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(54) **A HEAT EXCHANGER PLATE WITH GASKET**

WÄRMETAUSCHERPLATTE MIT DICHTUNG

PLAQUE D'ECHANGEUR DE CHALEUR DOTEES D'UN JOINT

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(56) References cited:
**EP-A- 0 024 195 EP-A- 0 302 802
EP-A- 0 579 208 WO-A-00/77468
WO-A-20/04011868 FR-A- 2 420 114
US-A- 5 597 453 US-A1- 2002 045 046**

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Description

[0001] The present invention relates to a method of manufacturing a heat exchanger plate with a gasket in accordance with the preamble of claim 1.

[0002] Plate heat exchangers are constructed from a number of heat exchanger plates. Most often, a heat exchanger plate has a rectangular configuration and at the corners it is provided with inlet and outlet openings for the heat exchanger media (the heat-emitting medium and the heat-absorbing medium, respectively). The plate is up-stroke pressed in a corrugated pattern and is provided with a gasket that will, when the heat exchanger is assembled, abut against the next plate in the stack. The gasket delimits a flow passage which is in liquid communication with two of the corner openings and therefore allows flow of a first heat exchanger medium on that side of the plate. The two other corner openings of the heat exchanger are blocked by the gasket. Most often, the subsequent heat-exchanger plate in the stack of plates is turned 180° relative to the first one, and therefore a corresponding gasket defines a flow area which is in contact with the two other corner openings at the opposite side of the first plate and allows flow of another heat exchanger medium on that side of the plate. By turning every other heat exchanger plate 180°, a plate heat exchanger is constructed wherein the first heat exchanger medium flows through every other space, while the second heat exchanger medium flows through the remaining spaces. The individual heat exchanger medium is provided with a gasket groove, in which a gasket which is preferably made of rubber can be arranged.

[0003] In order to facilitate assembly of the heat exchanger plate the gasket is secured in the gasket groove, and this can be accomplished in various ways. So far gluing was used to secure the gasket in the gasket groove, but development has taken the course of using mechanical attachment instead to secure the gasket in the gasket groove, co-operating coupling means being provided on the heat exchanger plate and the gasket, respectively.

[0004] The used gaskets are often manufactured from rubber with a profile and a dimension that suits the type of heat exchanger plate for which it is to be used. Moreover, it is most often necessary to manufacture the individual type of rubber gasket with various configurations that possess properties that are particularly suitable for the specific purpose for which the finished plate heat exchanger is to be used. It is hence perceivable that the individual type of gasket is to be manufactured to possess properties that enable them to tolerate eg influences from acids/bases or to tolerate high temperatures. Therefore it is necessary to have a comparatively large number of gasket types in stock.

[0005] WO 00/77468 A1 teaches a heat exchanger plate with a gasket, wherein the heat exchanger plate comprises a gasket groove in the form of an indentation, a part of which runs essentially in parallel with the pe-

ripheral edge of the heat exchanger plate. At intervals, the gasket groove is provided with an expanded section configured for receiving a coupling element on the associated gasket. The expanded section comprises a cam-like protrusion configured for engaging with the coupling element on the gasket, whereby the gasket is secured to the heat-exchanger plate.

[0006] When the gasket is to be mounted in the gasket groove on the heat-exchanger plate - irrespective of whether it is mounted by conventional positioning with gluing or by gasket and heat exchanger plate being interconnected mechanically as known from the above-referenced patent application - it is accomplished by each individual gasket being arranged and secured manually in the plate heat exchanger. In connection with small heat exchanger plates this task can be performed by one single person, but in case large heat exchanger plates are concerned it is most often necessary that two persons share the task, one the one hand to be able to handle the large heat exchanger plates, on the other to accomplish more rationalised work procedures.

[0007] Handling of the heat exchanger plates in connection with the arrangement of the gasket in the gasket groove and the subsequent attachment therein is a disproportionately resource-intensive part of the overall work involved in the manufacture of a heat exchanger plate with a gasket for use in a plate heat exchanger. It is therefore the object of the invention to provide a heat exchanger plate with a gasket, wherein the handling in connection with the arrangement of the gasket in the gasket groove can be reduced.

[0008] This is accomplished in accordance with the invention by the method as featured in the characterising part of claim 1.

[0009] Hereby a method is accomplished of manufacturing a heat exchanger plate with a gasket, wherein the manual part of the handling in connection with the positioning of the gasket in the gasket groove is eliminated. This is enabled by the gasket being dispensed directly into the gasket groove on the heat exchanger plate, whereby the handling that would otherwise be required in connection with the manufacture of a gasket and the subsequent handling and positioning in the gasket groove is obviated.

[0010] By dispensing a gasket that corresponds essentially to the gasket groove or corresponds fully to the gasket groove, it has surprisingly been found that a particularly stable shape is imparted to the gasket. In particular, it is accomplished that the top profile of the gasket (ie the part of the gasket profile that extends above the gasket groove) is configured with a profile having an even course that does not significantly change its shape over the expanse of the gasket following dispensing. This is provided in that the sub-profile essentially corresponds to/fills the gasket groove; and that further flowing of the dispensed gasket material within the gasket groove is avoided. Simultaneously a support of the gasket material against the gasket groove is established which will coun-

teract that the top profile collapses/flows out and hence entails that the dispensed gasket material collapses and in particular that the top profile collapses and hence alters the course of the gasket face.

[0011] Precisely by the top profile of the gasket being provided with an even course, a gasket face is provided that will, when the heat exchanger plate with the dispensed gasket is assembled to a plate heat exchanger, ensure an even gasket pressure between the gasket face in the top profile and a subsequent heat exchanger plate throughout the entire gasket face. This is particularly advantageous to ensure that the gaskets keep up their sealing effect also following protracted use.

[0012] It will be understood that in cases where the dispensed gasket material collapses in a delimited area (ie a local depression) of the gasket groove, it will entail a change in gasket pressure between gasket and heat exchanger plate in the overall plate heat exchanger. Such change in gasket pressure will most often mean that the heat exchanger plate with the dispensed gasket is able to tolerate only a smaller super-atmospheric pressure in the medium travelling through the assembled plate heat exchanger and it may in particular cases give rise to leak formation in that delimited area.

[0013] Moreover the method enables that it is not necessary to produce separate moulds for manufacturing the gaskets. Such production is costly since, of course, it must be ensured that the gasket is configured with a profile that matches the gasket groove in the heat exchanger plate it is to be mounted in.

[0014] Moreover, the method is advantageous in that, in connection with a renovation of a plate heat exchanger manufactured for a specific use, it is no longer necessary to see to it that the gaskets that can be used for the particular use are in stock before the renovation task can be initiated. Use of the method according to the invention enables such renovation task to be initiated at short notice and while having to take into account exclusively that the raw materials to be used in the gasket substance are in stock.

[0015] The method further comprises dispensing of the fluid gasket material in an expanded section of the gasket groove, whereby the gasket substance will also essentially enshroud a part of a tongue-like projection or a part of one or more tongue-like projections, and inasmuch as a part is concerned it will also flow into two openings that were up-stroke pressed centrally in the expanded section, since hereby two openings are formed between the sides of the tongue-shaped projections and the expanded section of the gasket groove. Hereby a method is provided which is particularly advantageous in those cases where heat exchanger plates with gaskets are provided that are to be secured with mechanical means in an expanded part of the gasket groove.

