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

(11) **EP 2 396 617 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
03.09.2014 Bulletin 2014/36

(21) Application number: **10706388.5**

(22) Date of filing: **15.02.2010**

(51) Int Cl.:
F28F 3/10 *(2006.01)* ***F28F 3/08*** *(2006.01)*

(86) International application number:
PCT/IB2010/050672

(87) International publication number:
WO 2010/092556 (19.08.2010 Gazette 2010/33)

(54) **A PLATE STRUCTURE AND GASKET FOR A PLATE HEAT EXCHANGER AND RESPECTIVE PLATE HEAT EXCHANGER**

PLATTENSTRUKTUR UND DICHTUNG FÜR PLATTENWÄRMETAUSCHER UND ZUGEHÖRIGER PLATTENWÄRMETAUSCHER

STRUCTURE D'UN PLAQUE ET JOINT D'ÉTANCHÉITÉ POUR ÉCHANGEUR DE CHALEUR À PLAQUE ET ÉCHANGEUR DE CHALEUR À PLAQUE CORRESPONDANT

(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

(30) Priority: **16.02.2009 IT VR20090014**

(43) Date of publication of application:
21.12.2011 Bulletin 2011/51

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(56) References cited:
EP-A- 0 952 420
EP-B- 0 729 003
WO-A1-87/01189
US-A- 4 905 758
US-A- 5 887 650

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EP 2 396 617 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention regards a plate structure and respective plate heat exchanger gasket.

[0002] As is known, a plate heat exchanger is formed by a plurality of metal plates (usually made of stainless steel with high corrosion resistance, or of titanium) of identical size, usually of substantially rectangular configuration and obtained by molding; such plates are packed-tightened together between two large terminal plates. Each plate usually has a border zone or band, intended to house a respective sealing gasket, and an intermediate zone, where a plurality of parallel rib groups are made in relief on one face of the plate and as depressions on the other face thereof, designed to delimit, in association with the ribs provided in an adjacent plate or counter-plate, numerous paths geared for the fluids fed to the exchanger. The rib groups, in addition to increasing the exchange surface of the plate, are intended to create turbulence in the fluids themselves. At predetermined spaced positions in the intermediate zone of each plate, a respective through hole can also be made.

[0003] On one face of the edge band of each plate, a continuous channel is formed which is intended to house a sealing gasket, in turn designed to ensure, in use, the seal between one plate and the other. The gasket has a cross-section of slightly greater thickness than the cross section of its housing channel, so that when the plates are packed-tightened, the gasket is compressed in order to ensure a good seal.

[0004] The plates are tightened and maintained packed by the large terminal plates, in which through holes are made for the passage of tie rods, on which respective tightening nuts can be screwed.

[0005] A plate heat exchanger has numerous applications, both in air conditioning plants in buildings, in the pharmaceutical and chemical industries and in numerous other industrial applications.

[0006] It is desirable to arrange heat exchangers capable of functioning in very wide temperature ranges, typically from -25°C to +180°C, so that even the gaskets between one plate and the other must be made with high quality polymers, such as mixtures of NBR (nitrile-butadiene rubber), fluorocarbon FPM (perfluoro elastomer) or EPDM (ethylene propylene elastomer), suitable for ensuring a useful lifetime in the range of two to five years.

[0007] A gasket for heat exchangers is substituted when its elastic memory (so-called "compression set") is less than a predetermined threshold value, i.e. when it no long ensures an adequate resistance to the thrust exerted by the tightening force of the packed plates, which could give rise to leakages.

[0008] As can be understood, therefore, the substitution of the gaskets in the heat exchangers is an operation which must be carried out in a simple and quick manner, so as to not overly affect the overall maintenance cost.

[0009] Perhaps the best known fixing system of the gaskets in the heat exchangers is that which provides for gluing the gasket, typically by means of polymerizable or vulcanizable polymer glue, to a respective housing plate. In order to ensure a perfect adhesion of the gaskets to the plate, it is usually necessary to "vulcanize" the glue in an oven at approximately 90°C. As will be understood, the vulcanization operation, in addition to being particularly long and costly, renders the disassembly process of the gasket quite difficult (e. g., when it must be substituted due to its deterioration), since the glue is firmly fixed to the housing seat or channel of the gasket.

[0010] Systems have also been proposed in which the gasket is mechanically locked to the plate, hence without using a glue. A mechanical locking system is, for example, described in the European patent application EP-A-0 952 420. It provides that each gasket is formed by an annular main body, from which a series of protuberances extend, substantially at 90° with respect to the main element, each of which composed of a roughly laminar section of lower thickness than that of the main body and comprising a first connection section to the main body followed by a substantially circular section.

[0011] Starting from one face of the substantially circular section, two cylindrical appendages extend with longitudinal axis substantially perpendicular, in use, to their respective substantially circular section. The cylindrical appendages have several outer diameters, so to delimit an intermediate peripheral groove intended to be engaged in a respective housing seat provided in the edge band of the plate housing the gasket.

[0012] As will be understood, apart from the structural complexity of the gasket and the slender engagement retention zone between the groove of each appendage and plate, one such mechanical blocking system does not allow an easy assembly automation of the gaskets on the respective housing plates.

[0013] The patent EP-0 729 003-B1 discloses a mechanical system for anchoring an annular gasket to a plate of a plate heat exchanger. The gasket has a plurality of radiating protuberances intended to be engaged in respective seats provided in the housing plate. In addition, each protuberance is equipped with a pin appendage with two diameters, so to delimit a peripheral groove. The pin is intended to be snap-inserted in a respective through hole provided in a suitable housing seat of the protuberance in the peripheral band of a housing plate.

[0014] As can be easily understood, the mounting of a gasket thus configured can in practice only be carried out manually by a trained operator, and hence it cannot be easily automated. In addition, the housing holes of the appendages usually have sharp corners, which quickly compromise the integrity of the anchoring between gasket and plate, and at the same time require great precision on the diameter of the pin in order to avoid the risk of seizure and consequent resistance to the insertion in the through hole, a precision which is hard to ensure in repeatable production processes.

[0015] The patent US-5 887 650 (Yang) discloses a heat exchanger plate provided with an intermediate por-

tion and a peripheral portion, a channel being formed in the peripheral portion and designed to receive a seal annular gasket. The channel is delimited, on one side, by an inner U-shaped wall and, on the other, by an outer U-shaped wall designed to severe the channel from the peripheral portion.

[0016] A plurality of radially extending grooves are formed in the peripheral portion of the exchanger plate, each groove being delimited by two side walls and a section of the outer U-shaped wall. A through opening is formed in each groove, more particularly at the U-shaped section thereof delimiting the groove, and extends from one side wall to the other.

[0017] A gasket has an annular main tubular body with a plurality of projections protruding from it, each designed to be received in a respective groove of the channel. More particularly, each projection is hook-shaped and the free end thereof is designed to be received in a respective through opening formed in the groove. The gasket is anchored to the plate first by manually lifting and then forcibly, inserting the projections into their respective through openings. In this way, the gasket is difficult to be seated in position and in any case a weak anchorage is established between plate and gasket.

