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(54) **A PLATE HEAT EXCHANGER**

PLATTENWÄRMETAUSCHER

ÉCHANGEUR DE CHALEUR À PLAQUES

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(73) Proprietor: **Alfa Laval Corporate AB
221 00 Lund (SE)**

(72) Inventors:
• **Björnsson, Peter
227 31 Lund (SE)**
• **Gudmundsson, Thord
211 48 Malmö (SE)**

(74) Representative: **Berglund, Stefan
Bjerkéns Patentbyrå KB
P.O. Box 5366
102 49 Stockholm (SE)**

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Description

THE FIELD OF THE INVENTION

[0001] The present invention refers to a plate heat exchanger according to the preamble of claim 1. US 2005/0121182 discloses an oil cooler according to the preamble of claim 1.

THE BACKGROUND OF THE INVENTION AND PRIOR ART.

[0002] In such plate heat exchangers having first plate interspaces for a first medium with a relatively low first working pressure and with second plate interspaces for a second medium with a relatively high second working pressure, stresses and forces may arise, which are asymmetric with regard to the centre axis extending centrally along the frame plate of the plate package in the middle of the portholes and substantially in parallel with the long sides of the plate package. Such asymmetric forces may lead to an increased load on the attachment of the plate package, in particular on the side where the ports relate to the second media with the highest working pressure.

[0003] US 2005/0121182 discloses an oil cooler having a plate package comprising a frame plate, a pressure plate and a plurality of heat exchanger plates between the frame plate and the pressure plate. The heat exchanger plates are provided beside each other and form first plate interspaces for the oil and second plate interspaces for a cooling medium. The frame plate and each of the heat exchanger plates have four portholes, which form four ports extending through the frame plate and the heat exchanger plates. The frame plate comprises a plurality of attachment members located around and outside the periphery of the plate package.

SUMMARY OF THE INVENTION

[0004] The object of the present invention is to provide an improved attachment for a plate package of a plate heat exchanger intended for receiving two heat exchanger media with different working pressures.

[0005] This object is achieved by the plate heat exchanger initially defined, which is **characterised in that** the attachment members are asymmetrically positioned in relation to the centre axis and the ports in such a way that forces caused by the difference between the first working pressure and the second working pressure are balanced, wherein all first one or several attachment members and all second one or several second attachment members have a common geometric centre of gravity located beside the centre axis. By means of such an asymmetric positioning of the attachment members in relation to the centre axis and the ports, non-equally distributed forces caused by different working pressures of the heat exchanger media may be balanced. The exact

positioning of the attachment members may be calculated from the number of attachment members, the actual working pressures and the positioning of the ports in relation to each other and the centre axis.

[0006] All attachments thus have a common geometric centre of gravity represented by a force centre for the forces, which may be absorbed by the attachments. This force centre may thus be located beside the centre axis and advantageously in the proximity of, in the same point as or substantially in the same point as the centre of gravity formed by the above-mentioned asymmetric forces.

[0007] According to an embodiment of the invention, the ports comprise a first inlet port and a first outlet port for the first medium, which communicate with the first plate interspaces and are provided on a first side of the centre axis, and a second inlet port and a second outlet port for the second medium, which communicate with the second plate interspaces and are provided on the second side of the centre axis. Advantageously the common centre of gravity may then be located on the second side of the centre axis.

[0008] According to a further embodiment of the invention, the attachment members consist of a first attachment member and a second attachment member, wherein these two attachment members both may be positioned on the second side. For certain, especially relatively small, plate heat exchangers it is sufficient if the plate package has two attachment members along the short sides, i.e. merely two attachment points. For such a plate heat exchanger it is advantageous if both the attachment points are located on the side where the working pressure is the highest.

[0009] According to a further embodiment of the invention, the attachment members consist of a first attachment member and two second attachment members, wherein at least the first attachment member and one of the second attachment members are positioned on the second side of the centre axis. For certain plate heat exchangers, at least three attachment points are required, wherein at least two of these advantageously are located on the side where the working pressure is the highest.

[0010] According to a further embodiment of the invention, the attachment members consist of two first attachment members and two second attachment members, wherein at least one of the first attachment members and one of the second attachment members are positioned on the second side of the centre axis. For larger plate heat exchangers, at least four attachment points are required, wherein at least two of these advantageously are located on the side where the working pressure is the highest. According to a further embodiment of the invention, the attachment members are designed as attachment tabs extending outwardly from the frame plate. These attachment tabs may then extend in parallel with the main extension plane of the frame plate. One or several of the attachment tabs may advantageously be pro-

vided with a hole for receiving an attachment element such as a screw.

[0011] According to a further embodiment of the invention, the first plate interspaces and the second plate interspaces are provided in an alternating order in the plate package, wherein the plate interspace, which is located most closely to the frame plate is a first plate interspace. The plate interspace located most closely to the frame plate is thus a plate interspace with a relatively low working pressure. Such an arrangement is advantageous from a thermal point of view.

[0012] According to a further embodiment of the invention, the frame plate, the heat exchanger plates and the pressure plate are permanently joined to each other.

[0013] According to a further embodiment of the invention, the plate heat exchanger comprises a connection member having an abutment surface abutting the frame plate of the plate package and comprising four connecting conduits located opposite to a respective one of the four ports. Advantageously, the connecting member may comprise a number of attachments that are arranged to be in engagement with a respective one of the attachment members for attachment of the plate package to the abutment surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The present invention is now to be explained more closely by means of a description of various embodiments and with reference to the drawings attached hereto.