[0016] According to a preferred embodiment of the invention, the fluid gasket material is dispensed into the gasket groove by means of a dispenser nozzle, and the heat exchanger plate is moved relative to the dispenser

nozzle in such a manner that the gasket groove essentially follows the dispenser nozzle. Hereby an advantageous method of dispensing the gasket substance is accomplished.

[0017] According to a further preferred embodiment of the invention, the fluid gasket substance is dispensed in the gasket groove by means of a dispenser nozzle, and the dispenser nozzle is moved in relation to the heat exchanger plate in such a manner as to effect that the dispenser nozzle essentially follows the gasket groove. Hereby a further advantageous method of dispensing the gasket substance is accomplished.

[0018] According to a further preferred embodiment of the invention, the gasket groove comprises an indentation in the heat exchanger plate. Hereby a well-defined gasket groove is accomplished which is particularly suitable for gasket substance to be dispensed therein.

[0019] According to a further preferred embodiment of the invention the stabilisation of the fluid gasket material for gasket with a stable elastic shape comprises vulcanisation. Hereby a particularly effective stabilisation process of the gasket substance is accomplished.

[0020] According to yet a further preferred embodiment of the invention, the vulcanisation takes place either by heating or by use of ultra-violet light. Hereby two particularly advantageous methods of vulcanising the gasket substance for a gasket with a stable elastic shape are provided.

[0021] According to yet a further preferred embodiment of the invention, the stabilisation of the fluid gasket material for a gasket with a stable shape comprises a curing. Hereby a further particularly advantageous method of curing the gasket substance to a gasket with a stable elastic shape is provided.

[0022] According to yet a further preferred embodiment of the invention, the fluid gasket material is dispensed by means of a dispenser nozzle with a nozzle profile comprising a sub-profile corresponding essentially to the gasket groove. Hereby a particularly advantageous method is provided, by which a particularly advantageous embodiment of the gasket is accomplished.

[0023] The invention will now be explained in further detail with reference to the drawings wherein

Figure 1 shows a heat exchanger plate with a gasket according to the invention; and

Figure 2 shows a step in the method, wherein gasket substance is dispensed into the gasket groove of the heat exchanger plate by use of a coordinate table; and

Figure 3 shows a step in the method, wherein gasket substance is dispensed into the gasket groove of the heat exchanger plate by use of an industrial robot; and

Figure 4 shows a further step in the method, wherein

the heat exchanger plate with the dispensed gasket travels through a device having means for curing/vulcanising the gasket; and

Figures 5A, 5B, 5C, and 5D show four different examples of an expanded section of the gasket groove with which it is advantageous to configure the gasket groove in particular contexts; and

Figures 6A, 6B and 6C show three different embodiments of a gasket profile that are used particularly advantageously for dispensing into a heat exchanger plate.

[0024] Figure 1 shows a heat exchanger plate 1 with a dispensed gasket according to the invention. The heat exchanger plate 1 has a rectangular configuration and comprises corner openings 2A, 2B intended for heat exchanger media. The heat exchanger plate 1 is provided with a gasket groove 3 configured as an indentation extending, at least across a portion of the heat exchanger plate 1, along the peripheral edge 6 of the heat exchanger plate 1. The gasket groove 3 is configured for receiving a gasket substance. In a stabilised shape the gasket substance constitutes a gasket 4A that delimits a flow passage 5 for a first heat exchanger medium, said heat exchanger medium being in communication with two of the corner openings 2A. The remaining two corner openings 2B are blocked by the gasket 4B and are thus not in fluid communication with the first heat exchanger medium. The two remaining corner openings 2B connect other flow passages (not shown) that are configured in a subsequent corresponding heat exchanger plate 1 with a gasket 4A, 4B. Preferably, the heat exchanger plate 1 is configured with a corrugated surface, as shown, as - on the one hand - the heat transmission across the heat exchanger plate 1 is hereby enhanced and - on the other - it imparts increased rigidity to the heat exchanger plate 1. The corrugations and the gasket groove 3 are produced by up-stroke pressing in a pressing tool. When a plate heat exchanger is assembled the heat exchanger plates can be turned to be offset 180° relative to each other, whereby the flow passage for each heat exchanger medium extends between corner openings in each their side of the heat exchanger plates 1.

[0025] In Figure 1 the gasket groove 3 is shown with a configuration comprising an indentation in the heat exchanger plate 1 and extending, at least across a portion of the heat exchanger plate 1, close to the peripheral edge 6 of the heat exchanger plate. The gasket groove 3 may furthermore comprise edges that extend at the peripheral edge 6 and/or at another edge 8 that delimits the gasket groove 3 towards the flow passage. Those edges 6,8 will most often be formed during the pressing of the heat exchanger plate 1. A person skilled in the art will thus be able to point to various embodiments of the gasket groove which it is possible to configure to enable the gasket 4 to receive and transmit a force to the gasket

groove 3 that originates from a pressurised heat exchanger medium travelling through the flow passages 5 in the heat exchanger plate 1.

[0026] In the above, the heat exchanger plate 1 with gasket 4 was described as a heat exchanger plate 1 manufactured from one metal plate. However, according to the idea behind the invention, a heat exchanger plate may also be manufactured from two or more metal plates that are fixedly secured to each other. Alternatively the heat exchanger plate 1 can be manufactured from metal plates that are stacked loosely in relation to each other and advantageously, the metal plates can be stacked with a plate of a different material being interposed between the metal plates.

[0027] Figures 2 through 4 explain a method of manufacturing a heat exchanger plate with a gasket according to the invention. The method comprises the following steps:

A rectangular plate with a configuration corresponding essentially to the configuration of the finished heat exchanger plate 1 is arranged in a pressing tool, where a profile is imparted to the plate that comprises corrugations, a gasket groove 3 and two corner openings 2A, 2B. The heat exchanger plate 1 is ejected from the pressing tool and any sharp edges are chamfered off. Oil/lubricants are subsequently cleaned away from the heat exchanger plate.

[0028] The cleaned heat exchanger plate 1 is arranged as shown in Figure 2 in a coordinate table 20 such that the gasket groove 3 in the heat exchanger plate 1 is available for dispensing of the gasket substance.

[0029] A dispenser device 22 with a dispenser nozzle 23 is taken to a pre-defined point in the gasket groove 3. The gasket substance is dispensed through the dispenser nozzle 23 into the gasket groove 3 in a pre-determined pattern in that the coordinate table 20 is moved in an x-y plane relative to the dispenser nozzle 23.

[0030] As an alternative to dispensing the gasket 4 by use of a coordinate table 20 the dispensing of the gasket substance may be accomplished by use of an industrial robot 30, as will appear from Figure 3. This will be discussed in further detail below.

[0031] The cleaned heat exchanger plate 1 is arranged as shown in Figure 3 in an auxiliary tool 30 such that the gasket groove 3 in the heat exchanger plate 1 is available for dispensing of the gasket substance. The auxiliary tool 30 is configured with means for securing the heat exchanger plate 1 relative to an industrial robot (not shown) by means of a dispenser device 32 that comprises a dispenser nozzle 33.

[0032] The dispenser device 32 with the dispenser nozzle 33 is conveyed along with the industrial robot to a predefined point above the gasket groove 3. The gasket groove is then dispensed through the dispenser nozzle 33 into the gasket groove 3 in a predefined pattern in that the dispenser device 32 with the dispenser nozzle 33 is

moved in an x-y plane relative to the gasket groove 3 in the heat exchanger plate 1.

