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(54) **PLATE HEAT EXCHANGER**

PLATTENWÄRMETAUSCHER

ÉCHANGEUR DE CHALEUR À PLAQUE

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Description

THE FIELD OF THE INVENTION

[0001] The present invention refers to a plate heat exchanger comprising a plurality of heat exchanger plates according to the preamble of claim 1, see US-5,918,664. Such plate heat exchangers may be used in various fields, for instance in the combustion gas channel of combustion plants for gaining heat energy from the combustion gases.

THE BACKGROUND OF THE INVENTION AND PRIOR ART

[0002] In plate heat exchangers of the kind mentioned above, which are open outwardly to the surrounding edge side and which do not have any downwardly bent flange along the edge of each heat exchanger plate, it is difficult to guide the heat exchanger plates in connection with the mounting of the plate package. Consequently, it is difficult to provide a correct position for each individual heat exchanger plate in relation to the other heat exchanger plates when the plate package is mounted and during the joining of the heat exchanger plates to each other, for instance during a following brazing of the plate package. The guiding and the positioning of the heat exchanger plates require with the technique of today use of external guiding elements of various kinds.

[0003] US-A-5,918,664 discloses a plate heat exchanger of the kind initially defined, which comprises a plurality of heat exchanger plates. Each of the heat exchanger plates extends in parallel with a main extension plane. The heat exchanger plates are provided beside each other so that they form a plate package having an surrounding edge side and first plate interspaces for a first medium and second plate interspaces for a second medium.

[0004] Every second heat exchanger plate is formed by a first of said heat exchanger plates and the remaining heat exchanger plates are formed by a second heat exchanger plate in such a way that such a first heat exchanger plate together with such a second heat exchanger plate form a pair of heat exchanger plates, which encloses such a first plate interspace, and that the plate package comprises a plurality of such pairs of heat exchanger plates. Each of the heat exchanger plates has at least two portholes forming ports extending through the plate package and communicating with the first plate interspaces. The heat exchanger plates are configured in such a way that the second plate interspaces are open through the surrounding edge side.

[0005] US-A-5,967,227 discloses a plate heat exchanger of another kind comprising a plurality of heat exchanger plates which each extends in parallel with a main extension plane. The heat exchanger plates are provided beside each other in an alternating order for forming a plate package. The heat exchanger plates form

first plate interspaces for a first medium and second plate interspaces for a second medium. The first and second plate interspaces are sealed by means of surrounding gaskets. Each of the heat exchanger plates has two portholes, which form ports extending through the plate package and communicating with the first plate interspaces, and two portholes, which form ports extending through the plate package and communicating with the first plate interspaces. Each heat exchanger plate comprises a bent part in each corner, which cooperates with a corresponding bent part of the adjoining heat exchanger plates in the plate package.

SUMMARY OF THE INVENTION

[0006] The object of the present invention is to overcome the problems mentioned above and to facilitate the guiding and the positioning of the heat exchanger plates in connection with the mounting and the joining of the plate package.

[0007] This object is achieved by a plate heat exchanger of the kind initially defined, which is characterized in that each of the portholes of such a first heat exchanger plate is configured in such a way that it cooperates with an opposite porthole of such a second heat exchanger plate in order to ensure that each pair of heat exchanger plates takes a determined position in relation to adjoining pairs of heat exchanger plates by the features of the characterizing portion of claim 1.

[0008] By means of two such bent parts cooperating with each other when a first heat exchanger plate is laid against a second heat exchanger plate, it may be ensured that the two heat exchanger plates are guided to a correct position and that this position is maintained during the whole mounting and joining of the plate package and the plate heat exchanger. When the two heat exchanger plates have been attached to each other, the two bent parts may prevent them from being displaced or rotated in relation to each other in a plane parallel to the extension plane. Furthermore, a correct positioning of the different pairs in relation to each other is facilitated thanks to the fact that the portholes are designed to cooperate with a corresponding porthole of an adjoining pair in the plate package. The portholes will thus contribute to the guiding of the pairs of heat exchanger plates to a determined position in relation to each other and to the maintaining of this position of the pairs of heat exchanger plates during the whole manufacturing process.

[0009] Since the bent parts extend in different directions in relation to the extension plane and in relation to the heat exchanging pattern and port areas of the compression-moulded plate, the bent parts are advantageously produced in a shaping operation after the main compression-moulding of the pattern and port areas of the plate. The first direction and the second direction may then extend transversally or substantially transversally to the extension plane. Furthermore, each second heat exchanger plate may be rotated 180° in relation to each

first heat exchanger plate in the finished plate package. In such a way the first bent part and the second bent part will extend in the same direction in the finished plate package, which makes it possible to provide a proper form fitting and a proper form locking between the first and second bent parts and thus between the first and second heat exchanger plates in each pair.

[0010] According to an embodiment of the invention, each heat exchanger plate extends along a longitudinal centre line, which extends through the bent part. Furthermore, each second heat exchanger plate in the plate package may be rotated 180° around the centre line of the heat exchanger plate.

[0011] According to a further embodiment of the invention, the first and second heat exchanger plates are permanently joined to each other in the plate package. Such a permanently joined plate package may be achieved by means of brazing, gluing or welding.

[0012] According to a further embodiment of the invention, each first heat exchanger plate comprises two first bent parts and each second heat exchanger plate two second bent parts. Two such bent parts of each heat exchanger plate are sufficient for ensuring the above mentioned positioning of the heat exchanger plates in relation to each other.

[0013] According to a further embodiment of the invention, the two first bent parts are provided opposite to each other along a respective edge of the first heat exchanger plate and the two second bent parts are provided opposite to each other along a respective edge of the second heat exchanger plate.

[0014] According to a further embodiment of the invention, each portholes comprises a surrounding port area, wherein the port area around a first porthole of each heat exchanger plate is located at a first level with regard to the extension plane, and the port area around a second of said portholes of each heat exchanger plate is located at another level with regard to the extension plane. Advantageously, the port area around the first porthole of a first pair of heat exchanger plates may be configured in such a way that it is in engagement with the port area around the second porthole of an adjoining second pair of heat exchanger plates. The port area around the second porthole of the first pair of heat exchanger plates may then be configured in such a way that it is in engagement with the port area around the first porthole of the adjoining second pair of heat exchanger plates. In such a way, the portholes may contribute to the guiding of the pairs of heat exchanger plates to a determined position in relation to each other and to the maintaining of this position of the pairs of heat exchangers plates during the whole manufacturing process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention is now to be explained more closely through a description of non-limiting embodiments and with reference to the drawings attached.