- Fig. 1 discloses a side view of a plate heat exchanger according to a first embodiment of the invention.
- Fig. 2 discloses a perspective view towards a frame plate of a plate heat exchanger in Fig. 1.
- Fig. 3 discloses a perspective view towards a pressure plate of the plate heat exchanger in Fig. 1.
- Fig. 4 discloses a perspective view towards a frame plate of a plate heat exchanger according to a second embodiment of the invention.
- Fig. 5 discloses a perspective view towards a pressure plate of the plate heat exchanger in Fig. 4.
- Fig. 6 discloses a perspective view towards a frame plate of a plate heat exchanger according to a first embodiment of the invention.
- Fig. 7 discloses a perspective view towards a pressure plate of the plate heat exchanger in Fig. 6.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

[0015] Figs. 1-3 disclose a side view of a plate heat exchanger comprising a plate package 1 with a frame plate 2, a plurality of heat exchanger plates 3 and a pressure plate 4. The plates 2, 3, 4 extend substantially in parallel to a main extension plane p. The frame plate 2 and the pressure plate 4 are provided on a respective

side of the heat exchanger plates 3. In the embodiments disclosed, the frame plate 2, all heat exchanger plates 3 and the pressure plate 4 are permanently joined to each other, for instance by means of brazing, gluing, welding or the like.

[0016] The heat exchanger plates 3 in the plate package 1 form a plurality of plate interspaces comprising first plate interspaces 5 for a first medium and second plate interspaces 6 for a second medium. The plate interspaces 5, 6 are provided in an alternating order in the plate package 1 in such a way that every second plate interspace is a second plate interspace 6 and the remaining plate interspaces are first plate interspaces 5. In the embodiments disclosed, the plate interspace located most closely to the frame plate 2 is a first plate interspace 5, see Fig. 1.

[0017] The first plate interspaces 5 are arranged to receive a first medium having a relatively low first working pressure. The second plate interspaces 6 are arranged to receive a second medium having a relatively high second working pressure. The plate heat exchanger disclosed is suitable for being provided in an apparatus for heating of hot-water. In such an application, the first plate interspaces 5 may receive and convey a first medium, in this case a primary medium for heating of a second medium which then is a secondary medium in the form of tap hot-water, which is received and conveyed through the second plate interspaces 6. In a typical case, the working pressure of the primary medium in the first plate interspaces 5 may be 2-4 bars, for instance approximately 3 bars, whereas the working pressure of the secondary medium in the second plate interspaces 6 may be 8-12 bars, for instance approximately 10 bars.

[0018] The plate package 1 has two opposite short sides 1a and 1b, and two opposite long sides 1c and 1d, see Fig. 3. The plate package 1 defines a longitudinal centre axis x, which extends centrally along the frame plate 2 in parallel with or substantially in parallel with the two long sides 1c and 1d. The plate package 1 has, seen in a direction towards the frame plate 2, a first side with regard to the centre axis x and a second side 16 with regard to the centre axis x.

[0019] The frame plate 2 and each of the heat exchanger plates 3 have four portholes, which form four ports 11, 12, 13 and 14 that extend through the frame plate 2 and the heat exchanger plates 3. The ports 11-14 comprise a first inlet port 11 and a first outlet port 12 for the first medium, and a second inlet port 13 and a second outlet port 14 for the second medium. The first inlet port 11 and the first outlet port 12 communicate with the first plate interspaces 5 and are provided on the first side 15 of the centre axis x. The second inlet port 13 and the second outlet port 14 communicate with the second plate interspaces 6 and are provided on the second side 16 of the centre axis x. In the embodiments disclosed, the two media thus flow in parallel to each other, but in opposite directions, see Figs. 2 and 4, or in the same direction, see Fig. 6.

[0020] In the embodiments disclosed, the ports 11-14 are symmetric with respect to the centre axis x, which means that the ports 11 and 12 on the first side 15 are located at the same absolute distance from the centre axis x as the ports 13 and 14 on the second side 16.

[0021] The plate heat exchanger comprises or co-operates with a connecting member 18 having an abutment surface 19 abutting the frame plate 2 of the plate package 1 in a mounted position when the plate package 1 is ready to be used. The connecting member 18 comprises four connecting conduits 21, 22, 23 and 24, which are located opposite to a respective one of the four ports 11-14 in the mounted position. Each connecting conduit 21-24 has an orifice in the abutment surface 19. Each such orifice is surrounded by a gasket 25, sealing the transition between the respective ports 11-14 and 21-24 in the mounted position. It is to be noted that the connecting member 18 may belong to the plate heat exchanger or the apparatus on which the plate package 1 is to be provided.

[0022] The plate package 1 comprises one or several first attachment members 30 which are located at a first of the short sides 1 a, and one or several second attachment members 40 which are located at the second short side 1b. The attachment members 30, 40 are in the embodiments disclosed, comprised by the frame plate 2, but may for instance also be provided on any other plate, for instance on a strengthening plate provided outside the frame plate 2. The attachment members 30, 40 are positioned in relation to the centre axis x and the ports 11-14 in such a manner that forces caused by the difference between the first working pressure and the second working pressure are balanced.

[0023] The attachment members 30, 40 are designed as attachment tabs extending outwardly from the frame plate 2. Such attachment tabs may advantageously constitute an integrated part of the frame plate 2, or more precisely of the sheet forming the frame plate 2. The attachment members 30, 40 may of course have another shape than the one disclosed, and for instance comprise a wider sheet than the tabs disclosed. The attachment members 30, 40 are arranged to be in engagement with corresponding attachments 46 of the connecting member 18 in the mounted position.

[0024] In the embodiments disclosed, each attachment member 30, 40 comprises a hole 45 for receiving a screw (not disclosed) which is intended to extend through the hole 45 and into a preferably threaded hole forming the above-mentioned attachment 46 of the connecting member 18. The holes 45 of the attachment members 30, 40 are thus located opposite to the corresponding holes of the attachments 46 of the connecting member 18. It is to be noted that the attachment members 30, 40 for instance may be formed by a respective sheet extending along the whole respective short side 1 a, 1b with holes provided in corresponding positions as in the embodiments disclosed. It is also to be noted that one or several of the attachment members 30, 40 may lack holes

and be intended to be inserted, for instance, into corresponding pockets, grooves, recesses or the like in the connecting member 18.