[0033] The industrial robot comprises means by which the dispenser device 32 can be controlled in an x-y-z plane relative to the heat exchanger plate 1. Hereby it is enabled that the dispenser device 32 can be moved in a controlled manner in relation to a heat exchanger plate 1 arranged in the auxiliary tool 30 to the effect that the dispenser nozzle 33 dispenses the gasket substance into the gasket groove 3 when the dispenser nozzle 33 is moved in the x-y plane relative to the heat exchanger plate 1. The industrial robot further comprises means for moving the dispenser device 32 in the z-direction which is perpendicular to the x-y plane.

[0034] Advantageously the dispensing procedure can be performed in a predefined movement around the gasket groove 3. The gasket substance 4 is dispensed in such a manner that the fewest possible dispensing boundaries are provided around the gasket groove 3. Therefore the dispensing is advantageously performed in that at first string of gasket substance 4A is dispensed in that part of the gasket groove 3 that delimits a first flow passage 5. A second string of gasket substance 4B is dispensed around each of the two remaining corner openings 2B that connect other flow passages (not shown) and are configured in a subsequent, corresponding heat exchanger plate 1. A third string of gasket substance 4C is dispensed in the gasket groove 3 and fills it between the two remaining strings of gasket substance 4A, 4B. Dispensing of the gasket substance 4 in that pattern provides a very particular gasket that comprises weak zones in advantageous places. Thus, a leak in eg that part of the gasket that encloses corner openings 2B will be able to more easily break through the weakened string 4C at the gasket boundaries. Thus the leak will travel to the outside of the heat exchanger where it is detectable.

[0035] Figure 4 shows a process step in a method where the dispensed gasket substance is stabilised to a form-stable gasket. The heat exchanger plate 1 with the dispensed gasket substance is arranged on a conveyor belt 40 with rotatably configured conveyor rolls 41 at an inlet side 43 and transported into a furnace 42 in which the heat exchanger plate 1 with the dispensed gasket substance is stabilised by vulcanisation to a form-stable gasket

[0036] The heat exchanger plate 1 with the dispensed gasket substance is ensured a dwelling time in the furnace which is sufficient for the gasket substance to acquire the desired stabilisation. Preferably, the dwelling time will range between one and 120 minutes depending on which type of stabiliser means (eg heat or UV-radiation) is used. Then the heat exchanger plate with the now form-stable gasket 4 is discharged from the furnace to a discharge side 44, where - following cooling, if any - it can be used directly for manufacture of a plate heat exchanger.

[0037] The furnace 42 can be configured with means

for conventional heating of the objects conveyed through the furnace, or it may comprise means that use ultraviolet light (UV radiation) for vulcanisation of the objects.

[0038] Preferably the gasket 4 will be manufactured from a gasket substance, wherein the subsequent stabilisation process comprises vulcanisation of the gasket substance. However, the gasket 4 could also be manufactured from a gasket substance that sets following dispensing to form a form-stable gasket 4.

[0039] However, a person skilled in the art will be able to point to various types of gasket substances and stabilisation processes that would be advantageous for use in the manufacture of a heat exchanger plate 1 with a dispensed gasket 4.

[0040] In particular cases, the heat exchanger plate 1 can be configured with a gasket groove 3 that comprises mechanical means for securing the gasket 4 as will appear from figures 5A, 5B. In those cases the gasket groove 3 is thus configured with spaced-apart extended portions 51 that comprise means configured for engaging a coupling element on the associated gasket 4.

[0041] As shown in Figure 5A the expanded section 51 comprises a tongue-like projection 53 with at least one opening 52 essentially perpendicular to the lengthwise direction of the gasket groove. The at least one opening 52 is produced by cutting and up-stroke pressing of plate material relative to the gasket groove 3 without removal of material.

[0042] Figure 5B shows a further advantageous embodiment, in which the expanded section 51 comprises two identical tongue-like projections 53 having at least one opening 52 essentially perpendicular to the lengthwise direction of the gasket groove at each tongue-like projection 53. The tongue-like projections 53 are configured interspaced centrally in the expanded section 51. The openings 52 are produced by cutting and up-stroke pressing of plate material relative to the gasket groove 3 without removal of material.

[0043] The coupling element on the gasket is dispensed in the expanded part of the gasket groove 3 whereby the gasket substance will essentially enclose a part of the tongue-like protrusion(s) 53 and inasmuch as a part thereof is concerned it will also flow into the openings 52. Hereby the gasket 4 is configured with at least two projecting tongues that correspond essentially to the configuration of the gasket groove 3 and the expanded portion 51, including the openings 52. During dispensing the tongues are configured such that the parts that face towards each other are able to snap into/out of the openings 52 in the heat exchanger plate 1.

[0044] The dispensing in the expanded section 51 can advantageously be performed in the same process step as the dispensing of the remaining part of the gasket 4.

[0045] The method of manufacturing a heat exchanger plate 1 with a gasket 4 also lends itself for use for particular types of heat exchanger plates 1. This type of heat exchanger plate 1 comprises a packaging groove 3 which, at least across a portion of the heat exchanger

plate 1, extends close to the peripheral edge 6 of the heat exchanger plate, wherein said gasket groove 3 comprises an expanded section 51, and wherein said expanded section 51 of the gasket groove 3 comprises at least one opening 52 essentially perpendicular to the lengthwise direction of the gasket groove, which opening 52 is produced by cutting and up-stroke pressing of plate material relative to the gasket groove 3 without removal of material.

[0046] Two tongue-like parts 53 are pressed up centrally in the expanded portion 51 at a distance from each other since hereby two openings 52 are formed between the sides of the tongue-shaped part and the expanded part 51 of the gasket groove 3. At the ends of the expanded part 7 plate material is up-stroke pressed to form two openings 52; one at each end of the expanded part 52.

[0047] Thus the method is characterised in comprising the following steps:

- dispensing of a fluid gasket material in the gasket groove 3 of the heat exchanger plate, said material essentially corresponding to the gasket groove 3;
- dispensing of the fluid gasket material in the expanded section 51 of the gasket groove 3, whereby the gasket substance will essentially enclose a part of a tongue-like projection 53 and, at least inasmuch as a part thereof is concerned, it also flows into two openings 52 that are up-stroke pressed into the expanded section 51;
- stabilisation of the fluid gasket material for a gasket 4 having a stable, elastic shape.

[0048] Figures 5C and 5D show two other advantageous examples of an expanded section 51, wherein the expanded section 51 comprises one opening 62 or at least one opening 62 in the gasket groove 3. The opening 62 is produced by cutting of plate material in the expanded portion of the gasket groove 3, whereby material is removed.

[0049] As shown in Figure 5C, an expanded section 51 comprises an opening 62 configured at the bottom of the gasket groove 3. The coupling element on the gasket is dispensed into the expanded section of the gasket groove 3, whereby the gasket substance will essentially flow into the opening 62, and in particular cases will extend through the opening 62 and form a bead-like portion on the bottom face 63 of the heat exchanger plate 1 opposite the gasket groove 3. By the dispensing, the bead-like portion is configured such that the portion extending through the opening 62 is able to snap into/snap out of the aperture 62 in the heat exchanger plate 1.

[0050] In Figure 5D an expanded section 51 is shown with an aperture 62 configured in an edge 63 that extends along the peripheral edge 6 of the heat exchanger plate 1. The coupling element on the gasket is dispensed in the expanded section of the gasket groove 3, whereby the gasket substance will be caused to flow essentially

into the opening 62 and will extend through the opening 62 and form a bead-like part on the outer face 64 of the heat exchanger plate 1 opposite the gasket groove 3. By the dispensing the bead-like portion is configured such that the part extending through the aperture 62 is able to snap into/snap out of the opening 62 in the heat exchanger plate 1.