Fig. 1 discloses an exploded perspective view of a plate heat exchanger according to an embodiment of the invention.

5 Fig. 2 discloses a view from above of the plate heat exchanger in Fig. 1.

Fig. 3 discloses a section through the plate heat exchanger along the line III-III in Fig. 2.

10 Fig. 4 discloses a section through the plate heat exchanger along the line IV-IV in Fig. 2.

15 Fig. 5 discloses more closely a part of an edge area V of the plate heat exchanger.

Fig. 6 discloses a simplified exploded perspective view of a plate package of a plate heat exchanger according to the invention.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

[0016] With reference to Figs. 1-5 an embodiment of a plate heat exchanger is disclosed. The plate heat exchanger comprises a plurality of heat exchanger plates 1, 2. The heat exchanger plates 1, 2 consists of first heat exchanger plates 1 and second heat exchanger plates 2. All heat exchanger plates 1, 2 have a heat exchanging function in the plate heat exchanger. Each heat exchanger plate 1, 2 extends in parallel with a main extension plane p, see Fig. 3. The extension plane p may be regarded as extending through and in parallel with a basic plane of each heat exchanger plate 1, 2, from which each plane heat exchanger plate 1, 2 has been compression-moulded in a manner known per se for achieving a compression-moulded pattern including a heat exchanging pattern with corrugations and a port area pattern.

[0017] The heat exchanger plates 1, 2 are provided beside each other in such a way that they form a plate package 3 having an edge side 4, which extends around the plate package 3. The heat exchanger plates 1, 2 form, in the plate package 3, first plate interspaces 5 for a first medium and second plate interspaces 6 for a second medium, see Fig. 3. The heat exchanger plates 1, 2 are also provided in such a way in the plate package 3 that every second heat exchanger plate is a first heat exchanger plate 1 and the remaining heat exchanger plates are a second heat exchanger plate 2. As can be seen especially from Figs. 1 and 3, a first heat exchanger plate 1 and an adjoining second heat exchanger plate 2 form a pair of heat exchanger plates in the plate package 3 in such a way that this pair of heat exchanger plates encloses a first plate interspace 5. As can be seen, the plate package 3 comprises in the embodiment disclosed three such pairs of heat exchangers plates 1, 2. It is to be noted here that the plate heat exchanger of course may comprise fewer or more such pairs of heat exchanger plates

1, 2 depending on the specific application for the plate heat exchanger.

[0018] In the embodiment disclosed, each heat exchanger plate 1, 2 has two portholes 8, 9, which form ports extending through the plate package 3 and communicating with the first plate interspaces 5. One of the portholes 8, 9 thus forms an inlet port for the first medium to the first plate interspaces 5 whereas the other porthole 9 forms an outlet port for the first medium from the first plate interspace 5.

[0019] The heat exchanger plates 1, 2 are configured in such a way that the second plate interspaces 6 are open through the surrounding edge side 4. The second medium may thus flow freely in through the edge side 4 of the plate heat exchanger into the second plate interspaces 6 and out through the edge side 4. Depending on how the plate heat exchanger is arranged in relation to the flowing of the second medium, the flow direction of the second medium through the plate heat exchanger may be determined.

[0020] Each porthole 8, 9 comprises a surrounding port area 10, 11. The port area 10 around the first porthole 8 of each heat exchanger plate 1, 2 is located at a first level p' with regard to the extension plane p, and the second port area 11 around the second porthole 9 of each heat exchanger plate 1, 2 is located at a second level p" with regard to the extension plane p, see Fig. 3. In the embodiment disclosed, both port areas 10, 11 are located on the same side of the extension plane p wherein the level p' is located more far away from the extension plane p than the level p".

[0021] The plate heat exchanger also comprises a frame plate 13 and a pressure plate 14, which do not have any heat exchanging function. The pressure plate 14 has in the embodiments disclosed no portholes whereas the frame plate 13 has portholes being concentric to the portholes 8 and 9, respectively. Connection pipes 15 and 16 are connected to the frame plate 13 for permitting communication with a respective one of the above-mentioned ports.

[0022] Each first heat exchanger plate 1 comprises two first bent parts 21 and each second heat exchanger plate 2 comprises two second bent parts 22. The first bent part 21 is arranged to cooperate with the second bent part 22 of each such pair of heat exchanger plates 1, 2 in order to ensure that the heat exchanger plates 1 and 2 in each pair takes a determined position in relation to each other and that this position is maintained during the whole manufacturing process of the plate heat exchanger.

[0023] In the embodiment disclosed, the first bent parts 21 extend in a first direction with regard to the extension plane p of the first heat exchanger plate 1 and more precisely away from the extension plane p. The second bent part 22 extends in a second direction with regard to the extension plane p of the second heat exchanger plate 2, i.e. away from the extension plane p. The second direction is opposite to the first direction with regard to the extension plane p. In the embodiment disclosed in Figs.

1-5, the first direction is opposite to the above-mentioned pressing direction. The second bent part 22 thus extends in the same direction, or substantially the same direction, as the compression-moulded pattern and port areas 10, 11 of the heat exchanger plates 1, 2. The first direction and the second direction extend transversally or substantially transversally to the extension plane p. All heat exchanger plates 1, 2 in the plate package 3 are thus identical except with regard to the bent parts 21, 22 extending in opposite directions.

[0024] When the plate heat exchanger is mounted, every second heat exchanger plate 2 is rotated 180° in relation to every first heat exchanger plate 1. After this rotation of the second heat exchanger plates 2, the first bent part 21 and the second bent part 22 will thus extend in the same direction in the finished plate package 3, see especially Fig. 5. Each heat exchanger plate 1, 2 extends along a longitudinal centre line x which is parallel with the extension plane p. The second heat exchanger plates 2 are in the plate package rotated 180° around the respective centre line x. Fig. 6 discloses schematically in a simplified manner a plate package 3 having two pairs of heat exchanger plates 1, 2, where the second heat exchanger plates 2 have been rotated 180° around the centre line x. The bent parts 21, 22 thus extend in the same direction in the plate package 3.