[0025] In the first embodiment disclosed in Figs. 2 and 3, the attachment members comprise or consist of one single first attachment member 30 at the first short side 1 a, and one single second attachment member 40 at the second short side 1b. Both the attachment members 30, 40 are then positioned on the second side 16 of the centre axis x, i.e. the side comprising the port 13 and 14 for the second medium with the higher working pressure. In this embodiment, the moment around the attachment members 30, 40 should more specifically be as small as possible in order to reduce the risk of leakage, which means that the two attachment members 30, 40 are to be positioned at the same distance from the centre line x, for instance between the centre line x and the centre points of the ports 13, 14, and in an extreme case the attachment members 30, 40 are positioned to be aligned with the centre points of the ports 13, 14.

[0026] In the second embodiment disclosed in Figs. 4 and 5, the attachment members comprise or consist of one single first attachment member 30 at the first short side 1a and two second attachment members 40 at the second short side 1b. The first attachment member 30 and one of the second attachment members 40 are then positioned on the second side 16 of the centre axis x, i.e. the side comprising the ports 13 and 14 for the second medium with the higher working pressure. In this case, the attachment members 30, 40 should be displaced towards the second side 16, wherein the two attachment members located on the second side 16 should be located between the centre line x and the centre points of the ports 13, 14. Preferably, all angles of the triangle formed by the attachment members 30, 40 are smaller than or equal to 90°.

[0027] In the third embodiment disclosed in Figs. 6 and 7, the attachment members comprise or consist of two first attachment members 30 and two second attachment members 40. One of the first attachment members 30 and one of the second attachment members 40 are then positioned on the second side 16 of the centre axis x. The attachment members 30, 40 are positioned in such a manner that the attachment members 30, 40 on the second side 16 of the centre axis x are located at a greater distance from the centre axis x than the attachment members 30, 40 on the first side 15 of the centre axis x. Suitably, one of the attachment members 30, 40 is located along each short side 1 a, 1b on a respective side of the centre axis x. All attachment members 30, 40 are suitably located at an absolute distance from the centre line x which is less or equal to the distance from the centre line to the ports 11, 12 and 13, 14, respectively. Common for all the embodiments disclosed is that all, i.e. one or several, of the first attachment members 30 and all, i.e. one or several, of the second attachment members 40 have a common geometric centre of gravity 50, which is located on the second side 16 of the centre axis x, i.e. on the

side comprising the ports 13 and 14 for the second medium with the higher working pressure. In such a manner, the above-mentioned balancing of the pressure difference between the working pressures is achieved. All attachment members 30, 40 thus form a geometric figure, which in the examples disclosed is a straight line, see Fig. 2, a triangle, see Fig. 4, or a rectangle, see Fig. 6. In the cases that the attachment members 30, 40 form a geometric figure in the form of a straight line or a rectangle, the centre of gravity 50 is also the centre of the geometric figure, i.e. the absolute distance from the centre to each of the attachment members 30, 40 is equal. It is to be noted that the plate package 1 of course may comprise several attachment members 30, 40 and/or attachment members 30, 40 which form other geometric figures than the ones disclosed herein.

[0028] It is to be noted that with the positioning of the attachment members 30, 40 is intended in this application the position of the attachment members 30, 40 in the extension plane p. More precisely, it is referred to a position for a point of each attachment members 30, 40 in which the attachment forces of the attachment member are concentrated. The position of the attachment members 30, 40 in depth, i.e. perpendicular to the extension plane p, may vary, wherein the attachments 46 of the connecting member are positioned in correspondence with such a position of the attachment members 30, 40. The attachment members 30, 40 may have a plane extension as in the embodiments described above, but also a curved or angled extension for engagement with the attachments 46. The attachment members 30, 40 may then be connected to the plate package 1 at a distance from the frame plate 2.

[0029] The invention is not limited to the embodiments disclosed, but may be varied and modified within the scope of the following claims. In the embodiments disclosed, the ports are as mentioned above symmetric with respect to the centre axis x. Within the scope of the invention it is possible to permit at least a certain asymmetry in this respect with the definition that the above mentioned centre of gravity is to be located on the second side of the centre axis x. In any case, the attachment members 30, 40 should also then be positioned in relation to the centre axis x and the ports 11-14 in such a manner that the above-mentioned asymmetric forces are balanced.

Claims

1. A plate heat exchanger comprising a plate package (1) having a frame plate (2), a pressure plate (4) and a plurality of heat exchanger plates (3) which are provided between the frame plate (2) and the pressure plate (4), wherein the plate package (1) has two opposite short sides (1 a, 1 b) and two opposite long sides (1 c, 1 d) and defines a longitudinal centre axis (x) which

extends centrally along the frame plate (2), wherein the heat exchanger plates (3) are provided beside each other and form a number of plate interspaces (5, 6) which comprise first plate interspaces (5), arranged to receive a first medium with a relatively low first working pressure, and second plate interspaces (6), arranged to receive a second medium with a relatively high second working pressure, wherein the frame plate (2) and each of the heat exchanger plates (3) have four portholes which form four ports (11-14) extending through the frame plate (2) and the heat exchanger plates (3), and wherein the plate package (1) comprises one or several first attachment members (30, 40) which are located at the first short side (1 a), and one or several second attachment members (40) which are located at the second short side (1 b),

characterised in that the attachment members (30, 40) are positioned in relation to the centre axis (x) and the ports (11-14) in such a manner that the forces caused by the difference between the first working pressure and the second working pressure are balanced, wherein all one or several first attachment members (30) and all one or several second attachment members (40) have a common centre of gravity (50) located beside the centre axis (x).