[0051] The dispensing in the expanded section 51 can advantageously be performed in the same process step as the dispensing of the remaining part of the gasket 4.

[0052] A method of manufacturing a heat exchanger plate 1 with a gasket 4 also lends itself for use for particular types of heat exchanger plates 1 that comprise an expanded portion 51 as shown in figures 5C and 5D. This type of heat exchanger plate 1 comprises a gasket groove 3 which, at least across a portion of the heat exchanger plate 1, extends in proximity of the peripheral edge 6 of the heat exchanger plate 1, said gasket groove 3 comprising an expanded section 51, and wherein said expanded section 51 of the gasket groove 3 comprises at least one opening 62, which opening 62 is produced by cutting of plate material in the expanded section of the gasket groove 3 by removal of material.

[0053] This method is thus characterised in comprising the following steps:

- dispensing of a fluid gasket material in the gasket groove 3 of the heat exchanger plate so as to essentially correspond to the gasket groove 3;
- dispensing of the fluid gasket material in the expanded section 51 of the gasket groove 3, whereby the gasket substance will flow essentially into the opening 62 produced by cutting of plate material in the expanded section 51;
- stabilisation of the fluid gasket material to a gasket 4 having a stable elastic shape.

[0054] It will be understood that a person skilled in the art will be able to point to advantageous examples of the openings 62 shown in figures 5C and 5D, and likewise more than one opening 62 may be produced, eg two or more.

[0055] In figures 6A, 6B and 6C three different embodiments are shown of a gasket profile which is particularly advantageously used for being dispensed into a heat exchanger plate.

[0056] Gasket profiles 6A, 6B and 6C are formed by a fluid gasket material being dispensed into the gasket groove 3 by means of a dispensing nozzle 23, 33 having a nozzle profile comprising a top profile 61 A, 61 B, 61C and a sub-profile 62A, 62B, 62C. The sub-profile 62A, 62B, 62C can be configured to correspond essentially to the gasket groove 3. The top profile 61 A, 61 B, 61C is made with a configuration that depends on the concrete demands made as to pressurisation of the finished plate heat exchanger. Thus, the top profile can advantageously be configured with concave side faces 63A that lead to a top face 64 as shown in Figure 6A. Figure 6B shows

a further advantageous embodiment of the top profile 61 B configured with concave side faces 63B that lead to a top edge 65. According to an alternative further advantageous embodiment shown in Figure 6C the top profile 61C is configured with a convex face 66.

[0057] It applies to the dispenser device 22, 32 that it comprises means for controlling the dispensing (the throughput volume) of the gasket substance through the dispenser nozzle.

[0058] It will be understood that the fluid gasket material will be a gasket material having a relatively high viscosity and preferably the gasket material will be a colloid solution, a colloid or a gel.

Claims

1. A method of manufacturing a heat exchanger plate (1) with a gasket (4), said heat exchanger plate (1) comprising a gasket groove (3) extending, at across a portion of the heat exchanger plate (1), in proximity of the peripheral edge (6) of the heat exchanger plate, the gasket groove (3) being configured with an expanded section (51), comprising at least one tongue-like projection (53) with two openings (52) produced by cutting and up-stroke pressing of plate material relative to the gasket groove (3) without removal of material, **characterised in that** the method comprises in the following order the steps of:

- dispensing of a fluid gasket material in the gasket groove (3) of the heat exchanger plate to correspond essentially to the gasket groove (3), comprising dispensing the fluid gasket material into the expanded section (51) of the gasket groove (3), whereby the gasket substance will essentially enclose a part of the at least one tongue-like projection (53) and, moreover flow into the two openings (52)
- stabilising the fluid gasket material to a gasket (4) having a stable elastic shape.

2. A method according to claim 1, **characterised in that** the fluid gasket material is dispensed into the gasket groove (3) by means of a dispenser nozzle (10); and that the heat exchanger plate (1) is moved in relation to the dispenser nozzle (10) in such a manner that the gasket groove (3) essentially follows the dispenser nozzle (10).
3. A method according to claim 1, **characterised in that** the fluid gasket material is dispensed into the gasket groove (3) by means of a dispenser nozzle (10); and that the dispenser nozzle (10) is moved in relation to the heat exchanger plate (1) in such a manner that the dispenser nozzle (10) essentially follows the gasket groove (3).

4. A method according to any one of claims 1 - 3, **characterised in that** the gasket groove comprises an indentation in the heat exchanger plate.
5. A method according to any one of claims 1 - 4, **characterised in that** the stabilisation of the fluid gasket material for gasket (4) with a stable elastic shape comprises a vulcanisation.
6. A method according to claim 5, **characterised in that** the vulcanisation is accomplished by heating.
7. A method according to claim 5, **characterised in that** the vulcanisation is accomplished by use of ultraviolet light.
8. A method according to any one of claims 1 - 4, **characterised in that** the stabilisation of the fluid gasket material to a gasket (4) with a stable elastic shape comprises a curing.
9. A method according to any one of the preceding claims, **characterised in that** the fluid gasket material is dispensed by means of a dispenser nozzle (23, 33) having a nozzle profile corresponding to a sub-profile (62A, 62B, 62C) corresponding essentially to the gasket groove (3).
10. A heat exchanger plate (1) with a gasket (3), **characterised in that** it is manufactured by a method according to any one of claims 1-9.

Patentansprüche

1. Verfahren zum Herstellen einer Wärmetauscherplatte (1) mit einer Dichtung (4), wobei die Wärmetauscherplatte (1) eine Dichtungsgrille (3) umfasst, die sich über einen Abschnitt der Wärmetauscherplatte (1) in der Nähe eines Umfangsrandes (6) der Wärmetauscherplatte erstreckt, wobei die Dichtungsgrille (3) mit einem erweiterten Abschnitt (51) ausgebildet ist, der zumindest einen zungenartigen Vorsprung (53) mit zwei Öffnungen (52) aufweist, die durch Schneiden und Unterdruckpressen von Plattenmaterial relativ zu der Dichtungsgrille (3) ohne Entfernen von Material hergestellt sind, **dadurch gekennzeichnet, dass** das Verfahren die folgenden Schritte in der folgenden Reihenfolge umfasst:
 - Ausgeben eines fluiden Dichtungsmaterials in die Dichtungsgrille (3) der Wärmetauscherplatte, um im Wesentlichen der Dichtungsgrille (3) zu entsprechen, umfassend das Ausgeben des fluiden Dichtungsmate-