[0025] As can be seen from Figs. 1, 2 and 6, the first parts 21 of each first heat exchanger plate 1 are provided opposite to each other along a respective edge 23 of the first heat exchanger plate 1. More precisely, each first bent part 21 is concentrically provided with regard to the longitudinal centre line x in such a way that the centre line x extends centrally through the first bent part 21. In the same way, the second parts 22 of each second heat exchanger plate 2 are provided opposite to each other along a respective edge of the second heat exchanger plate 2. More precisely, each second bent part 22 is concentrically provided with regard to the longitudinal centre line x in such a way that the centre line x extends centrally through the second bent part 22.

[0026] Each heat exchanger plate has in the embodiment disclosed in Figs. 1-5 two opposite short edges 23 and two opposite long edges 24. As can be seen the first and second parts 21, 22 are provided at the two short edges 23. It is of course possible, as an alternative with two bent parts of each heat exchanger plate or a supplement with four bent parts of each heat exchanger plate, to provide bent parts along the long edges 24.

[0027] In the embodiment disclosed, each heat exchanger plate 1, 2 has an edge area 25 adjoining the short and long edges 23, 24 and extending around the compression-moulded pattern and port areas 10, 11 of the heat exchanger plate 1, 2. The edge area 25 is substantially plane and parallel with the extension plane p. In the embodiment disclosed, the extension plane p also lies in the edge area 25. As can be seen from Fig. 3, the edge area 25 of the first heat exchanger plate 1 abuts, in each pair of heat exchanger plates 1, 2, the edge area

25 of the second heat exchanger plate 2.

[0028] The plate heat exchanger thus comprises the above-mentioned pairs of heat exchanger plates 21, 22. These pairs are disposed beside each other in the plate package. Each of the portholes 8, 9 of the first heat exchanger plate 1 of such a pair is thus configured in such a way that it cooperates with an opposite porthole 8, 9 of the second heat exchanger plate 2 of an adjoining such pair in order to ensure that each pair of heat exchanger plates 1, 2 takes a determined position in relation to adjoining pairs of heat exchanger plates 1, 2. More specifically, the port area 10 around the first porthole 8 of a first pair of heat exchanger plates 1, 2 is configured in such a way that it is in engagement with the port area 11 around the second porthole 9 of an adjoining second pair of heat exchanger plates 1, 2. The port area 11 around the second porthole 9 of the first pair is then configured in such a way that it is in engagement with the port area 10 around the first porthole 8 of the second pair.

[0029] Thanks to the guiding of the heat exchanger plates 1, 2 achieved by means of the bent parts 21, 22 and the port areas 10, 11, all parts of the plate package 3, i.e. at least all heat exchanger plates 1, 2 and possibly also the frame plate 13, the pressure plate 14 and the connection pipes 15, 16, may be mounted and disposed in their final position with a suitable braze material between the parts, whereafter the plate package 3 is disposed in an oven and brazed in a manner known per se. It is also imaginable to braze in a first step two heat exchanger plates 1, 2 to the above-mentioned pairs and in a second step braze the pairs so formed. Other joining methods than brazing may also be used, for instance welding or gluing.

[0030] According to another alternative embodiment, the bent parts 21 and 22 may extend in the same direction away from the extension plane p. When the plate package 3 is mounted, wherein every second heat exchanger plate is rotated 180°, the bent parts 21, 22 of the heat exchanger plates 1, 2 in each pair will extend in opposite directions towards each other. In order to achieve a locking of the position, the bent parts 21, 22 may then be displaced from the centre line x in such a way that they adjoin the centre line x. This embodiment has the advantage that all heat exchanger plates 1, 2 may be made completely identical. Possibly the locking of the position may be improved if there are bent parts along each edge 23, 24.

[0031] The invention is not limited to the embodiments disclosed but may be varied and modified within the scope of the following claims.

Claims

1. A plate heat exchanger comprising a plurality of heat exchanger plates (1, 2), which each extend in parallel to a main extension plane (p) and which are provided beside each other so that they form a plate package

(3) having a surrounding edge side (4) and first plate interspaces (5) for a first medium and second plate interspaces (6) for a second medium,

wherein every second heat exchanger plate is formed by a first heat exchanger plate (1) and the remaining heat exchanger plates are formed by a second heat exchanger plate (2) in such a way that such a first heat exchanger plate (1) together with such a second heat exchanger plate (2) form a pair of heat exchanger plates (1, 2), which encloses such a first plate interspace (5), and that the plate package (3) comprises a plurality of such pairs of heat exchanger plates (1, 2),

wherein each of the heat exchanger plates has at least two portholes (8, 9) which form ports extending through the plate package (3) and communicating with the first plate interspaces (5),

wherein the heat exchanger plates (1, 2) are configured in such a way that the second plate interspaces (6) are open through the surrounding edge side (4), and

wherein each of the portholes (8, 9) of such a first heat exchanger plate (1) is configured in such a way that it cooperates with an opposite porthole (8, 9) of such a second heat exchanger plate (2) in order to ensure that each pair of heat exchanger plates (1, 2) takes a determined position in relation to adjoining pairs of heat exchanger plates (1, 2),

characterized in that each first such heat exchanger plate (1) comprises at least a first bent part (21), and each second such heat exchanger plate (2) comprises at least a second bent part (22), wherein in each pair of heat exchanger plates (1, 2) the first bent part (21) is arranged to cooperate with the second bent part (22) in order to ensure that the two heat exchanger plates (1, 2) in each pair take a determined position in relation to each other, that each first and second exchanger plate (1, 2) has a compression-moulded pattern including a heat exchanging pattern with corrugations and a port area pattern, which compression-moulded pattern extends in a pressing direction with regard to the extension plane (p),

that the first bent part (21) extends in a first direction with regard to the extension plane (p) of the first heat exchanger plate (1) and

that the second bent part (22) extends in a second direction with regard to the extension plane (p) of the second heat exchanger plate (2), wherein the second direction extends in the same direction as the pressing direction but is opposite to the first direction.

2. A plate heat exchanger according to claim 1, **characterized in that** the first direction and the second direction extends transversally to the extension plane (p).
3. A plate heat exchanger according to any one of

claims 1 and, **characterized in that** each second heat exchanger plate (2) is rotated 180° in relation to each first heat exchanger plate (1) in the finished plate package (3).