2. A plate heat exchanger according to claim 1, wherein the ports comprise a first inlet port (11) and a first outlet port (12) for the first medium, which communicate with the first plate interspaces (5) and are provided on a first side (15) of the centre axis (x), and a second inlet port (13) and a second outlet port (14) for the second medium, which communicate with the second plate interspaces (6) and are provided on the second side (16) of the centre axis (x).
3. A plate heat exchanger according to claim 2, wherein the common centre of gravity (50) which is located on the second side (16) of the centre axis (x).
4. A plate heat exchanger according to any one of claims 2 and 3, wherein the attachment members consist of a first attachment member (30) and a second attachment member (40).
5. A plate heat exchanger according to any one of claims 2 to 4, wherein the attachment members (30, 40) are positioned on the second side (16) of the centre axis (x).
6. A plate heat exchanger according to any one of claims 2 to 4, wherein the attachment members consist of a first attachment member (30) and two second attachment members (40), wherein at least the first attachment member (30) and one of the second attachment members (40) are positioned on the sec-

ond side (16) of the centre axis (x).

7. A plate heat exchanger according to any one of claims 2 to 4, wherein the attachment members consist of two first attachment members (30) and two second attachment members (40), wherein at least one of the first attachment members (30) and one of the second attachment members (40) are positioned on the second side (16) of the centre axis (x).
8. A plate heat exchanger according to any one of the preceding claims, wherein the attachment members (30,40) are designed as attachment tabs extending outwardly from the frame plate (2).
9. A plate heat exchanger according to any one of the preceding claims, wherein the first plate interspaces (5) and the second plate interspaces (6) are provided in an alternating order in the plate package (1), wherein the plate interspace which is located most closely to the frame plate is a first plate interspace (5).
10. A plate heat exchanger according to any one of the preceding claims, wherein the frame plate (2), the heat exchanger plates (3) and the pressure plate (4) are permanently joined to each other.
11. A plate heat exchanger according to any one of the preceding claims, comprising a connecting member (18) with an abutment surface (19), which abuts the frame plate (2) of the plate package (1) and comprises four connecting conduits (21-24) which are located opposite to a respective one of the four ports (11-14).
12. A plate heat exchanger according to claim 11, wherein the connecting member (18) comprises a number of attachments (46) which are arranged to be in engagement with a respective one of the attachment members (30, 40) for attachment of the plate package (1) to the abutment surface (19).

Patentansprüche

1. Plattenwärmetauscher, umfassend einen Plattenstapel (1) mit einer Rahmenplatte (2), einer Druckplatte (4) und einer Mehrzahl von Wärmetauschplatten (3), die zwischen der Rahmenplatte (2) und der Druckplatte (4) angeordnet sind, wobei der Plattenstapel (1) zwei gegenüberliegende kurze Seiten (1a, 1b) und zwei gegenüberliegende lange Seiten (1c, 1d) aufweist und eine Längsmittelachse (x) definiert, die sich mittig entlang der Rahmenplatte (2) erstreckt, wobei die Wärmetauschplatten (3) nebeneinander angeordnet sind und eine Anzahl von Plattenzwischenräumen (5, 6) bilden, die

erste Plattenzwischenräume (5) umfassen, die dazu dienen, ein erstes Medium mit einem relativ niedrigen ersten Arbeitsdruck aufzunehmen, sowie zweite Plattenzwischenräume (6), die dazu dienen, ein zweites Medium mit einem relativ hohen zweiten Arbeitsdruck aufzunehmen, wobei die Rahmenplatte (2) und jede der Wärmetauschplatten (3) vier Durchgangslöcher aufweisen, die vier Anschlüsse (11-14) bilden, die sich durch die Rahmenplatte (2) und die Wärmetauschplatten (3) erstrecken, wobei der Plattenstapel (1) ein oder mehrere erste Befestigungselemente (30, 40) umfasst, die an der ersten kurzen Seite (1a) angeordnet sind, sowie ein oder mehrere zweite Befestigungselemente (40), die an der zweiten kurzen Seite (1b) angeordnet sind, **dadurch gekennzeichnet, dass** die Befestigungselemente (30, 40) in Bezug auf die Mittelachse (x) und die Anschlüsse (11-14) auf eine solche Weise angeordnet sind, dass die durch die Differenz zwischen dem ersten Arbeitsdruck und dem zweiten Arbeitsdruck erzeugten Kräfte ausgeglichen werden, wobei das eine oder alle ersten Befestigungselemente (30) und das eine oder alle zweiten Befestigungselemente (40) einen gemeinsamen Schwerpunkt (50) haben, der sich neben der Mittelachse (x) befindet.

2. Plattenwärmetauscher nach Anspruch 1, wobei die Anschlüsse einen ersten Einlassanschluss (11) und einen ersten Auslassanschluss (12) für das erste Medium umfassen, die mit den ersten Plattenzwischenräumen (5) verbunden sind und an einer ersten Seite (15) der Mittelachse (x) vorgesehen sind, und einen zweiten Einlassanschluss (13) und einen zweiten Auslassanschluss (14) für das zweite Medium, die mit den zweiten Plattenzwischenräumen (6) verbunden sind und an der zweiten Seite (16) der Mittelachse (x) vorgesehen sind.
3. Plattenwärmetauscher nach Anspruch 2, wobei sich der gemeinsame Schwerpunkt (50) an der zweiten Seite (16) der Mittelachse (x) befindet.

4. Plattenwärmetauscher nach einem der Ansprüche 2 und 3, wobei die Befestigungselemente aus einem ersten Befestigungselement (30) und einem zweiten Befestigungselement (40) bestehen.

5. Plattenwärmetauscher nach einem der Ansprüche 2 bis 4, wobei die Befestigungselemente (30,40) auf der zweiten Seite (16) der Mittelachse (x) angeordnet sind.

6. Plattenwärmetauscher nach einem der Ansprüche 2 bis 4, wobei die Befestigungselemente aus einem ersten Befestigungselement (30) und zwei zweiten Befestigungselementen (40) bestehen, wobei min-

destens das erste Befestigungselement (30) und eines der zweiten Befestigungselemente (40) an der zweiten Seite (16) der Mittelachse (x) angeordnet sind.