- rials in den erweiterten Abschnitt (51) der Dichtungsrille (3), wodurch die Dichtungssubstanz im Wesentlichen einen Teil von dem zumindest einen zungenartigen Vorsprung (53) einschließen wird und überdies in die beiden Öffnungen (52) fließen wird;
- Stabilisieren des fluiden Dichtungsmaterials zu einer Dichtung (4) mit einer stabilen elastischen Form.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das fluide Dichtungsmaterial in die Dichtungsrille (3) mittels einer Ausgabelüse (10) ausgegeben wird; und dass die Wärmetauscherplatte (1) relativ zu der Ausgabelüse (10) auf eine derartige Weise bewegt wird, dass die Dichtungsrille (3) im Wesentlichen der Ausgabelüse (10) folgt.
 3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das fluide Dichtungsmaterial in die Dichtungsrille (3) mittels einer Ausgabelüse (10) ausgegeben wird, und dass die Ausgabelüse (10) relativ zu der Wärmetauscherplatte (1) auf eine derartige Weise bewegt wird, dass die Ausgabelüse (10) im Wesentlichen der Dichtungsrille (3) folgt.
 4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Dichtungsrille eine Vertiefung in der Wärmetauscherplatte umfasst.
 5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Stabilisieren des fluiden Dichtungsmaterials zur Dichtung (4) mit einer stabilen elastischen Form eine Vulkanisation umfasst.
 6. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** die Vulkanisation durch Erwärmen erreicht wird.
 7. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** die Vulkanisation durch Verwenden von ultraviolettem Licht erreicht wird.
 8. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Stabilisieren des fluiden Dichtungsmaterials zu einer Dichtung (4) mit einer stabilen elastischen Form ein Aushärten umfasst.
 9. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das fluide Dichtungsmaterial mittels einer Ausgabelüse (23, 33) ausgegeben wird, die ein Düsenprofil umfasst, das einem Unterprofil (62A, 62B, 62C) entspricht, das im Wesentlichen der Dichtungsrille (3) entspricht.

10. Wärmetauscherplatte mit einer Dichtung (3), **dadurch gekennzeichnet, dass** sie durch ein Verfahren gemäß einem der Ansprüche 1 bis 9 hergestellt ist.

Revendications

1. Procédé pour fabriquer une plaque d'échangeur de chaleur (1) avec un joint (4), ladite plaque d'échangeur de chaleur (1) comprenant une gorge à joint (3) qui s'étend, en travers d'une portion de la plaque d'échangeur de chaleur (1), à proximité de la bordure périphérique (6) de la plaque d'échangeur de chaleur, la gorge à joint (3) étant configurée avec un tronçon élargi (51), comprenant au moins une projection (53) semblable à une languette avec deux ouvertures (52) produites en découpant et en pressant vers le haut le matériau de la plaque par rapport à la gorge à joint (3) sans enlèvement de matériau, **caractérisé en ce que** le procédé comprend les étapes consistant à, dans l'ordre suivant :
 - distribuer un matériau de joint fluide dans la gorge à joint (3) de la plaque d'échangeur de chaleur pour correspondre essentiellement à la gorge à joint (3), comprenant de distribuer le matériau de joint fluide dans le tronçon élargi (51) de la gorge à joint (3), de sorte que la substance de joint va essentiellement enfermer une partie de ladite au moins une projection (53) semblable à une languette et va en outre s'écouler dans les deux ouvertures (52) ;
 - stabiliser le matériau de joint fluide pour donner un joint (4) ayant une forme élastique stable.
2. Procédé selon la revendication 1, **caractérisé en ce que** le matériau de joint fluide est distribué dans la gorge à joint (3) au moyen d'une buse de distribution (10) ; et **en ce que** la plaque d'échangeur de chaleur (1) est déplacée en relation avec la buse de distribution (10) d'une manière telle que la gorge à joint (3) suit essentiellement la buse de distribution (10).
3. Procédé selon la revendication 1, **caractérisé en ce que** le matériau de joint fluide est distribué dans la gorge à joint (3) au moyen d'une buse de distribution (10) ; et **en ce que** la buse de distribution (10) est déplacée en relation avec la plaque d'échangeur de chaleur (1) d'une manière telle que la buse de distribution (10) suit essentiellement la gorge à joint (3).
4. Procédé selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** la gorge à joint comprend un cran dans la plaque d'échangeur de chaleur.

5. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** la stabilisation du matériau de joint fluide pour donner un joint (4) avec une forme élastique stable comprend une vulcanisation. 5
6. Procédé selon la revendication 5, **caractérisé en ce que** la vulcanisation est accomplie par chauffage.
7. Procédé selon la revendication 5, **caractérisé en ce que** la vulcanisation est accomplie en utilisant de la lumière ultraviolette. 10
8. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** la stabilisation du matériau de joint fluide pour donner un joint (4) avec une forme élastique stable comprend un durcissage. 15
9. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le matériau de joint fluide est distribué au moyen d'une buse de distribution (23, 33) ayant un profil de buse correspondant à un sous-profil (62A, 62B, 62C) correspondant essentiellement à la gorge à joint (3). 20
10. Plaque d'échangeur de chaleur (1) avec un joint (3), **caractérisée en ce qu'**elle est fabriquée par un procédé selon l'une quelconque des revendications 1 à 9. 25

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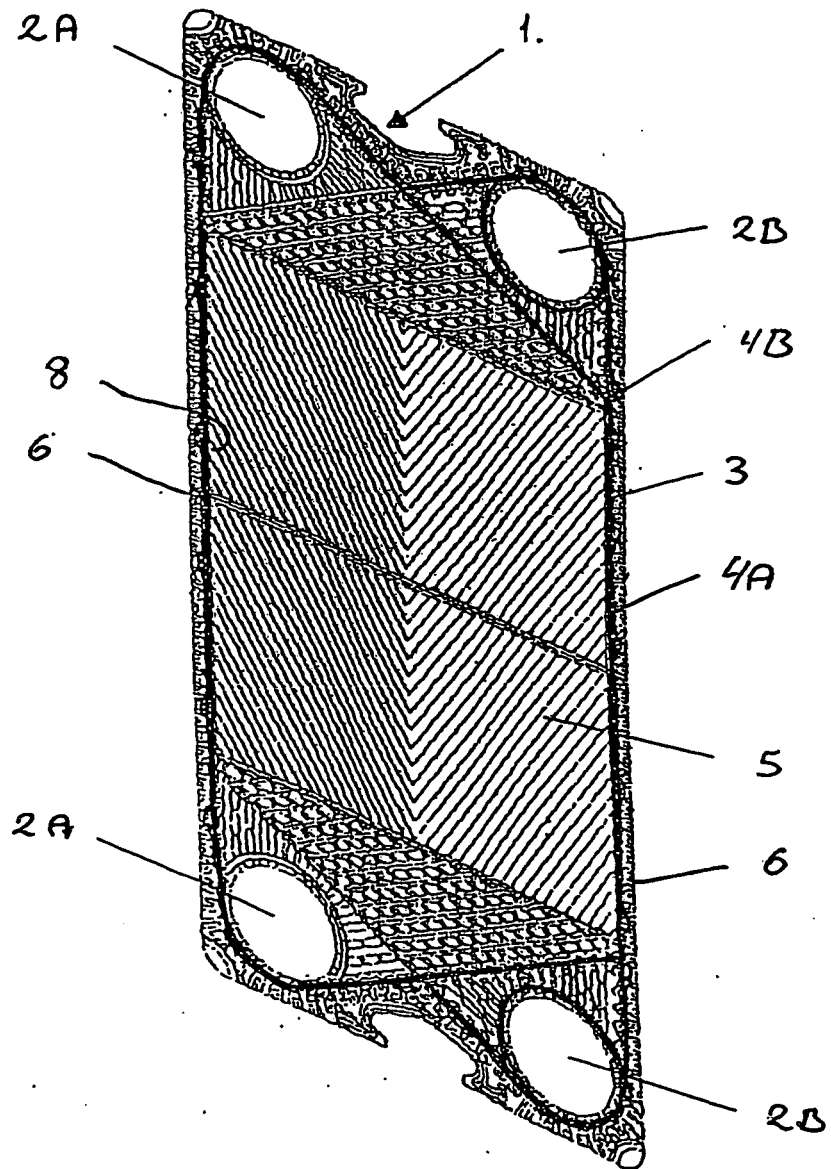


Fig. 1.