4. A plate heat exchanger according to claim 3, **characterized in that** the first bent part (21) and the second bent part (22) extend in the same direction in the finished plate package (3).
5. A plate heat exchanger according to any one of the preceding claims, **characterized in that** each heat exchanger plate (1, 2) extends along a longitudinal centre line (x), which extends through the bent part (21, 22).
6. A plate heat exchanger according to claim 5, **characterized in that** each second heat exchanger plate (2) in the plate package (3) is rotated 180° around the centre line (x) of the heat exchanger plate.
7. A plate heat exchanger according to any one of the preceding claims, **characterized in that** the first and second heat exchanger plates are permanently joined to each other in the plate package.
8. A plate heat exchanger according to any one of the preceding claims, **characterized in that** each first heat exchanger plate (1) comprises the two first bent parts (21) and each second heat exchanger plate (2) two second bent parts (22).
9. A plate heat exchanger according to claim 8, **characterized in that** the two first bent parts (21) are provided opposite to each other along a respective edge of the first heat exchanger plate (1) and that the two second bent parts (22) are provided opposite to each other along a respective edge of the second heat exchanger plate (2).
10. A plate heat exchanger according to any one of the preceding claims, **characterized in that** each porthole (8, 9) comprises a surrounding port area (10, 11), wherein the port area (10) around a first porthole (8) of each heat exchanger plate (1, 2) is located at a first level (p') with regard to the extension plane (p) and the port area (11) around a second of said portholes (9) of each heat exchanger plate (1, 2) is located at a second level (p'') with regard to the extension plane (p).
11. A plate heat exchanger according to claim 10, **characterized in that** the port area (10) around the first porthole (8) of a first pair of heat exchanger plates (1, 2) is configured in such a way that it is in engagement with the port area (11) around the second porthole (9) of an adjoining second pair of heat exchanger plates (1, 2).

12. A plate heat exchanger according to claim 11, **characterized in that** the port area (11) around the second porthole (9) of the first pair of heat exchanger plates (1, 2) is configured in such a way that it is in engagement with the port area (10) around the first porthole (8) of the second adjoining pair of heat exchanger plates (1, 2).

10 Patentansprüche

1. Plattenwärmetauscher, der mehrere Wärmetauscherplatten (1, 2) umfasst, die sich jeweils parallel zu einer Hauptausdehnungsebene (p) erstrecken und die nebeneinander bereitgestellt werden, so dass sie ein Plattenpaket (3) bilden, das eine umschließende Kantenseite (4) und erste Plattenzwischenräume (5) für ein erstes Medium und zweite Plattenzwischenräume (6) für ein zweites Medium hat, wobei jede zweite Wärmetauscherplatte durch eine erste Wärmetauscherplatte (1) gebildet wird und die verbleibenden Wärmetauscherplatten durch eine zweite Wärmetauscherplatte (2) gebildet werden, auf eine solche Weise, dass eine solche erste Wärmetauscherplatte (1) zusammen mit einer solchen zweiten Wärmetauscherplatte (2) ein Paar von Wärmetauscherplatten (1, 2) bildet, das einen solchen ersten Plattenzwischenraum (5) umschließt und dass das Plattenpaket (3) mehrere solcher Paare von Wärmetauscherplatten (1, 2) umfasst, wobei jede der Wärmetauscherplatten (8, 9) wenigstens zwei Anschlusslöcher (8, 9) hat, die Anschlüsse bilden, die sich durch das Plattenpaket (3) erstrecken und mit den ersten Plattenzwischenräumen (5) in Verbindung stehen, wobei die Wärmetauscherplatten (1, 2) auf eine solche Weise konfiguriert sind, dass die zweiten Plattenzwischenräume (6) durch die umschließende Kantenseite (4) offen sind, und wobei jedes der Anschlusslöcher (8, 9) einer solchen ersten Wärmetauscherplatte (1) auf eine solche Weise konfiguriert ist, dass mit einem gegenüberliegenden Anschlussloch (8, 9) einer solchen zweiten Wärmetauscherplatte (2) zusammenwirkt, um sicherzustellen, dass jedes Paar von Wärmetauscherplatten (1, 2) eine bestimmte Position im Verhältnis zu angrenzenden Paaren von Wärmetauscherplatten (1, 2) einnimmt, **dadurch gekennzeichnet, dass** jede erste solche Wärmetauscherplatte (1) wenigstens einen ersten gebogenen Teil (21) umfasst und jede zweite solche Wärmetauscherplatte (2) wenigstens einen zweiten gebogenen Teil (22) umfasst, wobei in jedem Paar von Wärmetauscherplatten (1, 2) der erste gebogene Teil (21) dafür angeordnet ist, mit dem zweiten gebogenen Teil (22) zusammenzuwirken, um sicherzustellen, dass die zwei Wärmetauscherplatten

- (1, 2) in jedem Paar eine bestimmte Position im Verhältnis zueinander einnehmen,
dass jede erste und zweite Wärmetauscherplatte (1, 2) ein formgepresstes Muster hat, das ein Wärme-
tauschmuster mit Wellungen und ein Anschlussbe-
reichsmuster einschließt, wobei sich das formge-
presste Muster in einer Pressrichtung in Bezug auf
die Ausdehnungsebene (p) erstrecken,
dass sich der erste gebogene Teil (21) in einer ersten
Richtung in Bezug auf die Ausdehnungsebene (p)
der ersten Wärmetauscherplatte (1) erstreckt und
dass sich der zweite gebogene Teil (22) in einer
zweiten Richtung in Bezug auf die Ausdehnungse-
bene (p) der zweiten Wärmetauscherplatte (2) er-
streckt, wobei sich die zweite Richtung in der glei-
chen Richtung erstreckt wie die Pressrichtung, aber
zu der ersten Richtung entgegengesetzt ist.
2. Plattenwärmetauscher nach Anspruch 1, **dadurch gekennzeichnet, dass** sich die erste Richtung und die zweite Richtung quer zu der Ausdehnungsebene (p) erstrecken.
3. Plattenwärmetauscher nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** in dem fertigen Plattenpaket (3) jede zweite Wärmetauscherplatte (2) um 180° im Verhältnis zu jeder ersten Wärmetauscherplatte (1) gedreht ist.
4. Plattenwärmetauscher nach Anspruch 3, **dadurch gekennzeichnet, dass** sich in dem fertigen Plattenpaket (3) der erste gebogene Teil (21) und der zweite gebogene Teil (22) in der gleichen Richtung erstrecken.
5. Plattenwärmetauscher nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich jede Wärmetauscherplatte (1, 2) entlang einer Längsmittellinie (x) erstreckt, die sich durch den gebogenen Teil (21, 22) erstreckt.
6. Plattenwärmetauscher nach Anspruch 5, **dadurch gekennzeichnet, dass** jede zweite Wärmetauscherplatte (2) in dem Plattenpaket (3) um 180° um die Längsmittellinie (x) der Wärmetauscherplatte gedreht ist.
7. Plattenwärmetauscher nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die ersten und die zweiten Wärmetauscherplatten in dem Plattenpaket dauerhaft miteinander verbunden sind.
8. Plattenwärmetauscher nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jede erste Wärmetauscherplatte (1) die zwei ersten gebogenen Teile (21) umfasst und jede zweite Wärmetauscherplatte (2) zwei zweite gebogene

Teile (22) umfasst.

