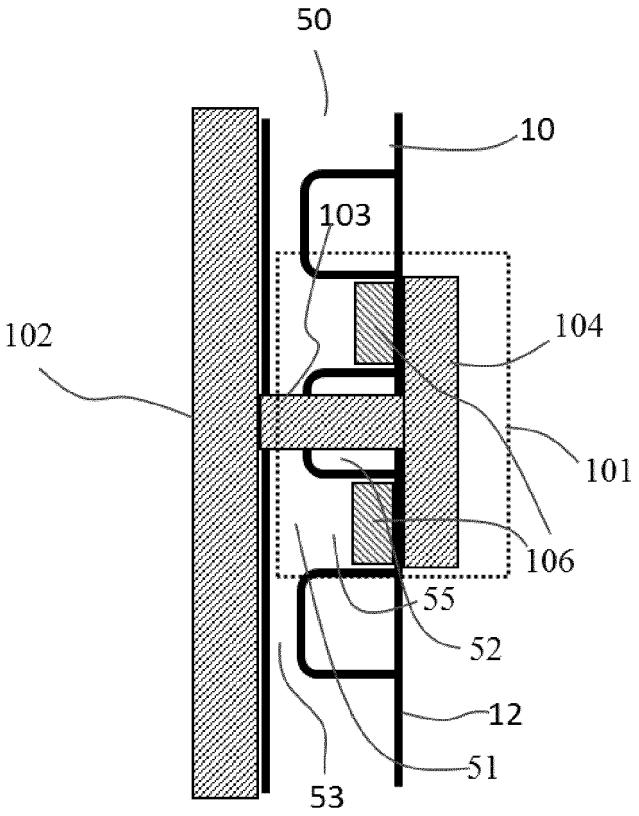
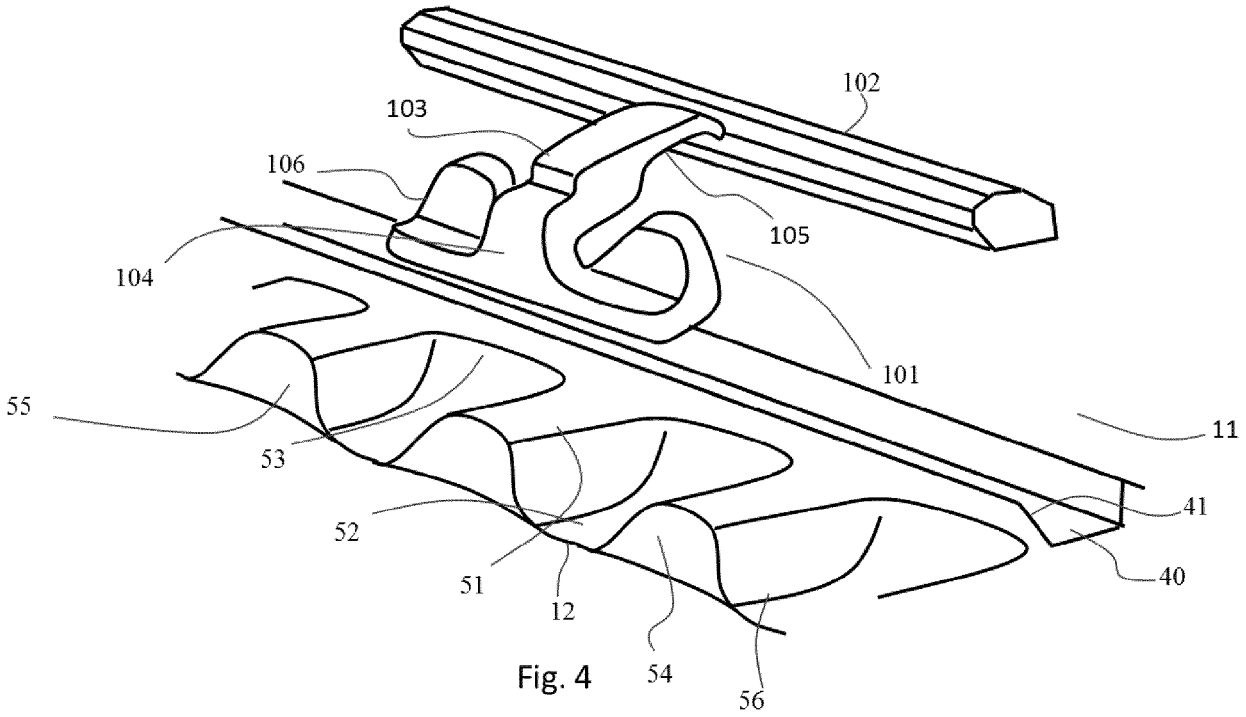


Fig. 3


102
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106
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101
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12
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56