[0018] Moreover, the solution taught by US-5 887 650, besides being complex and difficult to produce and assemble, cannot be implemented in an automatic way in an industrial assembling plant, bearing in mind that the free end of the gasket projections have to be forcibly inserted into its respective opening through a manual operation.

[0019] The main object of the present invention is that of providing a plate structure for plate heat exchangers and a structure of a respective sealing gasket which allow ensuring a stable and efficient anchoring of the gasket to the plate without the use of glue and without forming through holes or notches in the plate.

[0020] Another object of the present invention is that of providing a plate heat exchanger which is both easy to assemble and disassemble.

[0021] Another object of the present invention is that of providing a plate heat exchanger in which the assembly between plate and gasket can be carried out at the machine in an automatic manner.

[0022] According to a first aspect of the present invention a plate structure for plate heat exchangers is provided which has an intermediate portion prearranged for making, as needed, 1-4 through holes, and a peripheral portion or band in which a continuous channel is formed for housing a respective annular gasket, and a plurality of notches radially extending from the channel and formed at the peripheral portion for housing respective radially extending projections or protuberances which extend from the sealing gasket, at least one notch having at least one lateral wall having at least one portion thereof as an undercut for snap-engagement with a respective protuberance of the gasket.

[0023] According to another aspect of the present invention, there is provided a plate structure for a plate heat exchanger, which has an intermediate portion prearranged for making, as required, 1 to 4 through holes and a peripheral portion or band, in which a continuous channel is formed for housing a respective annular sealing gasket, and a plurality of notches extending from the channel for housing respective projections or protuberances which are extended from the sealing gasket, the continuous channel having two shunt extensions or lines provided in the intermediate portion. Moreover, at least one notch of the plurality of notches is formed at each shunt extension and has at least one lateral wall having an undercut portion thereof for snap-engagement with a respective protuberance of said gasket.

[0024] Further aspects and advantages of the present invention will be better appear from the following detailed description of specific embodiments of a plate for plate heat exchanger, description made with reference to the drawings, in which:

- Figure 1 is a perspective, exploded, slightly top view of a portion of a plate and its respective annular gasket;
- Figure 2 is a perspective view of the plate of Fig. 1 with assembled gasket;
- Figure 3 is a plan view of the plate portion of Fig. 2;
- Figure 4 is a cross-section view taken along the line IV-IV of Fig. 3;
- Figure 5 is a top view of another embodiment of plate according to the present invention;
- Figure 6 is a cross-section view taken along the line VI-VI of Fig. 5;
- Figure 7 is a top view of another embodiment of gasket according to the present invention;
- Figure 8 is a cross-section view taken along the line VIII-VIII of Fig. 7;
- Figure 9 is a top view of the plate of Fig. 5 with assembled gasket of Fig. 7;
- Figure 10 is a cross-section view taken along the line X-X of Fig. 9; and
- Figure 11 is an exploded view of a heat exchanger according to the present invention.

[0025] In the drawings, equivalent or similar parts or components were marked with the same reference numbers.

[0026] With reference to the above listed Figures, it will be noted that a plate 1 for plate heat exchanger PHE (Fig. 5) is obtained by molding a metal sheet, typically made of stainless steel or titanium, e. g. having a rectangular border with rounded vertices, and has an intermediate zone or portion 1 a, and a peripheral band or portion 1 b, in which a continuous channel 3 is formed.

[0027] An intermediate portion 1 a of a plate according to the present invention is prearranged for obtaining, as needed, 1 to 4 through holes 2 (two pairs of through holes 2 being made in the embodiment illustrated in the drawings), i.e. in the intermediate portion one or more zones

are provided for (usually zones at a respective corner) where a through hole can be made. Such zones can also be ribbed, for example, thereby having portions which on one side of the plate result in a depression or concavity and on the other side result in a relief or convexity for facilitating the packing, in use, between adjacent plates.

[0028] Around the channel 3, a plurality of radiating notches or slots 4 are provided which are suitably spaced from each other along the peripheral portion 1 b. Such slots 4 are also obtained via molding and have concavity directed on the same side as the concavity of the channel 3, and depth equal to that of the channel 3, in which case their own bottom is coplanar with that of the channel 3. The slots can have lesser depth than that of the channel, or they can have depth in part equal to and in part less than that of the channel 3. If desired, the distance between the notches 4 can be modular, e. g. 150 mm.

[0029] The channel 3 also has at least one shunt line 3b extending in the intermediate portion 1a.

[0030] Advantageously, for the purpose of stiffening between one radiating notch 4 and the next, one or more spaced notches or slots 5 can be provided that are open towards the outside, which are shorter than the notches 4 and can have depth equal to or lower than that of the channel 3, which is nevertheless separated therefrom by a double wall 5a and 3a (Fig. 4). In other words, the short notches 5, unlike the notches 4, do not communicate with the channel 3.

[0031] In the intermediate zone 1a of each plate 1, one or more groups of parallel ribs are provided, as is normal at the state of the art, e. g. the group of ribs indicated with 6a, 6b, 6c and 6d in Fig. 5, which are in low relief on one face of the plate and are in relief on its opposite face.

[0032] At one side, preferably at two opposite sides of each plate 1, i.e. in the peripheral zone 1 b, a respective undercut central notch 7a, 7b (Fig. 11) is made (as is normal in the state of the art), whose purpose will be further explained below.

[0033] The channel 3, together with the notches 4, is intended to house a gasket, which is composed of an annular body 8 and a predetermined number of protuberances 9 spaced from each other which are integrally made with the annular body 8 of the gasket and extend therefrom in a radial manner at the same mutual distance of the notches 4 of the channel 3, preferably according to a pre-established pitch (Fig. 1).

[0034] One or more notches or slots 4 have one or both lateral walls with at least one undercut portion, as is indicated with 4a and 4b. Advantageously each slot has an undercut portion. Preferably, the lateral walls of each notch 4 are connected with the adjacent wall of the channel 3 and are advantageously undercut also at their connected portion. Preferably, the lateral walls of a notch 4 have, starting from the bottom wall of the notch, a first flared section 4a followed by a recessed section 4b so as to delimit an internal opening of the slot with at least partially hexagonal section.

[0035] In addition, each notch 4 has a cross section area that advantageously increases towards the outside, in the direction moving away from the channel 3, at least at a terminal section thereof.

[0036] Similarly, the protuberances 9 of the gasket have slightly convex flanks and preferably are configured like the lateral walls of the respective housing notch 4, i.e. having a connection portion to the annual body 8 of the gasket and/or having a first flared section 9a followed by a recessed section 9b so as to delimit a cross section area at least partially hexagonal and/or advantageously increasing towards the outside, in the direction moving away from the annular body 8, at least at a terminal section thereof.

[0037] Preferably, the annular body 8 has a cross section area with substantially pentagonal border with joined corners (Fig. 4). Its cuspshaped portion 8a, not engaged by the notch 4, is located (in use before the pack pressing) at a greater height than the edge of the channel 3, as will be further explained below.

[0038] Figures 5 to 10 show another embodiment of plate and gasket according to the present invention, in which one or more notches 40 having one or more side wall with an undercut portion are located at the shunt extensions or lines 3b, and a respective projection or protuberance 90, preferably a bridge-connection projection 90 extends from the annular body 80 of the gasket.