9. Plattenwärmetauscher nach Anspruch 8, **dadurch gekennzeichnet, dass** die zwei ersten gebogenen Teile (21) einander gegenüberliegend entlang einer jeweiligen Kante der ersten Wärmetauscherplatte (1) bereitgestellt werden und dass die zwei zweiten gebogenen Teile (22) einander gegenüberliegend entlang einer jeweiligen Kante der zweiten Wärmetauscherplatte (2) bereitgestellt werden.
10. Plattenwärmetauscher nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jedes Anschlussloch (8, 9) einen umgebenden Anschlussbereich (10, 11) umfasst, wobei der Anschlussbereich (10) um ein erstes Anschlussloch (8) jeder Wärmetauscherplatte (1, 2) auf einem ersten Niveau (p') in Bezug auf die Ausdehnungsebene (p) angeordnet ist und der Anschlussbereich (11) um ein zweites der Anschlusslöcher (9) jeder Wärmetauscherplatte (1, 2) auf einem zweiten Niveau (p'') in Bezug auf die Ausdehnungsebene (p) angeordnet ist.
11. Plattenwärmetauscher nach Anspruch 10, **dadurch gekennzeichnet, dass** der Anschlussbereich (10) um das erste Anschlussloch (8) eines ersten Paares von Wärmetauscherplatten (1, 2) auf eine solche Weise konfiguriert ist, dass er sich in Eingriff mit dem Anschlussbereich (11) um das zweite Anschlussloch (9) eines angrenzenden zweiten Paares von Wärmetauscherplatten (1, 2) befindet.
12. Plattenwärmetauscher nach Anspruch 11, **dadurch gekennzeichnet, dass** der Anschlussbereich (11) um das zweite Anschlussloch (9) des ersten Paares von Wärmetauscherplatten (1, 2) auf eine solche Weise konfiguriert ist, dass er sich in Eingriff mit dem Anschlussbereich (10) um das erste Anschlussloch (8) des angrenzenden zweiten Paares von Wärmetauscherplatten (1, 2) befindet.

Revendications

1. Échangeur de chaleur à plaques comprenant une pluralité de plaques d'échange de chaleur (1, 2), qui sont chacune orientées parallèlement à un plan principal d'orientation (p) et qui sont prévues côte à côte de manière à former un ensemble de plaques (3) présentant un côté de bord périphérique (4) et des premiers interstices de plaques (5) destinés à un premier fluide et des deuxième interstices de plaques (6) destinés à un deuxième fluide, dans lequel une plaque sur deux est formée par une première plaque d'échange de chaleur (1) et les autres plaques d'échange de chaleur sont formées par une deuxième plaque d'échange de chaleur (2)

de telle manière qu'une telle première plaque d'échange de chaleur (1) associée à une telle deuxième plaque d'échange de chaleur (2) forment une paire de plaques d'échange de chaleur (1, 2) qui renferme un tel premier interstice de plaques (5), et de telle manière que l'ensemble de plaques (3) comprenne une pluralité de telles paires de plaques d'échange de chaleur (1, 2),

dans lequel chacune des plaques d'échange de chaleur présente au moins deux trous de port (8, 9) qui forment des orifices s'étendant à travers l'ensemble de plaques (3) et en communication avec les premiers interstices de plaques (5),

dans lequel les plaques d'échange de chaleur (1, 2) sont configurées de telle manière que les deuxièmes interstices de plaques (6) soient ouverts par le côté de bord périphérique (4), et

dans lequel chacun des trous de port (8, 9) d'une telle première plaque d'échange de chaleur (1) est configuré de telle manière qu'il coopère avec un trou de port (8, 9) opposé d'une telle deuxième plaque d'échange de chaleur (2) afin d'assurer que chaque paire de plaques d'échange de chaleur (1,2) adopte un positionnement précis par rapport aux paires adjacentes de plaques d'échange de chaleur (1,2), **caractérisé en ce que** chacune des telles premières plaques d'échange de chaleur (1) comprend au moins une première partie courbée (21), et chacune des telles deuxièmes plaques d'échange de chaleur (2) comprend au moins une deuxième partie courbée (22), en sachant que, au sein de chaque paire de plaques d'échange de chaleur (1, 2), la première partie courbée (21) est agencée pour coopérer avec la deuxième partie courbée (22) afin d'assurer que les deux plaques d'échange de chaleur (1, 2) de chaque paire prennent un positionnement précis l'une par rapport à l'autre,

en ce que chacune des premières et deuxièmes plaques d'échange de chaleur (1,2) présente un motif moulé par compression comportant un motif d'échange de chaleur présentant des ondulations et un motif de zone d'orifice, ledit motif moulé par compression étant orienté dans un sens de pression eu égard au plan d'orientation (p),

en ce que la première partie courbée (21) est orientée dans un premier sens eu égard au plan d'orientation (p) de la première plaque d'échange de chaleur (1), et

en ce que la deuxième partie courbée (22) est orientée dans un deuxième sens eu égard au plan d'orientation (p) de la deuxième plaque d'échange de chaleur (2), le deuxième sens étant orienté dans le même sens que le sens de pression mais à l'opposé du premier sens

2. Échangeur de chaleur à plaques selon la revendication 1, **caractérisé en ce que** le premier sens et le deuxième sens sont orientés transversalement au

plan d'orientation (p).