Fig. 4

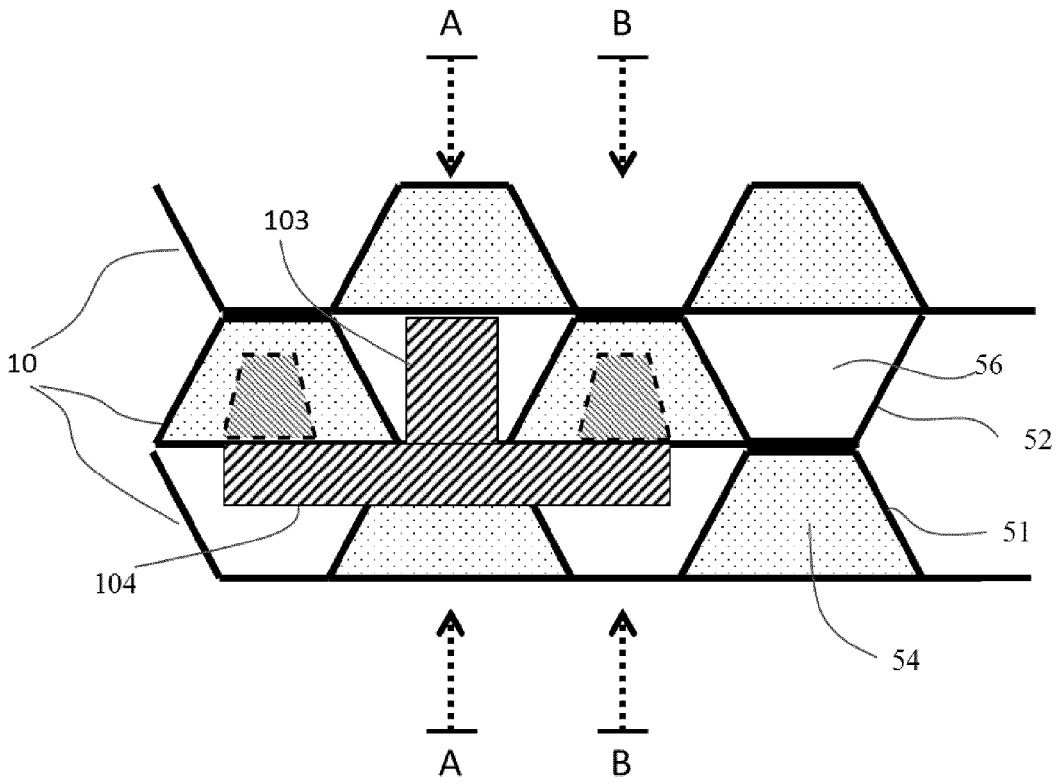
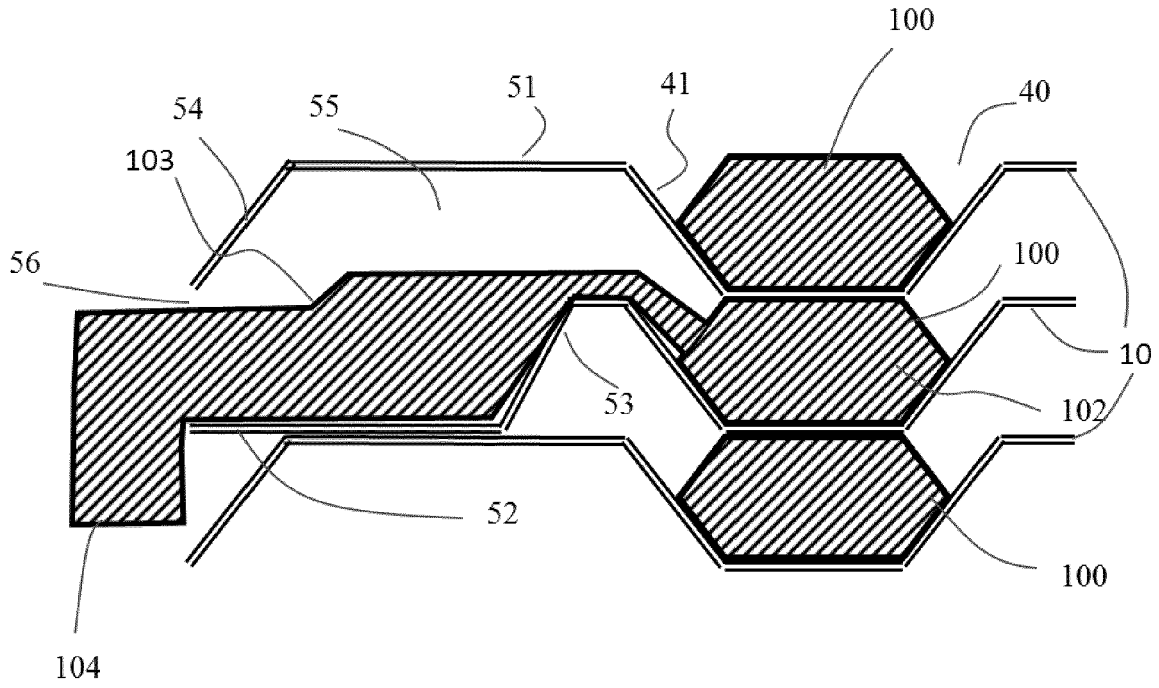

