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(54) **HEAT EXCHAGER WITH HEAT TRANSFER PLATE AND GASKET FIXATION TO THE HEAT TRANSFER PLATE**

WÄRMEÜBERTRÄGER MIT WÄRMEÜBERTRAGUNGSPLATTE UND DICHTUNGSBEFESTIGUNG AN DER WÄRMEÜBERTRAGUNGSPLATTE

ECHANGEUR DE CHALEUR AVEC PLAQUE DE TRANSFERT THERMIQUE ET FIXATION DE JOINT SUR LA PLAQUE DE TRANSFERT THERMIQUE

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(56) References cited:
US-A- 4 635 715
US-A- 5 887 650
US-A- 6 073 687
US-A1- 2011 259 561

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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.

[0004] A prior publication, US patent filing no. 20110259561, discloses a heat exchanger plate for a plate heat exchanger, where the heat exchanger plate includes a gasket groove extending in the edge region outside the regions and round the ports, whereby the gasket groove accommodates a gasket for sealing abutment against an adjacent heat exchanger plate in the plate heat exchanger where the gasket groove creates at least a recess of the heat transfer region along each side of the heat transfer region and that the recess enables a clip-on tab to be securely fastened to an edqe region of the heat exchanqer plate at the recess.

[0005] Another similar publication, US patent filing no. US4635715, relates to a gasket for a plate heat exchanger which gasket has several projections for securing the gasket to a heat exchanger plate. Said projections protrude towards an edge of the plate along which the gasket extends.

SUMMARY OF THE INVENTION

[0006] The objects are solved according to the solutions as indicated in the claims.

[0007] 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.

[0008] According to the invention said click-on tap comprise a first portion projecting from said main portion and being formed with a 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.

[0009] 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.

[0010] 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.

[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] 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.

[0015] 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

[0016]

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

[0017] It should be understood, that the detailed description and specific examples, while indicating embodiments of the invention, are given by way of illustration only.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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).

[0022] 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).

[0023] 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).

[0024] 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).

[0025] 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).

[0026] 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).

[0027] 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).

[0028] 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).

[0029] Shown is also the first portion (103) comprising a recess (105) at its lower surface adapted to fit over a projection (53) formed in the edge region (50).

[0030] 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.

[0031] When a valley (52) of an upper plate (10) con-

nects 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).

[0032] 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.

[0033] 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.

[0034] 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).

[0035] 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).

[0036] 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).

[0037] In one embodiment the closed end face (54) is formed by shaping the material forming the heat transfer plate (10).

[0038] 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.

[0039] 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.

[0040] 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 and in an alternative embodiment the one has a recess (105) whereas the other has not.

[0041] 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. Heat exchanger (1) comprising heat transfer plates (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) receives a gasket (100) comprising a main portion (102) adapted to be positioned in a gasket groove (40) formed in said heat transfer plate (10)), and where the gasket (100) comprises a click-on tap (101) adapted to be positioned within a valley (52), **characterized in that** said click-on tap (101) comprise a first portion (103) projecting from said main portion (102) and being formed with a 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 the outer edge region (50).

2. Heat exchanger (1) according to claim 1, wherein said gasket (100) 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. Heat exchanger (1) according to claim 1, wherein said gasket (100) second portion (104) comprise a part (106) reaching around and under the end face (12) of the heat transfer plate (10).

4. Heat exchanger (1) according to claim 3, 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).

5. Heat exchanger (1) according to any of the previous claims, wherein said gasket (100) click-on tap (101) is an upper projection (107) on the first portion (103) reaching into a projection formed in the upper connected heat transfer plate (10).

6. Heat exchanger (1) according to any of the previous claims, wherein the gasket (100) click-on tap (101) includes two first portions (103) connected by one common second portion (104).

Patentansprüche

1. Wärmetauscher (1), umfassend Wärmeübertragungsplatten (10), die mit Strukturen, sodass Strömungspfade zwischen jedem Satz von benachbarten Wärmeübertragungsplatten (10) ausgebildet sind, die Wärmeaustauschbereiche (11) definieren, und mit Öffnungen (20) und (21), um Einlässe und Auslässe für Fluide zu den Strömungspfaden auszubilden, und einer Dichtungsnut (40), die den Wärmeaustauschbereich (11) umschließend ausgebildet ist, ausgebildet sind, wobei die Wärmeübertragungsplatte (10) ferner eine Struktur von Erhebungen (51) und Vertiefungen (52) umfasst, die an einer Außenkantenregion (50) an dem Außenumfang der Dichtungsnut (40) positioniert sind, und wobei die Endfläche (12) zwischen zwei benachbarten Erhebungen (51) geschlossen (54) ist, und wobei die Wärmeübertragungsplatte (10) eine Dichtung (100) aufnimmt, die einen Hauptabschnitt (102) umfasst, der ausgelegt ist, in einer Dichtungsnut (40) positioniert zu sein, die in der Wärmeübertragungsplatte (10) ausgebildet ist, und wobei die Dichtung (100) eine Einrastlasche (101) umfasst, die ausgelegt ist, in einer Vertiefung (52) positioniert zu sein, **dadurch gekennzeichnet, dass** die Einrastlasche (101) einen ersten Abschnitt (103), der von dem Hauptabschnitt (102) hervorsteht und mit einer Aussparung (105) an seiner unteren Fläche ausgebildet ist, die ausgelegt ist, über einen Vorsprung (53) zu passen, der in der Kantenregion (50) ausgebildet ist, und einen zweiten Abschnitt (104), der ausgelegt ist, aus der Außenkantenregion (50) heraus zu reichen, umfasst.