3. Échangeur de chaleur à plaques selon l'une quelconque des revendications 1 et 2, **caractérisé en ce que** chacune des deuxièmes plaques d'échange de chaleur (2) présente une rotation de 180° par rapport à chacune des premières plaques d'échange de chaleur (1) de l'ensemble de plaques (3) fini.
4. Échangeur de chaleur à plaques selon la revendication 3, **caractérisé en ce que** la première partie courbée (21) et la deuxième partie courbée (22) sont orientées dans le même sens dans l'ensemble de plaques (3) fini.
5. Échangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque plaque d'échange de chaleur (1, 2) est orientée sur une ligne centrale longitudinale (x) passant par la partie courbée (21, 22).
6. Échangeur de chaleur à plaques selon la revendication 5, **caractérisé en ce que** chacune des deuxièmes plaques d'échange de chaleur (2) de l'ensemble de plaques (3) présente une rotation de 180° autour de la ligne centrale (x) de la plaque d'échange de chaleur.
7. Échangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les premières et deuxièmes plaques d'échange de chaleur sont jointes entre elles de manière permanente dans l'ensemble de plaques.
8. Échangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chacune des premières plaques d'échange de chaleur (1) comprend les deux premières parties courbées (21) et chacune des deuxièmes plaques d'échange de chaleur (2) comprend deux deuxièmes parties courbées (22).
9. Échangeur de chaleur à plaques selon la revendication 8, **caractérisé en ce que** les deux premières parties courbées (21) sont prévues en étant opposées l'une à l'autre sur un bord respectif de la première plaque d'échange de chaleur (1) et **en ce que** les deux deuxièmes parties courbées (22) sont prévues en étant opposées l'une à l'autre sur un bord respectif de la deuxième plaque d'échange de chaleur (2).
10. Échangeur de chaleur à plaques selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque trou de port (8, 9) comprend une zone d'orifice (10, 11) périphérique, la zone d'orifice (10) entourant un premier trou de port (8) de chaque plaque d'échange de chaleur (1, 2) étant

située à un premier niveau (p') eu égard au plan d'orientation (p), et la zone d'orifice (11) entourant un deuxième desdits trous de port (9) de chaque plaque d'échange de chaleur (1, 2) étant située à un deuxième niveau (p'') eu égard au plan d'orientation (p). 5

11. Échangeur de chaleur à plaques selon la revendication 10, **caractérisé en ce que** la zone d'orifice (10) entourant le premier trou de port (8) d'une première paire de plaques d'échange de chaleur (1, 2) est configurée de manière à être en prise avec la zone d'orifice (11) entourant le deuxième trou de port (9) d'une deuxième paire de plaques d'échange de chaleur (1,2) adjacente. 10 15

12. Échangeur de chaleur à plaques selon la revendication 11, **caractérisé en ce que** la zone d'orifice (11) entourant le deuxième trou de port (9) de la première paire de plaques d'échange de chaleur (1, 2) est configurée de manière à être en prise avec la zone d'orifice (10) entourant le premier trou de port (8) de la deuxième paire de plaques d'échange de chaleur (1,2) adjacente. 20 25