7. Plattenwärmetauscher nach einem der Ansprüche 2 bis 4, wobei die Befestigungselemente aus zwei ersten Befestigungselementen (30) und zwei zweiten Befestigungselementen (40) bestehen, wobei mindestens eines der ersten Befestigungselemente (30) und eines der zweiten Befestigungselemente (40) an der zweiten Seite (16) der Mittelachse (x) angeordnet sind.
8. Plattenwärmetauscher nach einem der vorangegangenen Ansprüche, wobei die Befestigungselemente (30, 40) als Befestigungsstreifen ausgebildet sind, die sich von der Rahmenplatte (2) auswärts erstrecken.
9. Plattenwärmetauscher nach einem der vorangegangenen Ansprüche, wobei die ersten Plattenzwischenräume (5) und die zweiten Plattenzwischenräume (6) in abwechselnder Anordnung im Plattenstapel (1) vorgesehen sind, wobei derjenige Plattenzwischenraum, der der Rahmenplatte am nächsten liegt, ein erster Plattenzwischenraum (5) ist.
10. Plattenwärmetauscher nach einem der vorangegangenen Ansprüche, wobei die Rahmenplatte (2) die Wärmetauschplatten (3) und die Druckplatte (4) dauerhaft miteinander verbunden sind.
11. Plattenwärmetauscher nach einem der vorangegangenen Ansprüche, umfassend ein Verbindungselement (18) mit einer Auflagefläche (19), die auf der Rahmenplatte (2) des Plattenstapels (1) aufliegt und vier Verbindungsleitungen (21-24) umfasst, die jeweils einem der vier Anschlüsse (11-14) gegenüberliegen.
12. Plattenwärmetauscher nach Anspruch 11, wobei das Verbindungselement (18) eine Anzahl von Befestigungen (46) umfasst, die in Eingriff mit jeweils einem der Befestigungselemente (30, 40) angeordnet sind und der Befestigung des Plattenstapels (1) an der Auflagefläche (19) dienen.

Revendications

1. Echangeur de chaleur à plaques comprenant un ensemble de plaques (1) ayant une plaque cadre (2), une plaque de pression (4) et une pluralité de plaques d'échange de chaleur (3) qui sont placées entre la plaque cadre (2) et la plaque de pression (4), dans lequel l'ensemble de plaques (1) a deux petits côtés opposés (1a, 1b) et deux grands côtés oppo-

sés (1c, 1d) et définit un axe central longitudinal (x) qui s'étend au centre le long de la plaque cadre (2), dans lequel les plaques d'échange de chaleur (3) sont placées côte à côte, et forment un certain nombre d'espaces entre les plaques (5, 6) qui comprennent des premiers espaces entre les plaques (5), conçus pour recevoir un premier milieu avec une première pression de travail relativement basse, et des deuxièmes espaces entre les plaques (6), conçus pour recevoir un deuxième milieu avec une deuxième pression de travail relativement élevée, dans lequel la plaque cadre (2) et chacune des plaques d'échange de chaleur (3) ont quatre trous qui forment quatre orifices (11 - 14) s'étendant à travers la plaque cadre (2) et les plaques d'échange de chaleur (3), et dans lequel l'ensemble de plaques (1) comprend un ou plusieurs premiers éléments de fixation (30, 40) qui sont situés sur le premier petit côté (1a), et un ou plusieurs deuxièmes éléments de fixation (40) qui sont situés sur le deuxième petit côté (1b), **caractérisé en ce que** les éléments de fixation (30, 40) sont positionnés par rapport à l'axe central (x) et aux orifices (11 - 14) de telle manière que les forces dues à la différence entre la première pression de travail et la deuxième pression de travail sont équilibrées, dans lequel l'ensemble desdits un ou plusieurs premiers éléments de fixation (30, 40) et l'ensemble desdits un ou plusieurs deuxièmes éléments de fixation (40) ont un centre de gravité commun (50) situé à côté de l'axe central (x).

2. Echangeur de chaleur à plaques selon la revendication 1, dans lequel les orifices comprennent :

un premier orifice d'entrée (11) et un premier orifice de sortie (12) pour le premier milieu, qui communiquent avec les premiers espaces entre les plaques (5) et qui sont situés sur un premier côté (15) de l'axe central (x), et un deuxième orifice d'entrée (13) et un deuxième orifice de sortie (14) pour le deuxième milieu, qui communiquent avec les deuxièmes espaces entre les plaques (6) et qui sont situés sur le deuxième côté (16) de l'axe central (x).

3. Echangeur de chaleur à plaques selon la revendication 2, dans lequel le centre de gravité commun (50) se trouve sur le deuxième côté (16) de l'axe central (x).

4. Echangeur de chaleur à plaques selon l'une quelconque des revendications 2 et 3, dans lequel les éléments de fixation sont constitués d'un premier élément de fixation (30) et d'un deuxième élément de fixation (40).

5. Echangeur de chaleur à plaques selon l'une quel-

conque des revendications 2 à 4, dans lequel les éléments de fixation (30, 40) sont positionnés sur le deuxième côté (16) de l'axe central (x). (19).