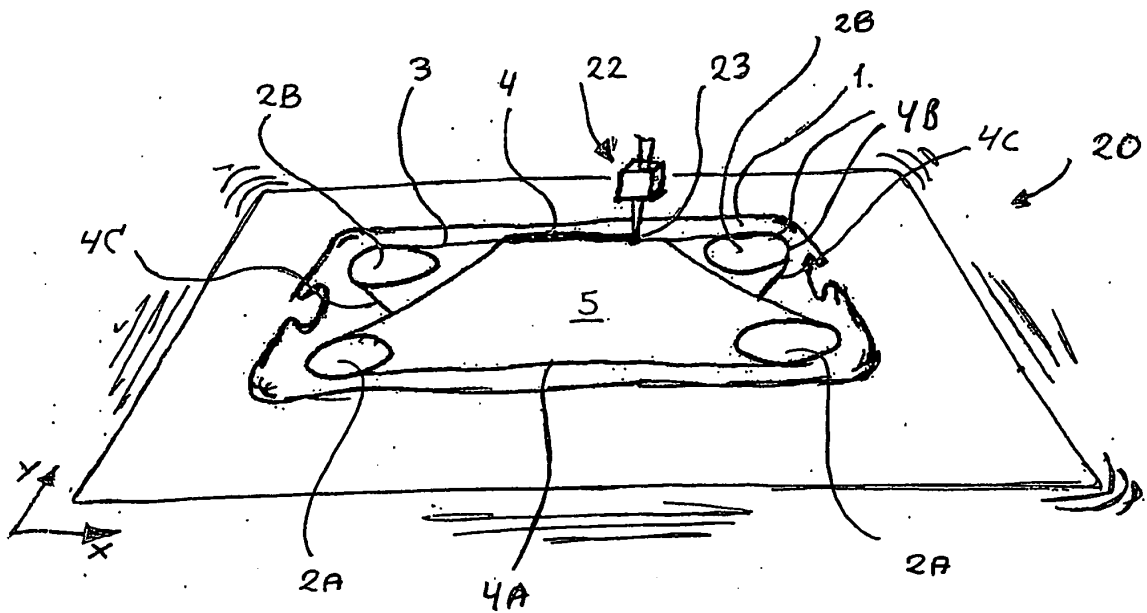


Fig 2.