A
B
103
10
56
52
51
104
54
A
B

Fig. 5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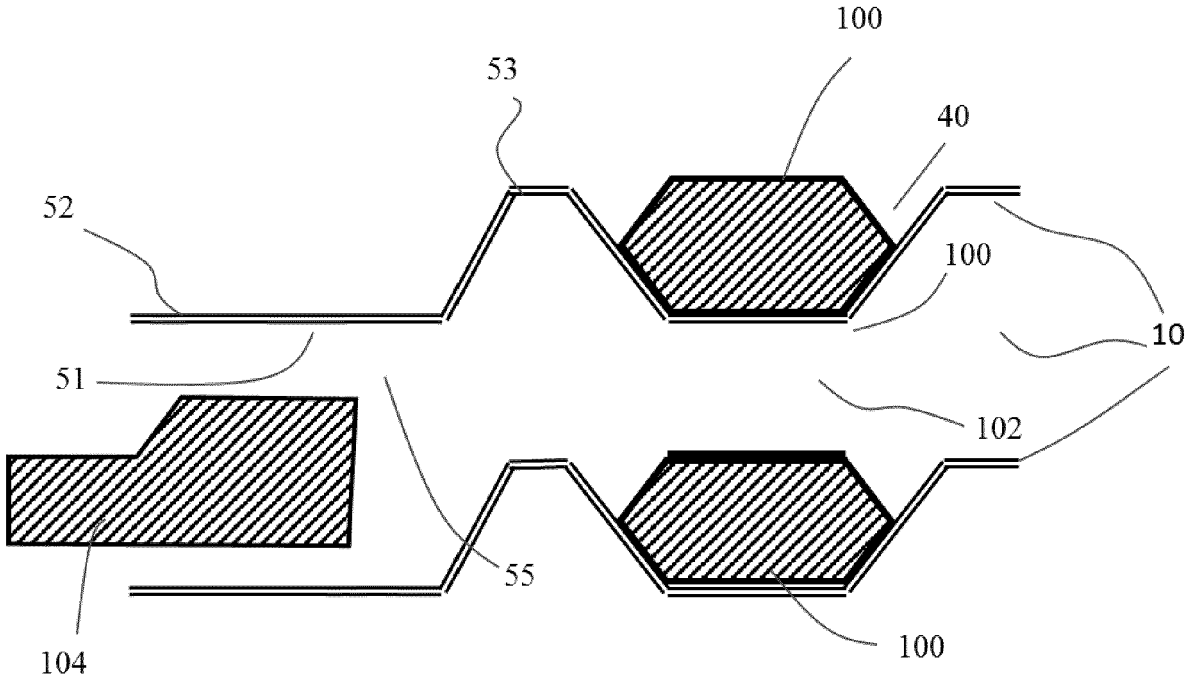
54
55
103
56
100
10
53
102
52
100
104

Fig. 6A


100
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10
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102
55
100
104