[0039] More particularly, the plate is formed with four main through holes 2, 2a, two holes 2a being, in use, fully peripherally sealed by the gasket 80. A portion of the channel 3 extends around the fully sealed holes 2a, i. e. it has an outer semicircular part 3c and an inner semicircular part 3d. The fully sealed holes 2a are located at the same side of the plate. Advantageously, one or more notches 40 extend from the shunt extensions or lines 3b to a portion of the channel 3 surrounding the respective fully sealed hole 2a, i. e. a respective inner semicircular part 3d of the channel.

[0040] A gasket to be engaged by such a plate is provided with two main lateral sections 80a, an upper and a lower section 80b bridge-connecting the main lateral sections 80a to each other.

[0041] Moreover, the gasket 80 has two circular portions 80c each designed to be received in a respective semicircular part 3c, 3d of the channel and two connecting portions 80d, each designed to be received in a respective shunt line 3b of the plate and extending from the upper and lower bridge-connecting sections 80b to a respective main lateral section 80a.

[0042] One or more projections 90 connect both the circular portions 80c and their respective connecting portion 80d, and are designed to be received in a notch 40.

[0043] As it will be understood, part of the circular portions 80c and connecting portion 80d are internally located far from the outer edge of the gasket. Bearing in mind that the solutions proposed up to know for anchoring a gasket to a respective plate are provided at the outer edge of the plate, clearly with the prior art solutions the circular portions 80c and the connecting portions 80d can

be kept in position only with difficulty upon assembling the plate heat exchanger.

[0044] It should be noted that, particularly with reference to the lower, in use, connecting portion, it, while being assembled, may be caused to become disengaged, e. g. owing to gravity, from its seat and be deformed, thereby causing a drop of pressure, which is a function of the extent to which the gasket is out of seat.

[0045] Moreover, the gasket 80, notches 40 and projections 90 may have the features above-described in connection with gasket 8, notches 4 and projections 9.

[0046] Thus, owing to the notch/s 4 and/or 40 and respective projection/s 9 and/or 90, it is possible to obtain an improved and effective engagement between plate and respective gasket, specifically at its peripheral portion (should notch/s 4 and projection/s 9 only be provided), at its intermediate portion (should notch/s 40 and projection/s 90 only be provided), or throughout the length of the gasket (should notch/s 4 and 40 and projection/s 9 and 90 be provided).

[0047] As is better seen in Figure 11, a plate heat exchanger PHE according to the present invention is formed by a plurality of plates 1, a respective annular sealing gasket 8, 80 installed on each of these, two large lateral plates 10 and 11, a certain number (two in Fig. 11) of tightening tie rods 12 having at least two ends thereof threaded, and tightening nuts 13.

[0048] The last plate 1f, that intended to abut against the large lateral plate 11, differs from the others in that it is entirely blind, i.e. there is no hole or opening 2 formed therein.

[0049] Preferably, in the flanks of the two large lateral plates, a corresponding number of notches or slots 14 are formed, which (in pairs) are intended to house and support a respective tie rod 12, as is normal in the state of the art.

[0050] In the large lateral plate 10, two pairs of through holes are made, each provided with a connection nipple 15, 16 for attaching to delivery and return piping for two work fluids intended to be placed in a heat exchange relationship within the exchanger PHE. At the top center, a pair of through holes 17 is made in the large plate 10, while on the bottom, still in the center, a single through hole is provided, not visible in Fig. 11.

[0051] The large lateral plate 11 is instead entirely blind, and a pair of slots 18 and 19 is made therein at the top and bottom.

[0052] Moreover, the exchanger comprise one, preferably two, longitudinal members or plate-guide beams: one upper 20 and the other lower 21, e. g. having a flank configured as a dovetail 22 and adapted to allow sliding form coupling with an undercut notch, for example 7a or 7b of a plate 1 or 1f, so to facilitate the assembly operations and to ensure a precise position of the plates. The upper plate-guide longitudinal member 20 terminates at its ends with a pair of threaded pins 23, while a threaded pin 24 projects from the end of the lower plate-guide longitudinal member 21.

[0053] The plate-guide longitudinal members 20 and 21 are designed to abut against the large lateral plates 10 and 11, the pins 23 of the plate-guide longitudinal member 20 being inserted and exiting out from one side in the holes 17 and on the other side in the slot 18, while the pins 24 of the lower plate-guide longitudinal member 21 are inserted on one side in the lower hole (not shown) provided in the large lateral plate 10 and on the other side in the lower slot 19 of the large lateral plate 11. At the large lateral plate 10, the pins 23 and 24 are engaged and tightened by a respective fixing nut, while at the large lateral plate 11, a listel 25 abutting against the large plate can be threaded on such pins, which are then fixed by means of fixing nuts.

[0054] With the structure of the heat exchanger described above, in order to carry out the mounting of a gasket 8, 80 in the channel and in the notches 4, 40 of a respective plate 1, it will suffice that an operator sets the body of the gasket in the channel 3 and its protuberances in the respective notches 4, 40 and presses for the snap-engagement between protuberances 9, 90 and notches 4, 40. The same operation can be easily carried out in an automatic manner by a gasket setting device and by pressing the gasket against the respective installation plate 1 d.

[0055] Once the plates 1 are pack-tightened between the large lateral plates 10 and 11, the body 8, 80 of each sealing gasket is pressed at its cusp portion 8a so that it is forced to be deformed, thus ensuring an optimal seal along the entire border zone of each plate.

[0056] If required, e. g.-at the time of the substitution of all the gaskets of a heat exchanger PHE, the removal of the gaskets is quite easy and quick, being achieved via simple extraction by pulling the body 8 of the gasket itself.

[0057] US-5 887 650 (Yang) does not disclose a heat exchanger plate provided with grooves delimited by at least one side wall having an undercut portion. It teaches a plate with grooves having through openings designed to receive the free end of gasket projections.

[0058] Moreover, the gasket projections are forcibly inserted (with no snap-engagement effect) into a respective through opening, whereas according to the application invention the protuberances or projections are and should be snap-engaged with the undercut portion of at least one lateral wall. Thus, with a plate structure according to the present invention an optimal engagement and an easy assembling and disassembling are obtained. Moreover, as above-mentioned, with a plate and a gasket according to the present invention, a heat plate exchanger can be easily implemented in an automatic way in an industrial assembling plant.

[0059] The heat exchanger plate, the gasket and the heat exchanger described above are susceptible to numerous modifications and variants within the protection scope as defined by the claims.

Claims

1. A plate structure for a plate heat exchanger, which has an intermediate portion (1a) prearranged for making, as required, 1 to 4 through holes (2) and a peripheral portion or band (1 b), in which a continuous channel (3) is formed for housing a respective annular sealing gasket (8), and a plurality of notches (4) radially extending from said channel (3) and formed at said peripheral portion (1 b) for housing respective radially extending projections or protuberances (9) which are extended from said sealing gasket (8),
characterized in that at least one notch (4) of said plurality of notches has at least one lateral wall having an undercut portion thereof for snap-engagement with a respective protuberance (9) of said gasket (8).