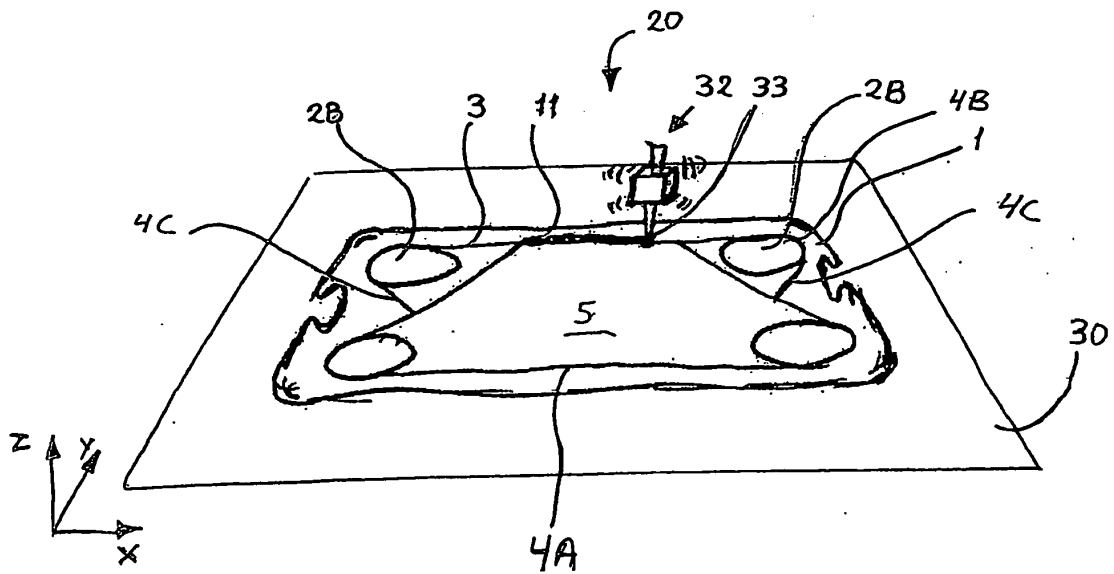


Fig 3

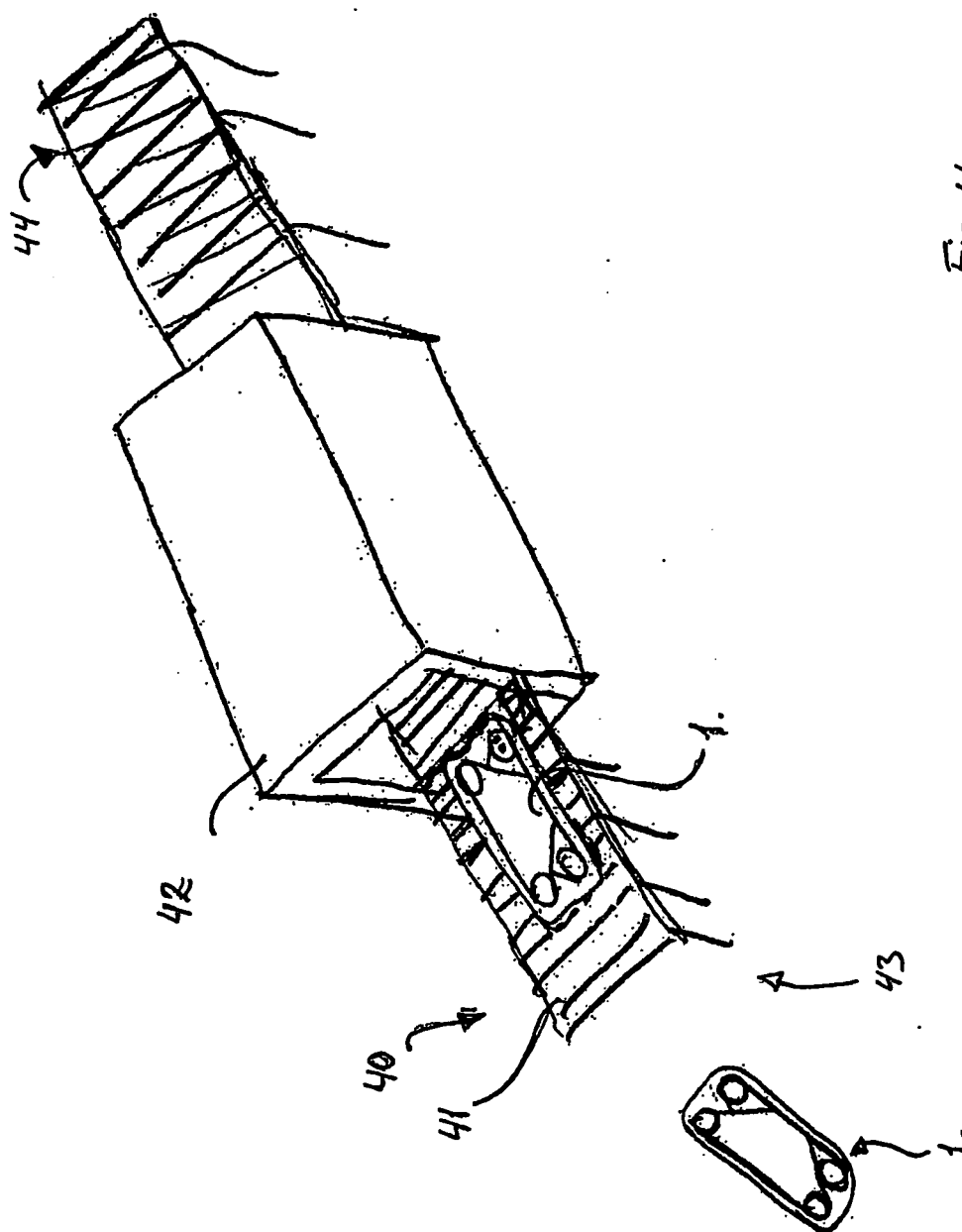
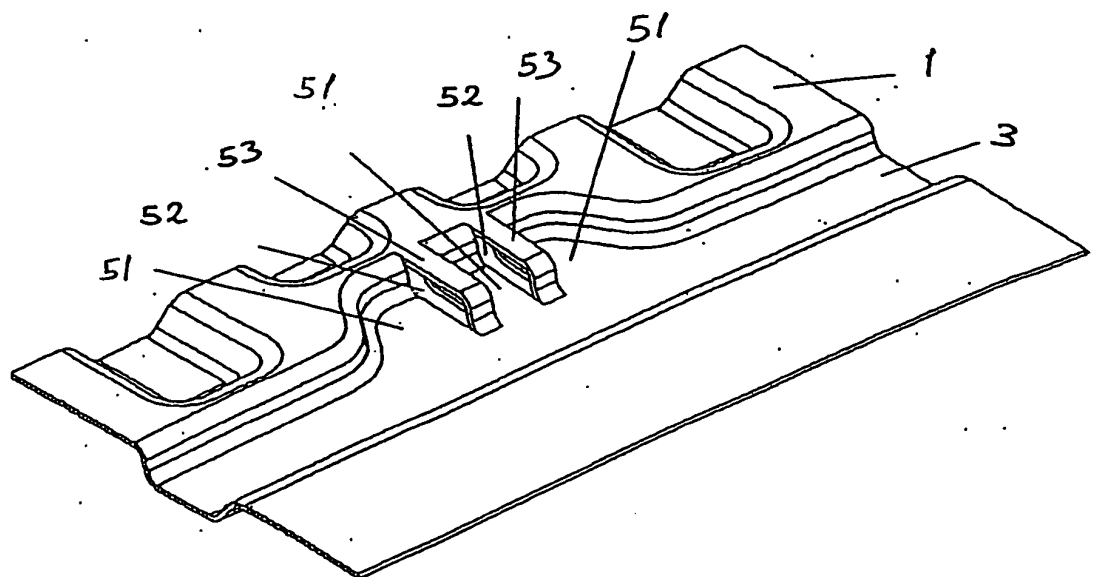
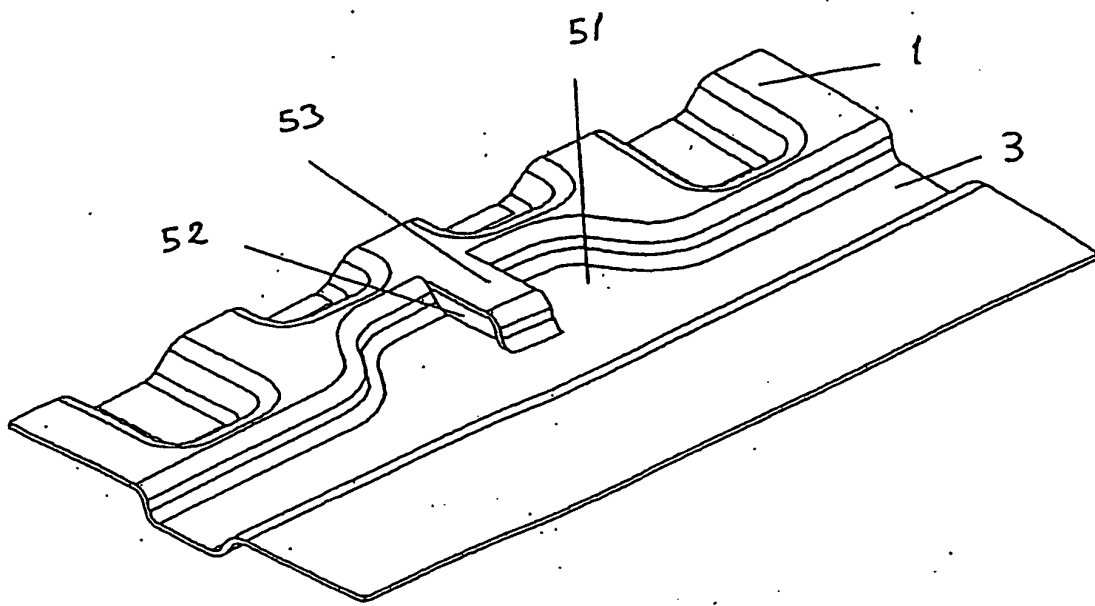


Fig 4.