Fig. 6B

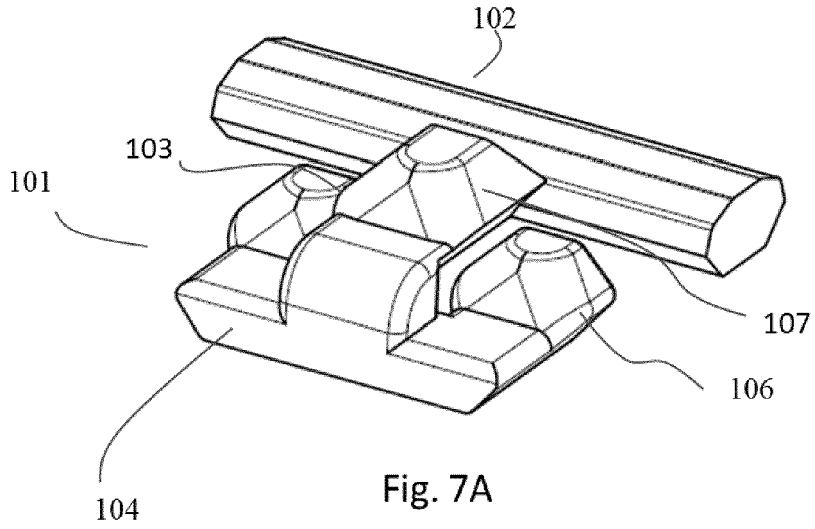

Fig. 7A

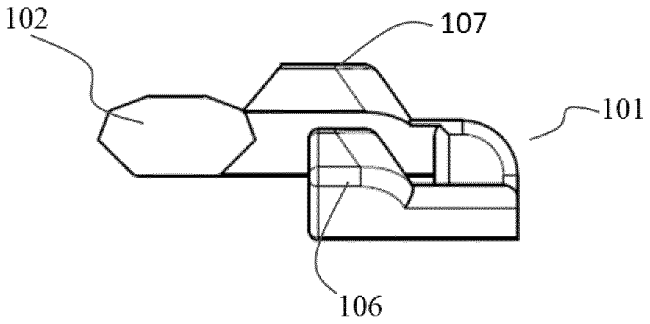

Fig. 7B

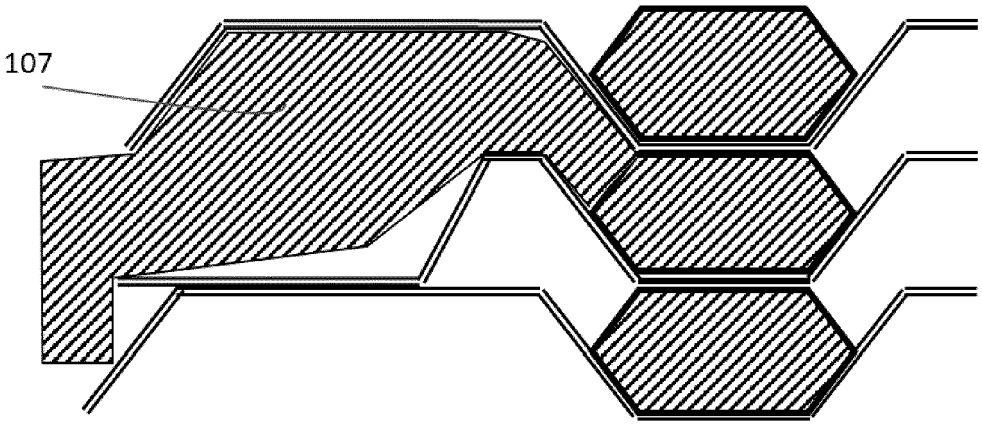

Fig. 8

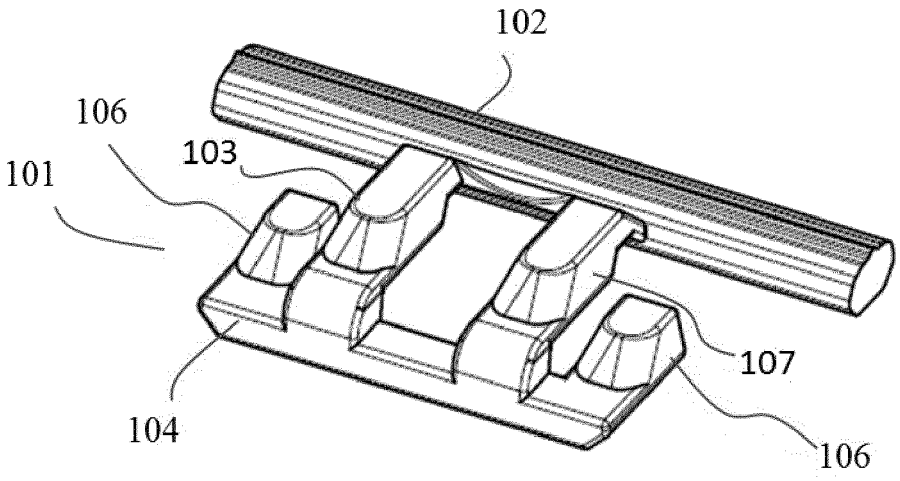

Fig. 9

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 9446

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 A	US 2011/259561 A1 (KRANTZ JOAKIM [SE]) 27 October 2011 (2011-10-27) * figures 3-6 *	1,11,12 2-8, 13-15	INV. F28D9/00 F28F3/10
X	US 5 887 650 A (YANG IN CHUL [KR]) 30 March 1999 (1999-03-30) * figures 1,2 *	1,2	
X	US 4 635 715 A (ANDERSSON JARL A [SE]) 13 January 1987 (1987-01-13) * figures 1-4 *	1	
X	US 6 073 687 A (JENSEN BENNY [DK] ET AL) 13 June 2000 (2000-06-13) * figure 2 *	9,10,15	

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	20 February 2020	Martínez Rico, Celia

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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