2. A plate structure for a plate heat exchanger, which has an intermediate portion (1a) prearranged for making, as required, 1 to 4 through holes (2) and a peripheral portion or band (1 b), in which a continuous channel (3) is formed for housing a respective annular sealing gasket (8, 80), and a plurality of notches (4, 40) extending from said channel (3) for housing respective projections or protuberances (9, 90) which are extended from said sealing gasket (8, 80),
characterized in that said continuous channel (3) has two shunt extensions or lines (3b) provided in said intermediate portion (1 a),
and **in that** at least one notch (40) of said plurality of notches is formed at each shunt extension (3b) and has at least one lateral wall having an undercut portion thereof for snap-engagement with a respective protuberance (90) of said gasket (80).

3. A plate structure as claimed in claim 2, **characterized in that** at least one notch (4) of said plurality of notches (4) is formed at said peripheral portion (1 b) and has at least one lateral wall having an undercut portion thereof for snap-engagement with a respective protuberance (9) of said gasket (8).

4. A plate structure as claimed in claim 2 or 3, **characterized in that** a portion of said channel (3) extends around two fully sealed holes (2a), and said at least one notch (40) extends from each shunt line (3b) to a respective section of said channel (3) surrounding a fully sealed hole (2a).

5. A plate structure according to any one of the preceding claims, **characterized in that** said notches (4, 40) lead into said channel (3) and have substantially the same depth as said channel (3).

6. A plate structure according to any one of the preceding claims, **characterized in that** at least part of said notches (4, 40) has increasing cross section area starting from the channel (3).

7. A plate structure according to any one of the preceding claims, **characterized in that** each notch (4, 40) has lateral walls connected with a wall of said channel (3).

8. A plate structure according to claim 7, **characterized in that** at least one of said connected lateral walls is undercut.

9. A plate structure according to any one of the preceding claims, **characterized in that** at least one of said notches (4, 40) is delimited by a bottom wall and by two lateral walls, which, starting from said bottom wall, have at least one flared section (4a) followed by at least one recessed section (4b).

10. A sealing gasket for a plate according to any one of the preceding claims, **characterized in that** it comprises at least one annular body (8, 80) designed to be housed in a respective channel (3) and a plurality of radially extending protuberances (9, 90) suitable for being snap-engaged in a respective housing notch (4, 40).

11. A gasket according to claim 10, **characterized in that** each protuberance (9, 90) has at least one flank thereof convex, for snap-engagement with a respective undercut lateral wall of its housing notch (4, 40).

12. A gasket according to claim 10 or 11, **characterized in that** each protuberance (9, 90) has an increasing cross section area, at least at a terminal section thereof.

13. A gasket according to any one of the claims 10 to 12, **characterized in that** each protuberance (9, 90) has a zone of connection with said annular body (8, 80), at which it is engaged, in use, with a respective undercut zone of its housing notch (4, 40).

14. A gasket according to any one of the claims 10 to 13, **characterized in that** said protuberances (9, 90) extend substantially coplanar with a bottom wall of the respective annular body (8, 80).

15. A plate heat exchanger comprising a plurality of plates according to any one of the claims 1 to 9, each equipped with a sealing gasket (8, 80) according to any one of the claims 10 to 14 and pack-tightened against each other between two large terminal plates (10, 11).

Patentansprüche

1. Plattenstruktur für einen Plattenwärmetauscher, welche einen Zwischenabschnitt (1a), der vorbereitet ist zur Herstellung nach Bedarf von 1 bis 4 Durchgangslöcher, und einen Umfangsabschnitt oder Band (1b) aufweist, in denen ein durchgehender Kanal (3) gebildet wird, um eine entsprechende ringförmige Dichtung (8) aufzunehmen, und eine Mehrheit von Kerben (4) vorhanden ist, die sich radial aus diesem Kanal (3) erstrecken und bei diesem umfänglichen Abschnitt (1b) gebildet werden, um respektive sich radial erstreckende Vorsprünge oder Erhebungen aufzunehmen, die sich von der besagten Dichtung (8) erstrecken,
dadurch gekennzeichnet, dass mindestens eine Kerbe (4) der besagten Mehrheit von Kerben mindestens einen seitlichen Wand aufweist, der eine Hinterschneidung desselben aufweist, um mit einer entsprechenden Erhebung (9) der besagten Dichtung (8) in einer Rasteingriff zu kommen.

2. Plattenstruktur für einen Plattenwärmetauscher, welche einen Zwischenabschnitt (1a), der vorbereitet ist zur Herstellung nach Bedarf von 1 bis 4 Durchgangslöcher, und einen Umfangsabschnitt oder Band (1b) aufweist, in denen ein durchgehender Kanal (3) gebildet wird, um eine entsprechende ringförmige Dichtung (8) aufzunehmen, und eine Mehrheit von Kerben (4) vorhanden ist, die sich radial aus diesem Kanal (3) erstrecken und bei diesem umfänglichen Abschnitt (1b) gebildet werden, um respektive sich radial erstreckende Vorsprünge oder Erhebungen aufzunehmen, die sich von der besagten Dichtung (8, 80) erstrecken,
dadurch gekennzeichnet, dass der besagte durchgehender Kanal (3) zwei Shunt-Erweiterungen oder Linien (3b) aufweist, die im besagten Zwischenabschnitt (1a) vorhanden sind,
und dass mindestens eine Kerbe (40) der besagten Mehrheit von Kerben bei jeder Shunt-Erweiterung gebildet und mindestens einen seitlichen Wand aufweist, der eine Hinterschneidung desselben aufweist, um mit einer entsprechenden Erhebung (90) der besagten Dichtung (80) in einer Rasteingriff zu kommen.

3. Plattenstruktur für einen Plattenwärmetauscher nach Anspruch 2, **dadurch gekennzeichnet, dass** mindestens eine Kerbe (4) der besagten Mehrheit von Kerben (4) bei dem besagten umfänglichen Abschnitt gebildet und mindestens einen seitlichen Wand aufweist, der eine Hinterschneidung desselben aufweist, um mit einer entsprechenden Erhebung (9) der besagten Dichtung (8) in einer Rasteingriff zu kommen.

4. Plattenstruktur nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** ein Abschnitt des besagten Kanals (3) sich um zwei vollständig versiegelte Löcher (2a) erstreckt, und die besagte mindestens eine Kerbe (40) sich von jeder Shunt-Linie (3b) bis zu einem entsprechenden Abschnitt des besagten Kanals (3) erstreckt, der ein vollständig versiegeltes Loch (2a) umgibt.

5. Plattenstruktur nach jedem der vorangehenden Ansprüchen, **dadurch gekennzeichnet, dass** die besagten Kerben (4, 40) in den besagten Kanal (3) führen, und im Wesentlichen dieselbe Tiefe als die des besagten Kanals (3) besitzen.

6. Plattenstruktur nach jedem der vorangehenden Ansprüchen, **dadurch gekennzeichnet, dass** mindestens ein Anteil der besagten Kerben (4) eine zunehmende Querschnittfläche aufweist, die aus dem Kanal (3) beginnt.