2. Wärmetauscher (1) nach Anspruch 1, wobei die Einrastlasche (101) der Dichtung (100) nur an einem oberen Teil des Hauptabschnitts (102) der Dichtung (100), etwa der oberen Hälfte oder dem oberen Drittel oder dem oberen Viertel, positioniert ist.

3. Wärmetauscher (1) nach Anspruch 1, wobei der zweite Abschnitt (104) der Dichtung (100) einen Teil (106) umfasst, der um und unter die Endfläche (12) der Wärmeübertragungsplatte (10) reicht.

4. Wärmetauscher (1) nach Anspruch 3, wobei die Endfläche (12) zwischen zwei benachbarten Erhebungen (51) geschlossen (54) ist, und wobei der Teil (106) ferner an der Innenseite der geschlossenen Endfläche (54) in die Innenkammer (55), die unter der Erhebung (51) ausgebildet ist, hinauf reicht.

5. Wärmetauscher (1) nach einem der vorhergehenden Ansprüche, wobei die Einrastlasche (101) der Dichtung (100) ein oberer Vorsprung (107) an dem ersten Abschnitt (103) ist, der in einen Vorsprung reicht, der in der oberen verbundenen Wärmeübertragungsplatte (10) ausgebildet ist.

6. Wärmetauscher (1) nach einem der vorhergehenden Ansprüche, wobei die Einrastlasche (101) der Dichtung (100) zwei erste Abschnitte (103) umfasst, die durch einen gemeinsamen zweiten Abschnitt (104) verbunden sind.

Revendications

1. Échangeur de chaleur (1), comprenant des plaques de transfert de chaleur (10) formées avec des motifs de telle sorte que des chemins d'écoulement soient formés entre chaque ensemble de plaques de transfert de chaleur voisines (10) définissant des zones d'échange de chaleur (11), et avec des ouvertures (20) et (21) pour former des entrées et des sorties, pour des fluides, sur les chemins d'écoulement, et une rainure à joint d'étanchéité (40) formée entourant ladite zone d'échange de chaleur (11), ladite plaque de transfert de chaleur (10) comprenant en outre un motif de sommets (51) et de creux (52) positionnés dans une région de bord extérieure (50) à la circonférence extérieure de la rainure à joint d'étanchéité (40), et dans lequel la face d'extrémité (12) entre deux sommets voisins (51) est fermée (54), et dans lequel ladite plaque de transfert de chaleur (10) reçoit un joint d'étanchéité (100) comprenant une portion principale (102) adaptée pour être positionnée dans une rainure à joint d'étanchéité (40) formée dans ladite plaque de transfert de chaleur (10), et où le joint d'étanchéité (100) comprend une pièce d'encliquetage (101) adaptée pour être positionnée au sein d'un creux (52), **caractérisé en ce que** ladite pièce d'encliquetage (101) comprend une première portion (103) faisant saillie à partir de ladite portion principale (102) et étant formée avec un évidement (105) sur sa surface inférieure adapté

pour aller par-dessus une saillie (53) formée dans la région de bord (50), et une seconde portion (104) adaptée pour ressortir de la région de bord extérieure (50).

2. Échangeur de chaleur (1) selon la revendication 1, dans lequel ladite pièce d'encliquetage (101) dudit joint d'étanchéité (100) est positionnée purement au niveau d'une partie supérieure de ladite portion principale (102) du joint d'étanchéité (100), par exemple à la moitié supérieure, ou au tiers supérieur, ou au quart supérieur.

3. Échangeur de chaleur (1) selon la revendication 1, dans lequel ladite seconde portion (104) dudit joint d'étanchéité (100) comprend une partie (106) allant autour et en dessous de la face d'extrémité (12) de la plaque de transfert de chaleur (10).

4. Échangeur de chaleur (1) selon la revendication 3, dans lequel la face d'extrémité (12) entre deux sommets voisins (51) est fermée (54), et où la partie (106) remonte en outre sur le côté intérieur de la face d'extrémité fermée (54) dans la chambre intérieure (55) formé en dessous du sommet (51).

5. Échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel ladite pièce d'encliquetage (101) dudit joint d'étanchéité (100) est une saillie supérieure (107) sur la première portion (103) allant dans une saillie formée dans la plaque de transfert de chaleur raccordée supérieure (10).

6. Échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel la pièce d'encliquetage (101) du joint d'étanchéité (100) inclut deux premières portions (103) raccordées par une seconde portion commune (104).

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20110259561 A **[0004]**
- US 4635715 A **[0005]**