6. Echangeur de chaleur à plaques selon l'une quelconque des revendications 2 à 4, dans lequel les éléments de fixation sont constitués d'un premier élément de fixation (30) et de deuxièmes éléments de fixation (40), dans lequel au moins le premier élément de fixation (30) et l'un des deuxièmes éléments de fixation (40) sont positionnés sur le deuxième côté (16) de l'axe central (x). 5
10
7. Echangeur de chaleur à plaques selon l'une quelconque des revendications 2 à 4, dans lequel les éléments de fixation sont constitués de deux premiers éléments de fixation (30) et de deux deuxièmes éléments de fixation (40), dans lequel au moins l'un des premiers éléments de fixation (30) et l'un des deuxièmes éléments de fixation (40) sont positionnés sur le deuxième côté (16) de l'axe central (x). 15
20
8. Echangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, dans lequel les éléments de fixation (30, 40) sont conçus comme des pattes de fixation s'étendant vers l'extérieur depuis la plaque cadre (2). 25
9. Echangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, dans lequel les premiers espaces entre les plaques (5) et les deuxièmes espaces entre les plaques (6) sont placés en alternance dans l'ensemble de plaques (1), dans lequel l'espace entre les plaques qui se trouve le plus près de la plaque cadre est un premier espace entre les plaques (5). 30
35
10. Echangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, dans lequel la plaque cadre (2), les plaques d'échange de chaleur (3) et la plaque de pression (4) sont assemblées de manière permanente les unes aux autres. 40
11. Echangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, comprenant un élément de raccordement (18) avec une surface de butée (19), qui vient buter contre la plaque cadre (2) de l'ensemble de plaques (1) et comprend quatre conduits de raccordement (21 - 24) qui sont placés à l'opposé de l'un respectif des quatre orifices (11 - 14). 45
50
12. Echangeur de chaleur à plaques selon la revendication 11, dans lequel l'élément de raccordement (18) comprend un certain nombre de fixations (46) qui sont agencées de façon à s'accoupler avec l'un respectif des éléments de fixation (30, 40) pour fixer l'ensemble de plaques (1) sur la surface de butée 55