7. Plattenstruktur nach jedem der vorangehenden Ansprüchen, **dadurch gekennzeichnet, dass** jede Kerbe (4, 40) seitliche Wände aufweist, die mit einem Wand des besagten Kanals (3) verbunden sind.

8. Plattenstruktur nach Anspruch 7, **dadurch gekennzeichnet, dass** mindestens einer der besagten verbundenen seitlichen Wände eine Hinterschneidung aufweist.

9. Plattenstruktur nach jedem der vorangehenden Ansprüchen, **dadurch gekennzeichnet, dass** mindestens eine der besagten Kerben (4, 40) von einem Bodenwand und zwei seitlichen Wänden begrenzt wird, die von dem besagten Bodenwand ausgehend, mindestens einem erweiterten Teil (4a) umfassen, die von mindestens einem eingebetteten Teil (4b) gefolgt ist.

10. Dichtung für einem Plattenwärmetauscher nach jedem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie mindestens einen ringförmigen Körper (8, 80) aufweist, der vorgesehen ist, um in einem entsprechenden Kanal (3) aufgenommen zu werden, und eine Mehrheit von sich radial erstreckenden Vorsprünge (9, 90) aufweist, die geeignet sind, um sich in einer entsprechenden Kerbe (4, 40) eingerastet zu werden.

11. Dichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** jeder Vorsprung (9, 90) mindestens eine konvex-förmige Seite derselben aufweist, um sich in einem entsprechenden seitlichen Wand mit Hinterschneidung seiner lagernden Kerbe (4, 40) eingerastet zu werden.

12. Dichtung nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** jeder Vorsprung (9, 90) eine

zunehmende Querschnittfläche, mindestens bei einem Endbereich derselben, aufweist.

13. Dichtung nach jedem der Ansprüche 10 bis 12, **dadurch gekennzeichnet, dass** jeder Vorsprung (9, 90) einen Verbindungsbereich mit dem besagten ringförmigen Körper (8, 80) aufweist, an dem es in Gebrauch mit einer entsprechenden Zone mit Hinterschneidung seiner lagernden Kerbe (4, 40), in Eingriff ist.

14. Dichtung nach jedem der Ansprüche 10 bis 13, **dadurch gekennzeichnet, dass** jeder Vorsprung (9, 90) sich im Wesentlichen komplanar mit einer Bodenwand des entsprechenden Ringkörpers (8, 80) erstreckt.

15. Plattenwärmetauscher umfassend eine Mehrheit von Platten nach jedem der Ansprüche 1 bis 9, jeder mit einer Dichtung ausgerüstet nach jedem der Ansprüche 10 bis 14 und als gegeneinander festgezogene Packung zwischen zwei grossen Endplatten (10, 11).

Revendications

1. Structure de plaques pour un échangeur de chaleur à plaques, avec une partie intermédiaire (1a) pourvue pour former, selon les besoins, de 1 à 4 trous de passage (2) et avec une partie périphérique ou bande (1b), dans laquelle un canal continu (3) est formé pour loger un respectif joint d'étanchéité annulaire (8), et une pluralité d'encoches (4) s'étendant en sens radial à partir dudit canal (3) et étant formées sur ladite partie périphérique (1b) pour loger des respectives projections ou protubérances (9) étendues dans un sens radial, qui s'étendent à partir dudit joint d'étanchéité (8),
caractérisée en ce qu'au moins une encoche (4) de ladite pluralité d'encoches a au moins une paroi latérale avec une partie en contre-dépouille de celle-ci pour un engagement en déclanchement avec une respective protubérance (9) dudit joint d'étanchéité (8).

2. Structure de plaques pour un échangeur de chaleur à plaques, avec une partie intermédiaire (1a) pourvue pour former, selon les besoins, de 1 à 4 trous de passage (2) et avec une partie périphérique ou bande (1b), dans laquelle un canal continu (3) est formé pour loger un respectif joint d'étanchéité annulaire (8), et une pluralité d'encoches (4) s'étendant en sens radial à partir dudit canal (3) et étant formées sur ladite partie périphérique (1b) pour loger des respectives projections ou protubérances (9, 90) étendues dans un sens radial, qui s'étendent à partir dudit joint d'étanchéité (8, 80),
caractérisée en ce que ledit canal continu (3) a deux extensions ou lignes de shunt (3b) formées dans ladite partie intermédiaire (1a),
et que au moins une encoche (40) de ladite pluralité d'encoches est formée près de chaque extension de shunt (3b) et a au moins une paroi latérale avec une partie en contre-dépouille de celle-ci pour un engagement en déclanchement avec une respective protubérance (90) dudit joint d'étanchéité (80).

3. Structure de plaques selon la revendication 2, **caractérisée en ce qu'**au moins une encoche de ladite pluralité d'encoches (4) est formée sur ladite partie périphérique (1b) et a au moins une paroi latérale avec une partie en contre-dépouille pour un engagement en encliquetage avec une respective protubérance (9) dudit joint d'étanchéité.

4. Structure de plaques selon la revendication 2 ou 3, **caractérisée en ce qu'**une partie dudit canal (3) s'étend autour de deux trous (2a) complètement scellés, et ladite au moins une encoche (40) s'étend à partir de chaque ligne de shunt (3b) jusqu'à une respective partie dudit canal (3) environnant un trou (2a) complètement scellé.

5. Structure de plaques selon une quelconque des précédentes revendications, **caractérisée en ce que** lesdites encoches (4, 40) portent dans lesdits canaux (3) et ont pratiquement la même profondeur dudit canal (3).

6. Structure de plaques selon une quelconques des précédentes revendications, **caractérisée en ce qu'**au moins une partie desdites encoches (4, 40) a une zone de croissance de sa section normale, à partir du canal (3).

7. Structure de plaques selon une quelconque des précédentes revendications, **caractérisée en ce que** chaque encoche (4, 40) a des parois latérales connectées avec une paroi dudit canal (3).

8. Structure de plaques selon la revendication 7, **caractérisée en ce qu'**au moins une desdites parois latérales connectées est en contre-dépouille.

9. Structure de plaques selon une quelconque des précédentes revendications, **caractérisée en ce qu'**au moins une desdites encoches (4, 40) est délimitée par une paroi de fond et par deux parois latérales, qui à partir de ladite paroi de fond, ont au moins une partie évasée (4a) suivie par au moins une partie évidée.

10. Joint d'étanchéité pour une plaque selon une quelconque des précédentes revendications, **caractérisé en ce qu'**il comprend au moins un corps annulaire

(8, 80) destiné à être logé dans un respectif canal (3) et une pluralité de protubérances (9, 90) s'étendant dans un sens radial, aptes à être engagées dans une respective encoche (4, 40) de logement.

11. Joint d'étanchéité selon la revendication 10, **caractérisé en ce que** chaque protubérance (9, 90) a au moins une côté convexe de celle-ci, pour un engagement avec une respective paroi latérale en contre-dépouille de son encoche (4, 40) de logement.

12. Joint d'étanchéité selon la revendication 10 ou 11, caractérisé en ce chaque protubérance (9, 90) a une croissance de la surface de sa section normale, au moins dans une partie terminale de celle-ci.