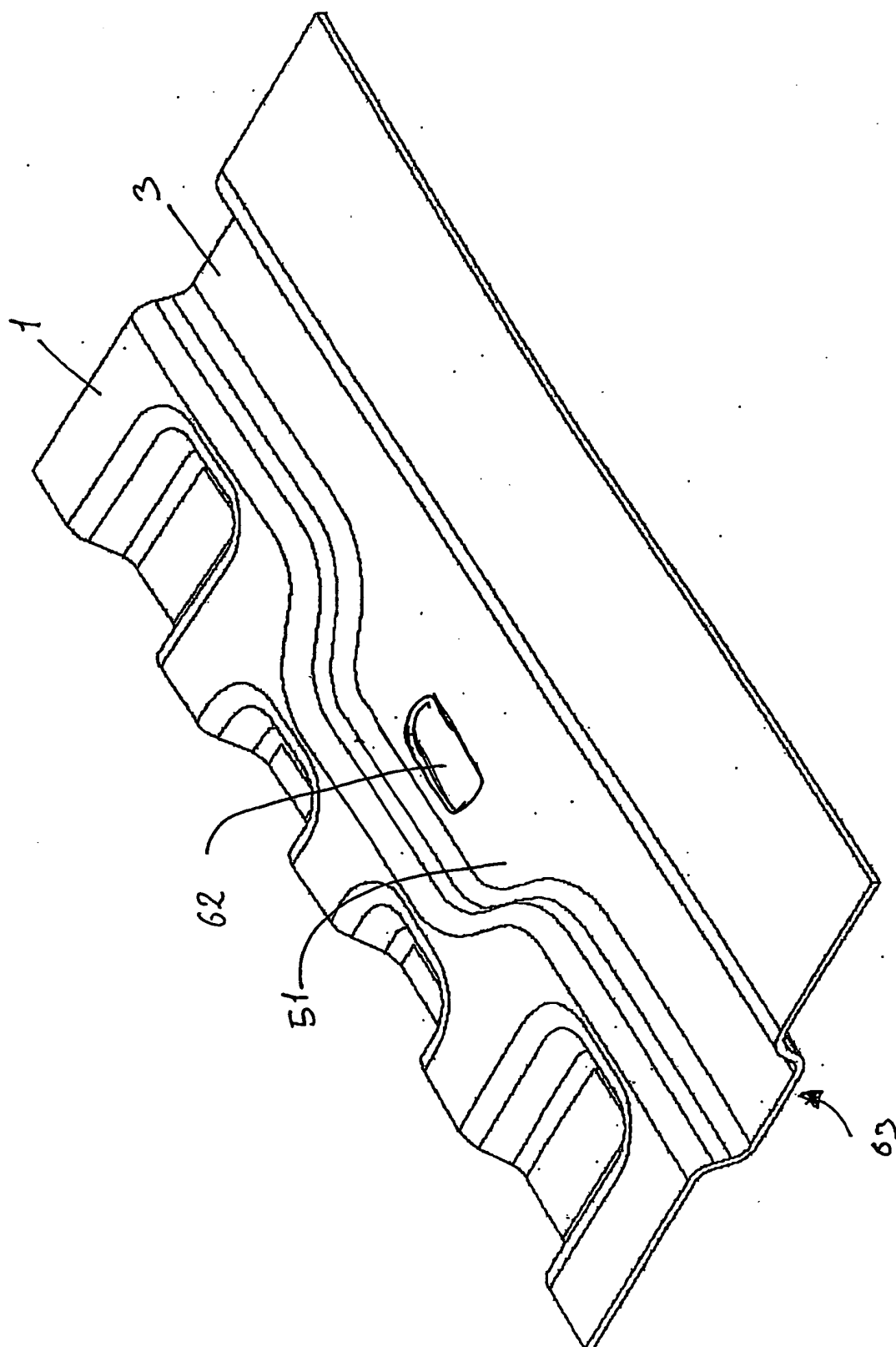


Fig. 5C

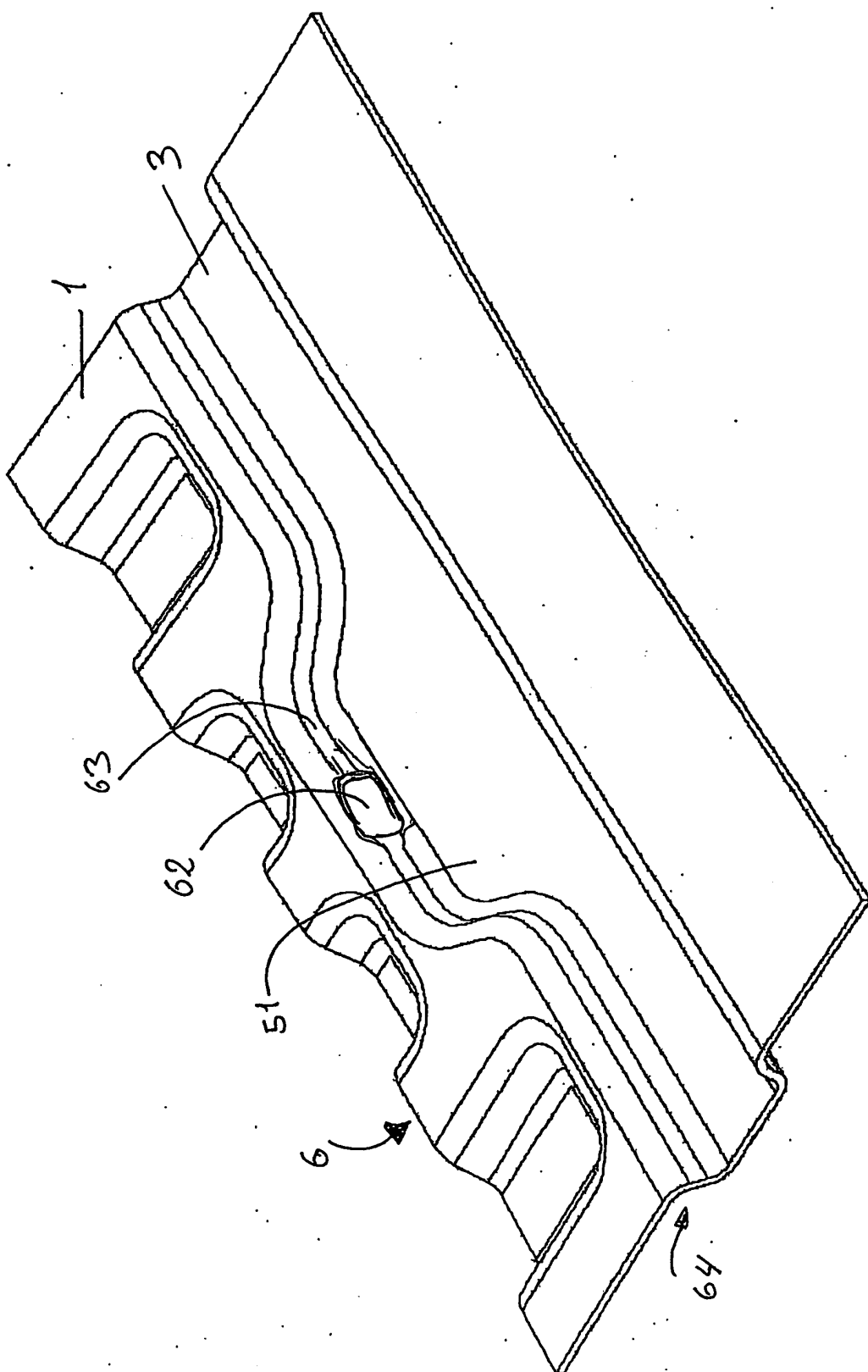


Fig 5D

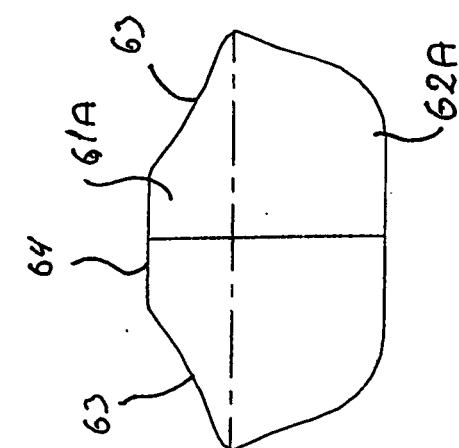


Fig 6A

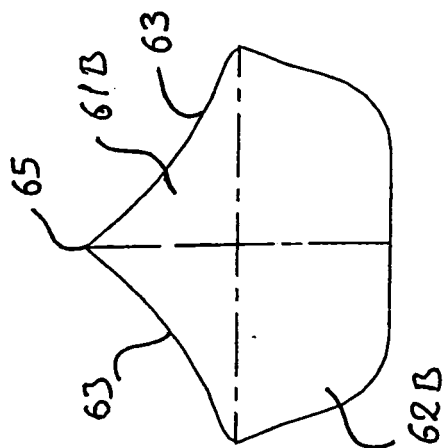


Fig. 6B

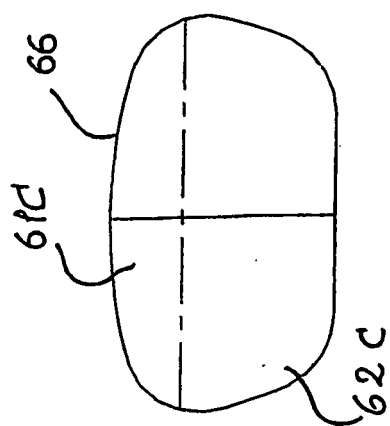


Fig 6C

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0077468 A1 [0005]