Fig 1

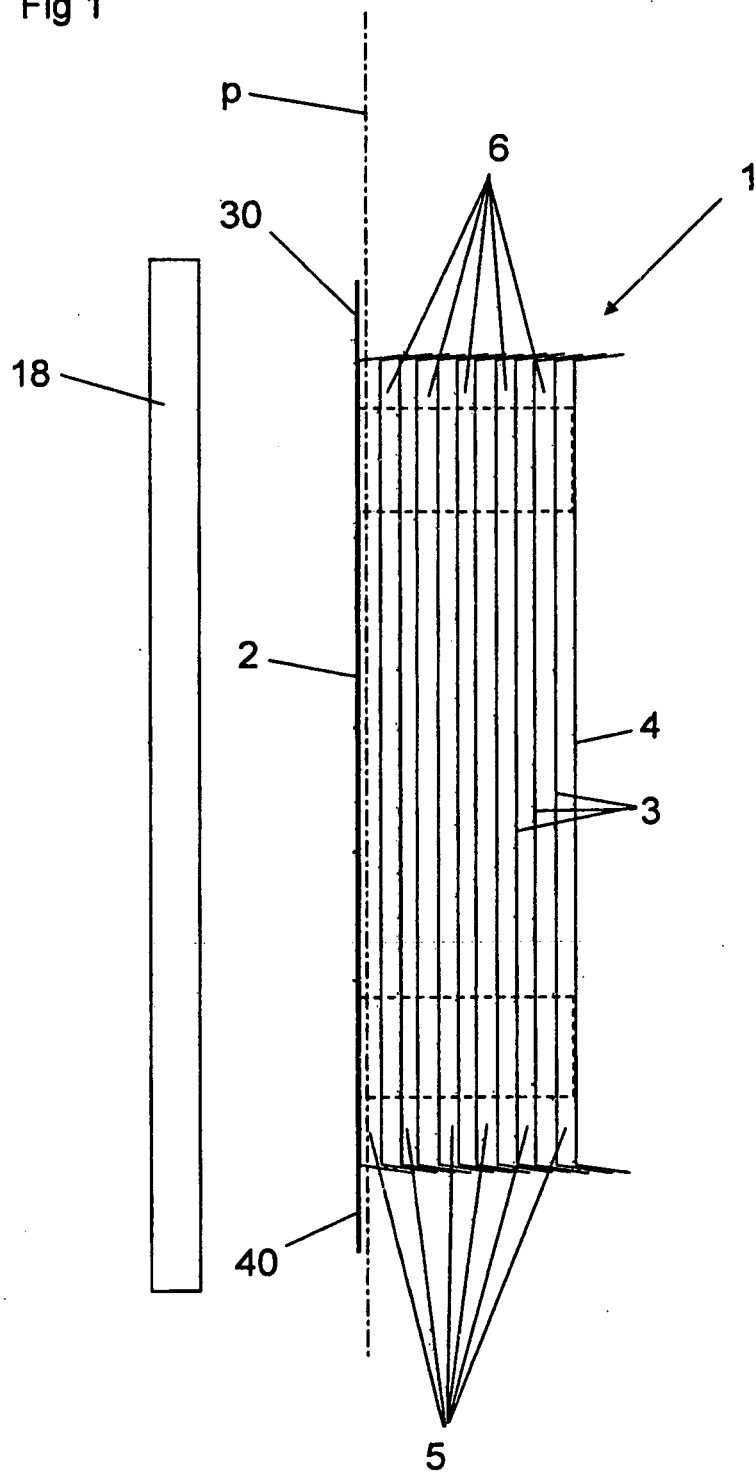


Fig 2

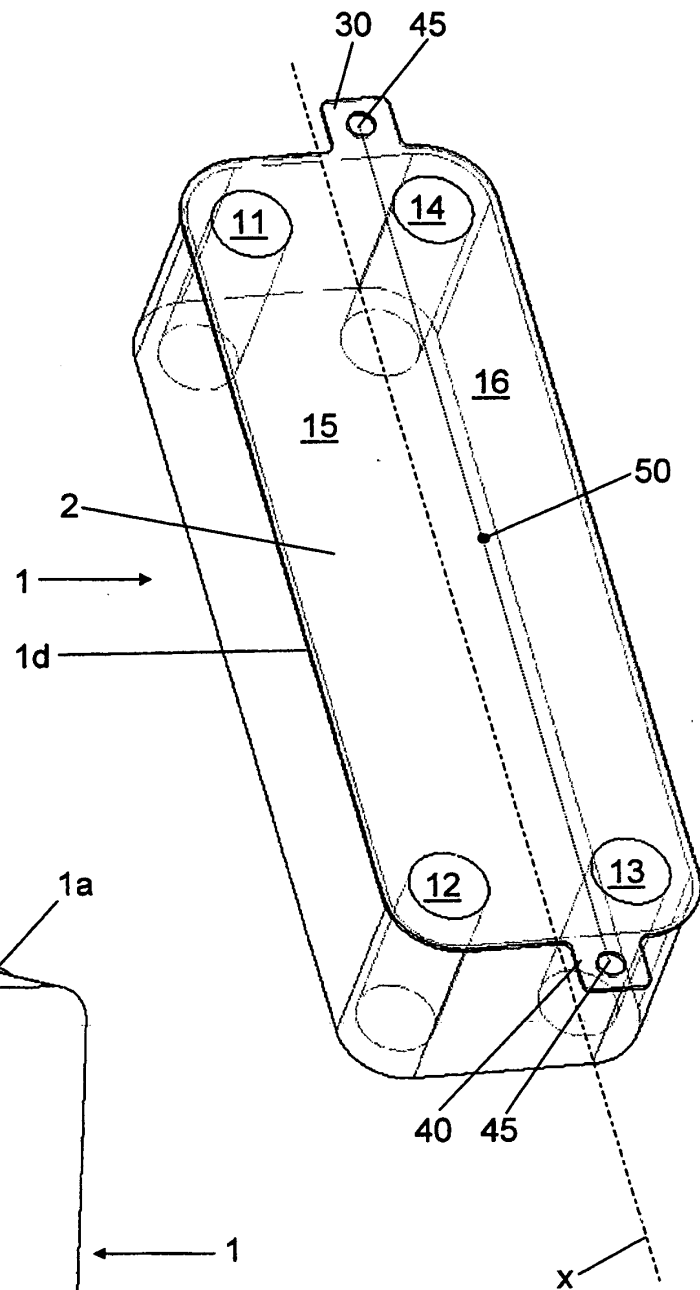


Fig 3

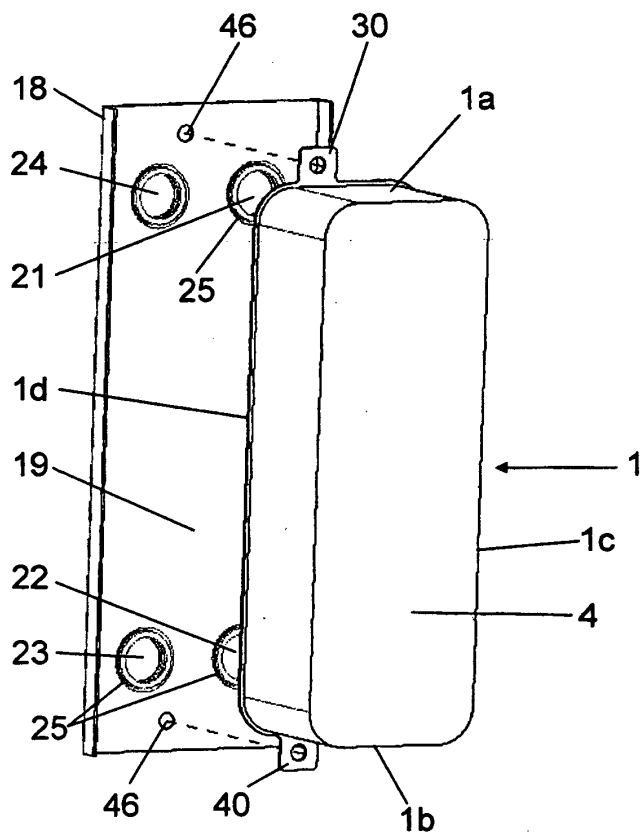


Fig 4

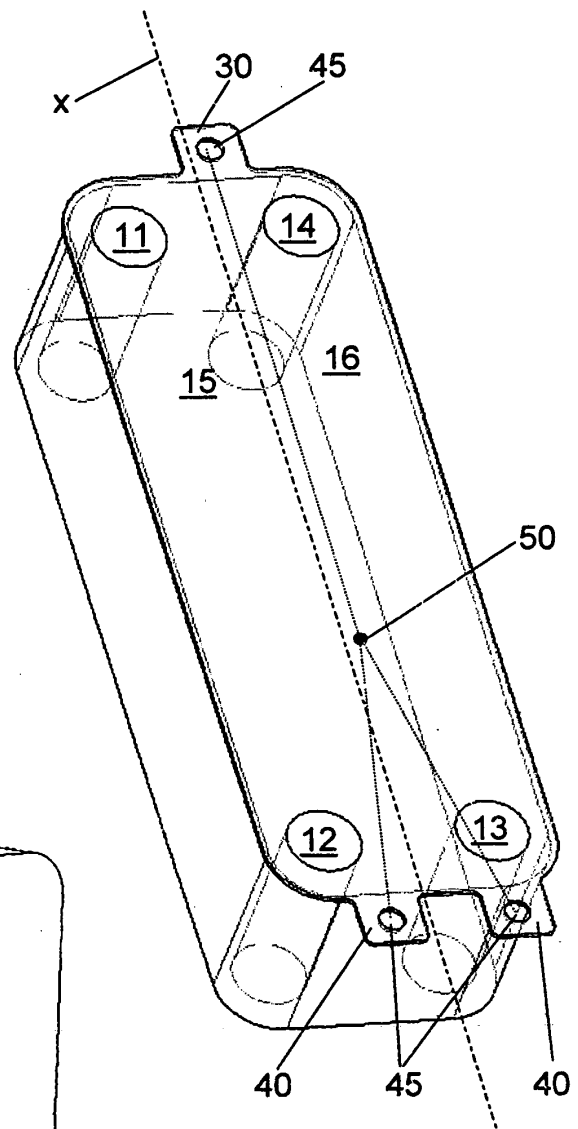


Fig 5