13. Joint d'étanchéité selon une quelconque des revendications 10 à 12, **caractérisé en ce que** chaque protubérance (9, 90) a une zone de connexion avec ledit corps annulaire (8, 80) sur lequel elle est engagée pendant l'usage, avec une respective zone en contre-dépouille de son encoche (4, 40) de logement.

14. Joint d'étanchéité selon une quelconque des revendications 10 à 13, **caractérisé en ce que** lesdites protubérances (9, 90) s'étendent dans une manière substantiellement coplanaires avec une paroi de fond du respectif corps annulaire (8, 80).

15. Echangeur de chaleur à plaques comprenant une pluralité de plaques selon une quelconque des revendications 1 à 9, chacun équipé avec un joint d'étanchéité (8, 80) selon une quelconque des revendications 10 à 14 et serré à paquet contre chacun autre entre deux grandes plaques terminales (10, 11).

Fig. 1

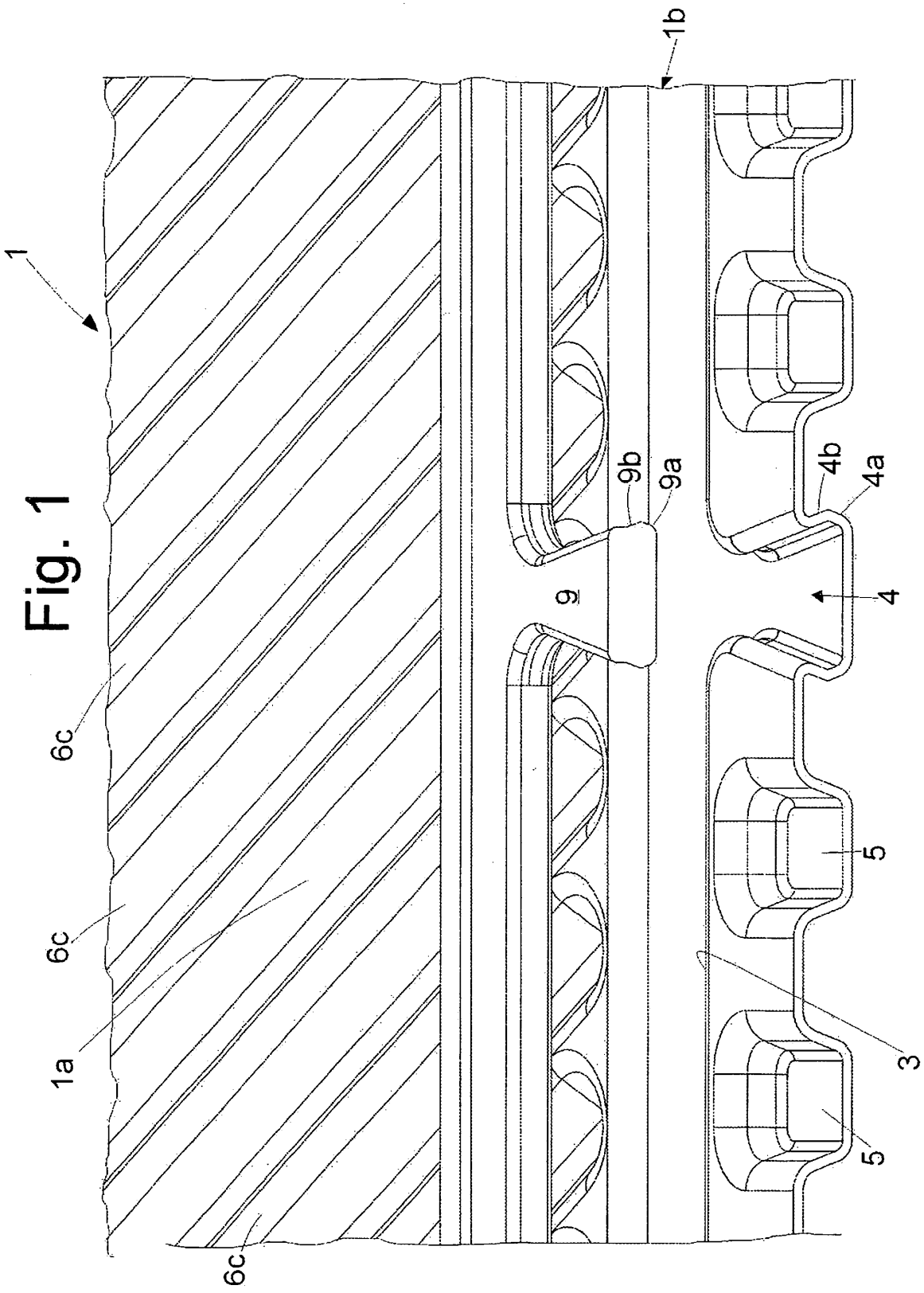


Fig. 2

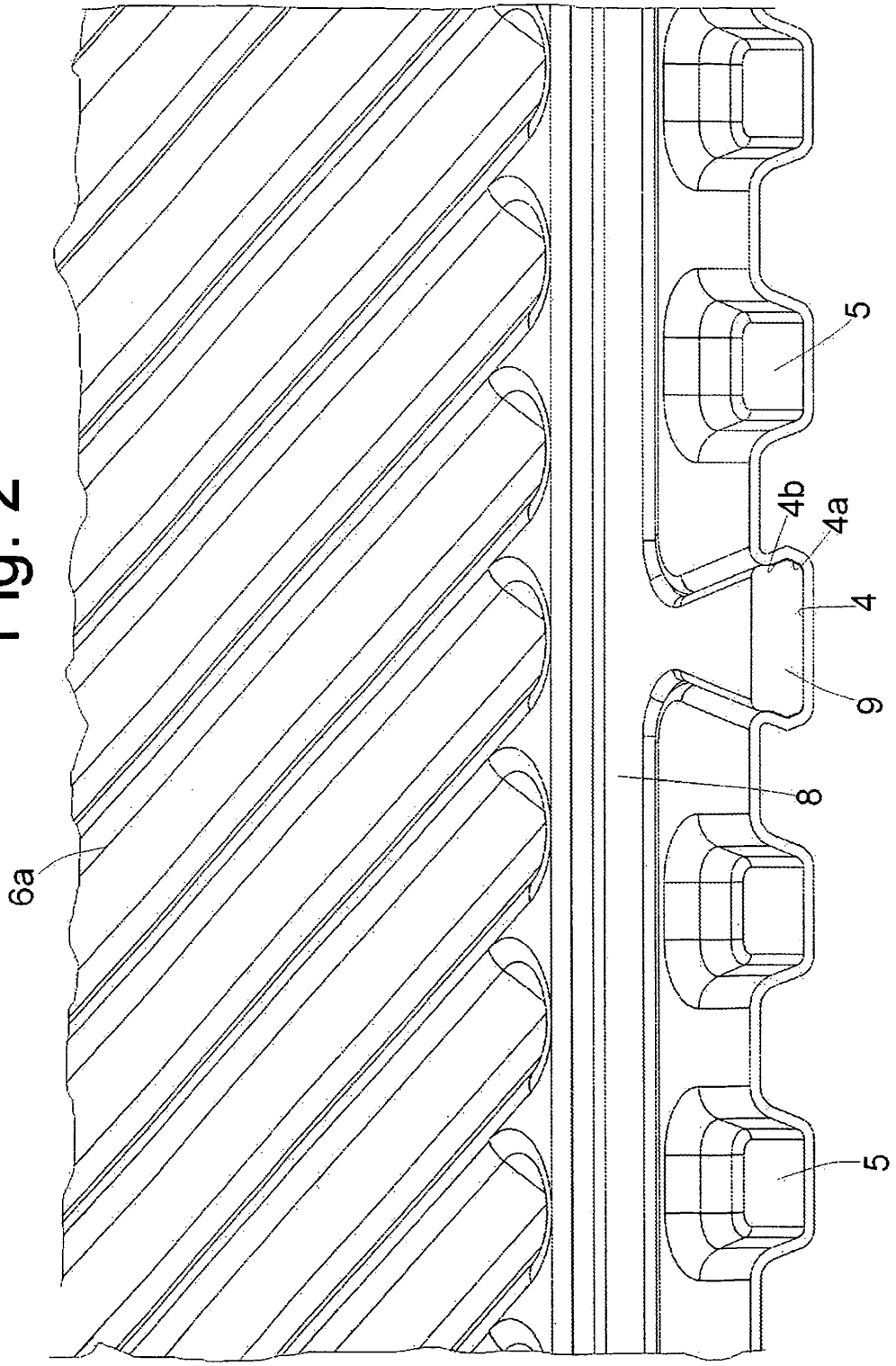
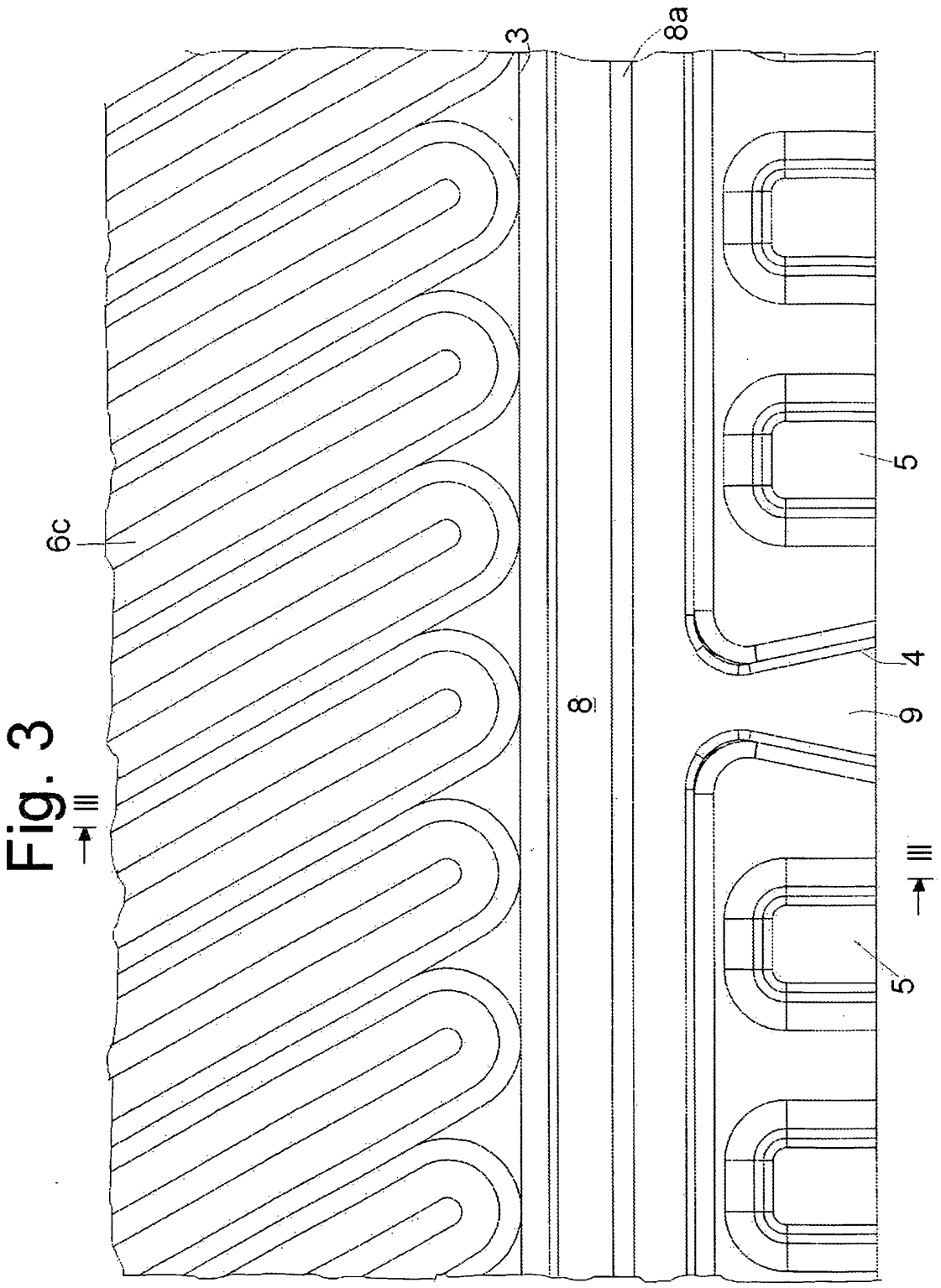