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Fig 1

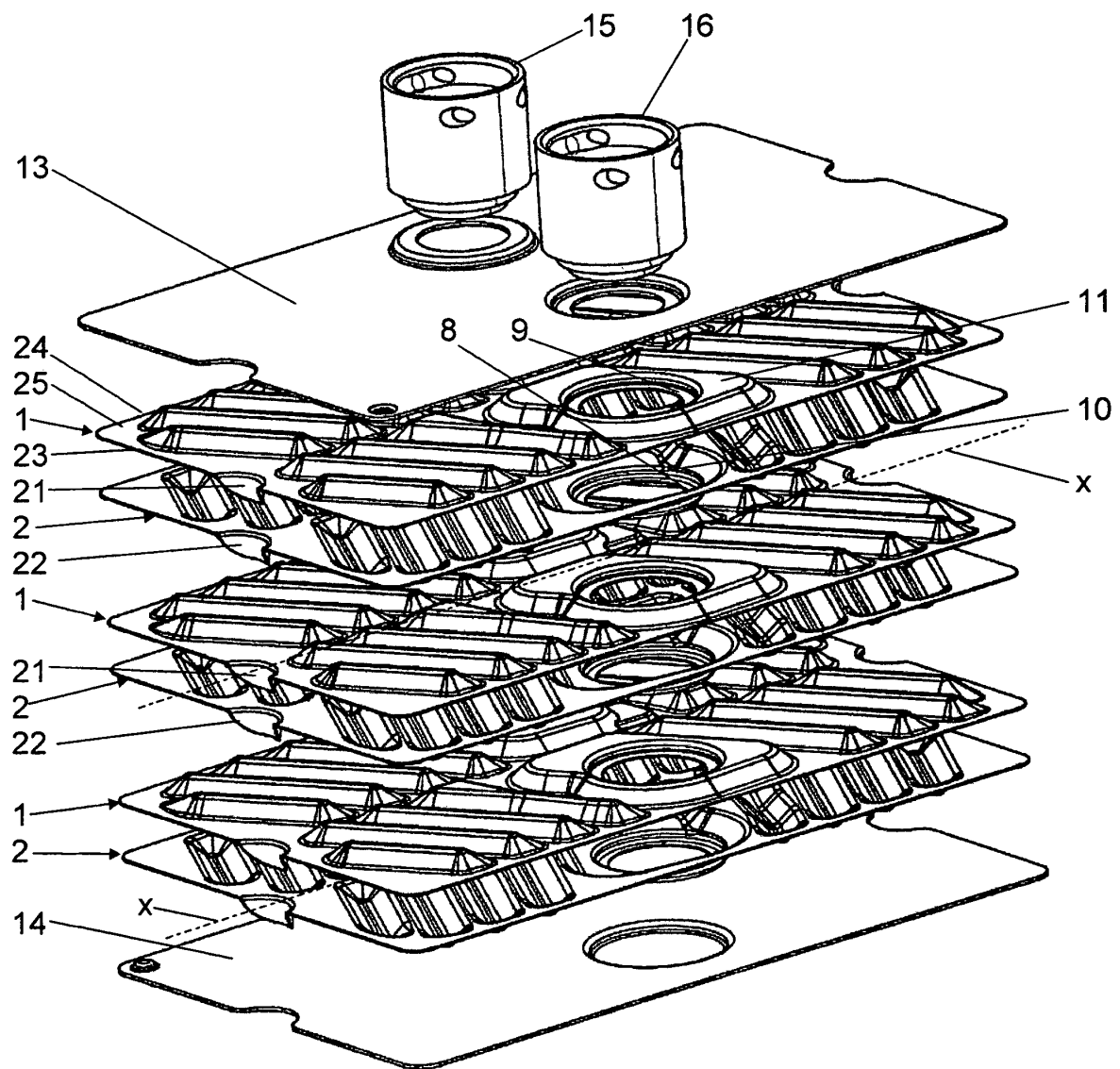


Fig 2

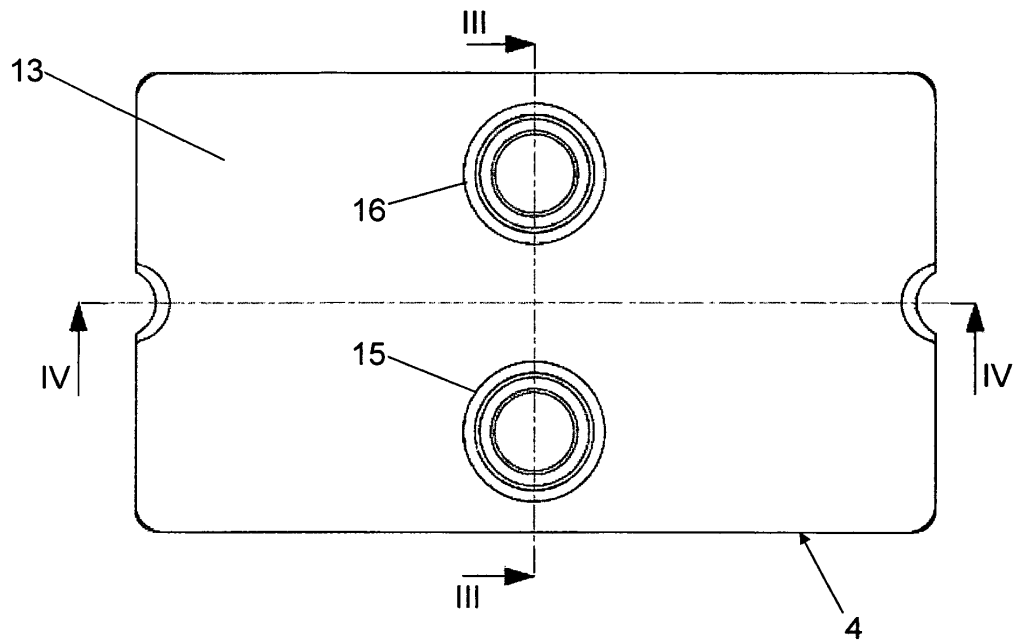
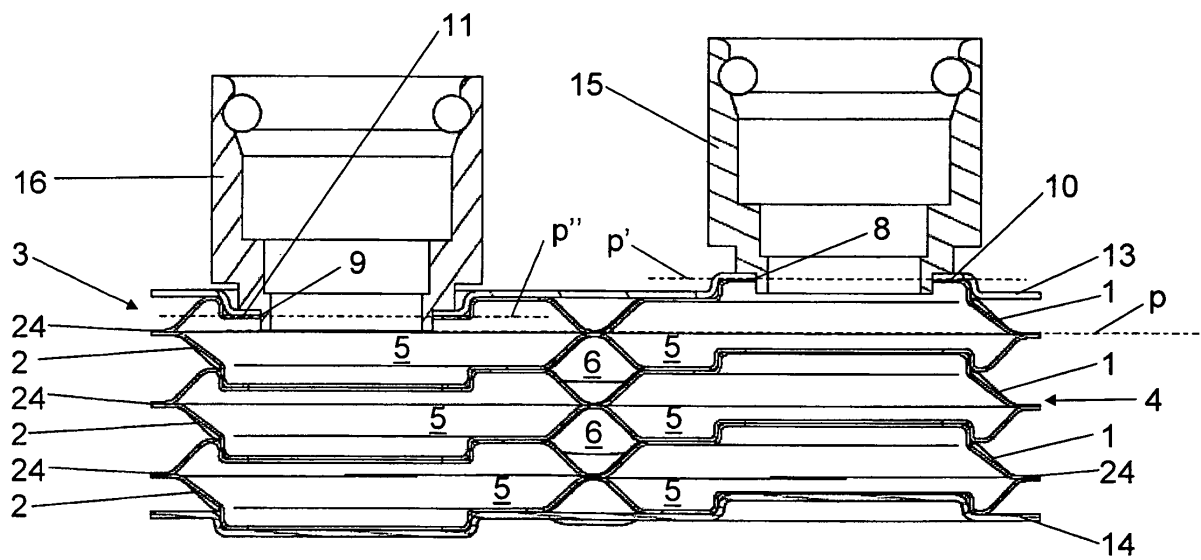