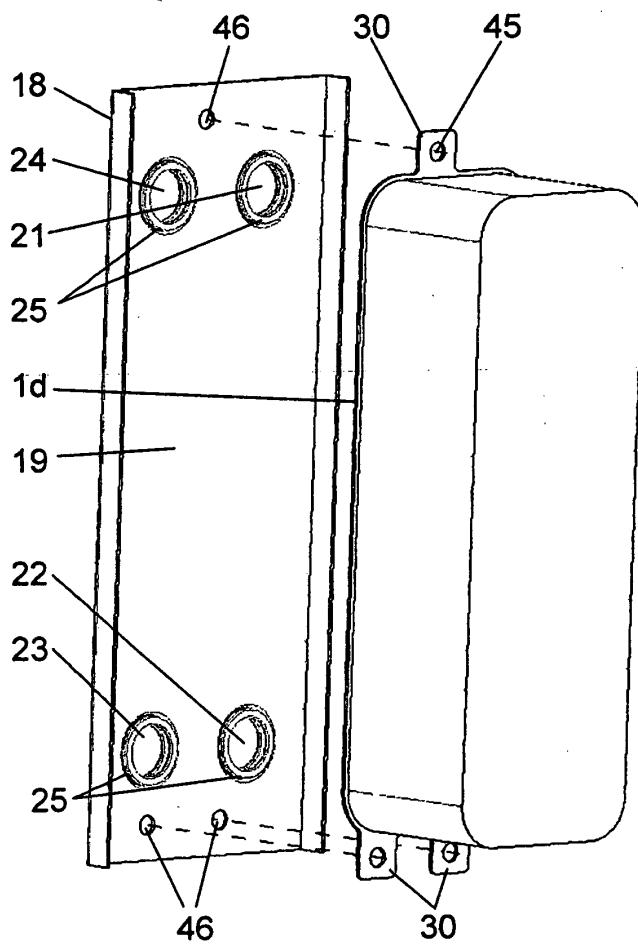


Fig 6

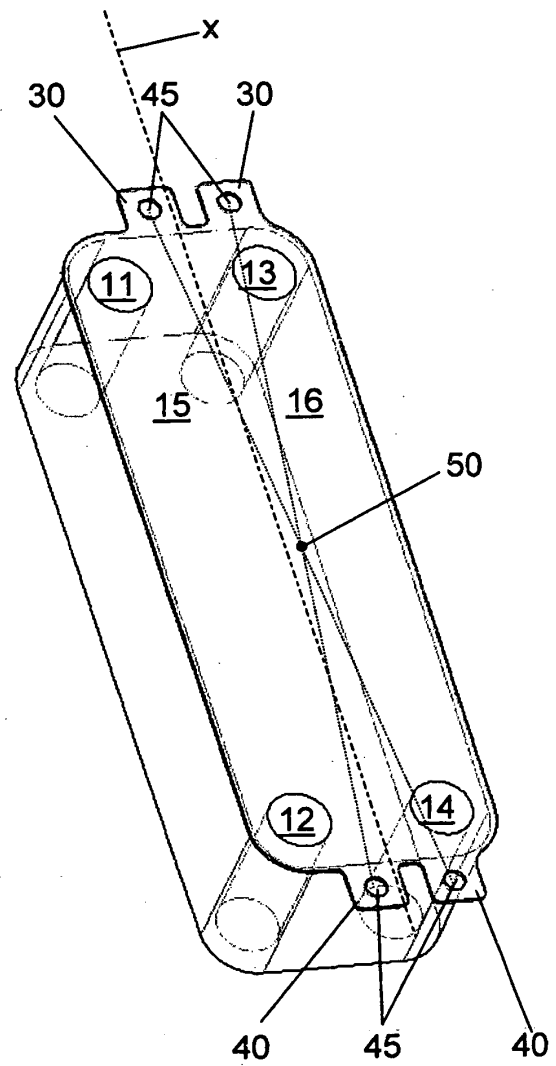
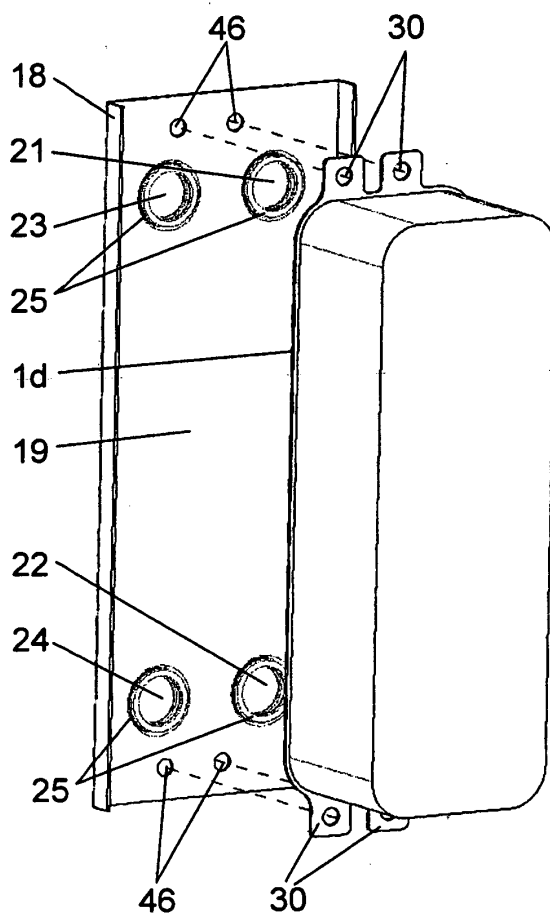


Fig 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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