Fig. 3



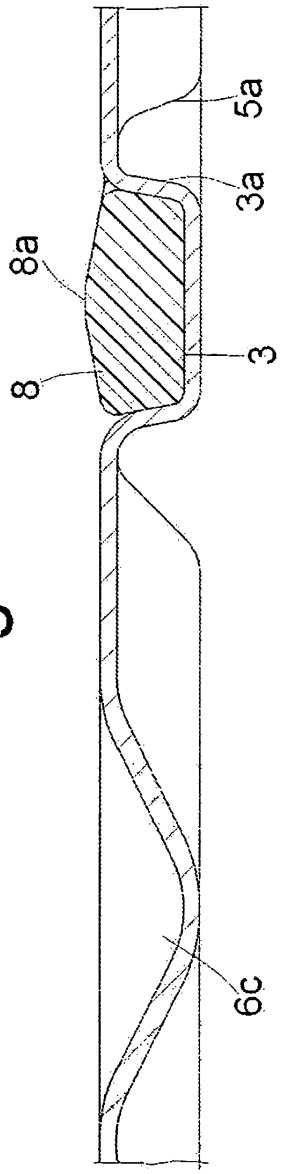


Fig. 4

Fig. 5

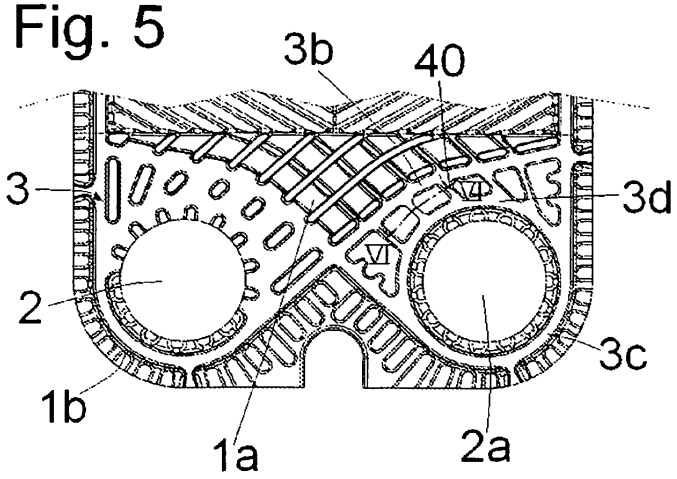


Fig. 6

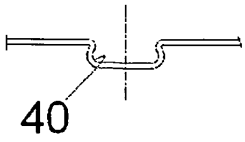


Fig. 7

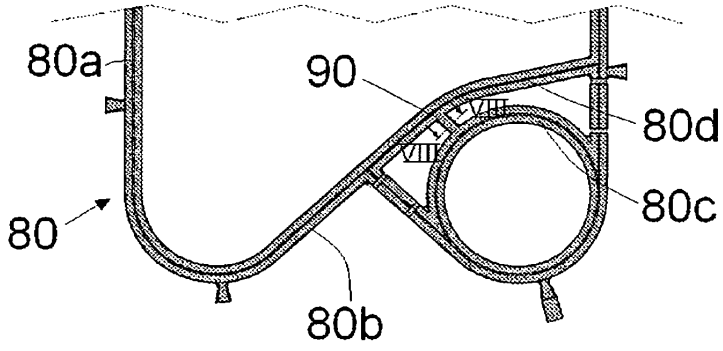


Fig. 8

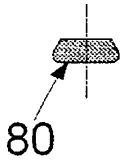


Fig. 9

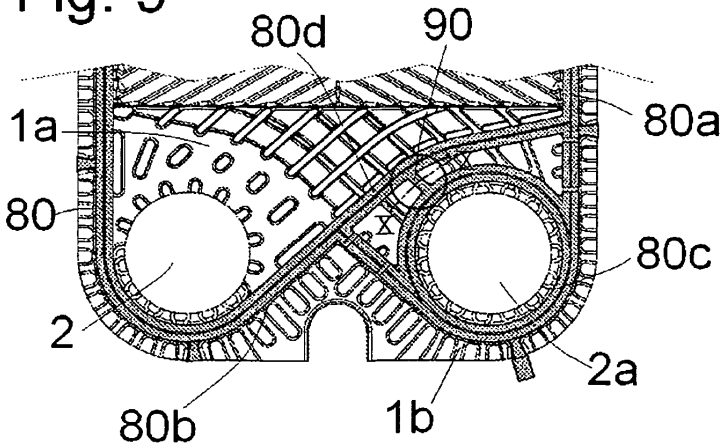
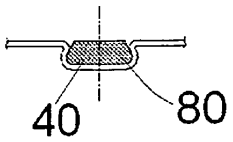


Fig. 10



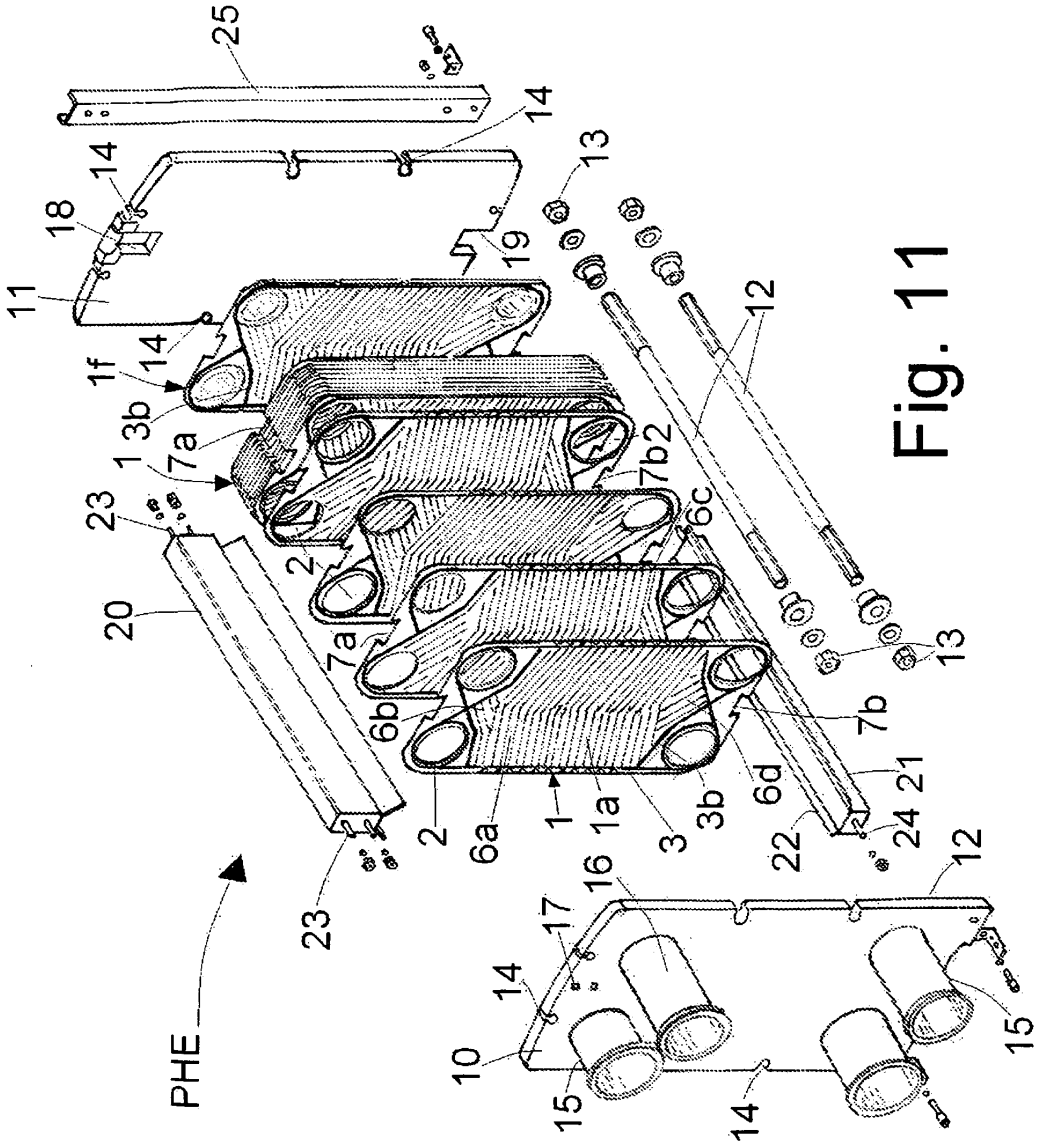

25
14
18
19
13
11
12
1f
3b
7a
7b
6c
23
20
2
6b
6d
21
1
1a
3
22
24
6a
16
17
10
15
PHE

Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0952420 A **[0010]**
- EP 0729003 B1 **[0013]**
- US 5887650 A, Yang **[0015] [0018] [0057]**