Fig 3



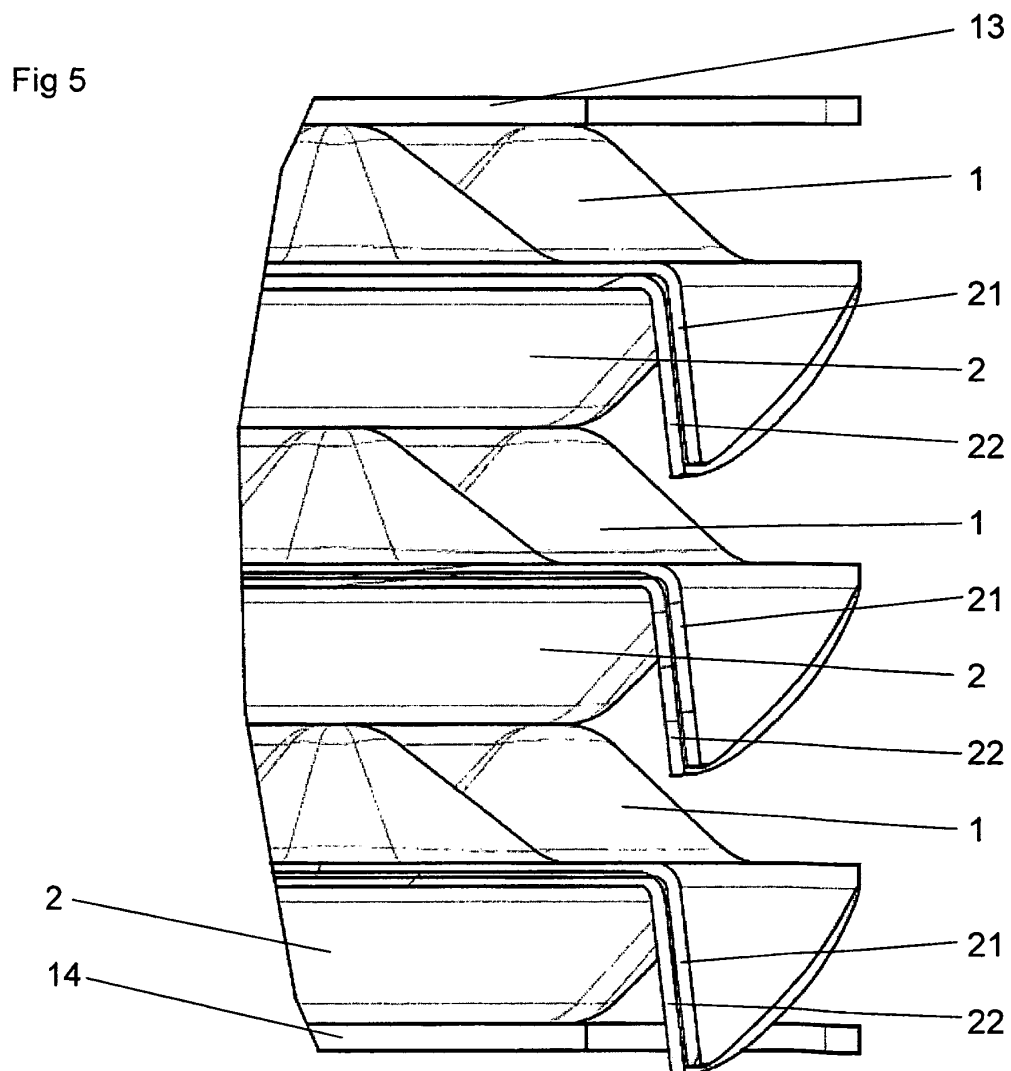
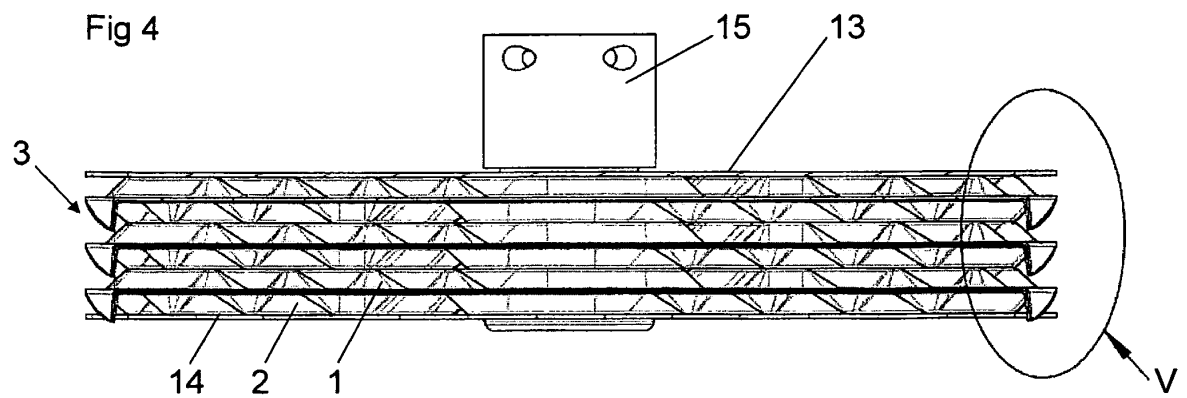
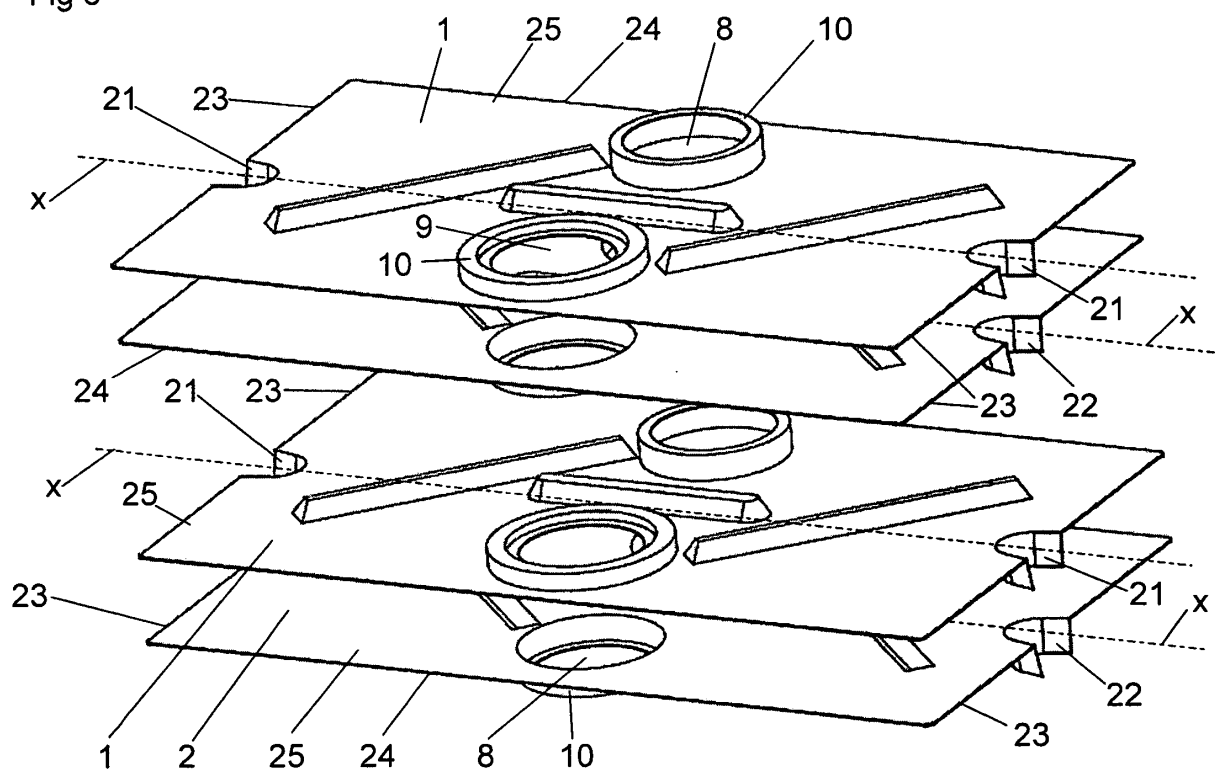


Fig 6



REFERENCES CITED IN THE DESCRIPTION

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