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(72) Inventor: **BLOMGREN, Fredrik**
SE-217 45 MALMÖ (SE)

(74) Representative: **Alfa Laval Attorneys**
Alfa Laval Corporate AB
Patent Department
P.O. Box 73
221 00 Lund (SE)

(71) Applicant: **Alfa Laval Corporate AB**
221 00 Lund (SE)

(54) **A RETAINING MEANS FOR A HEAT EXCHANGER PLATE, A GASKET ARRANGEMENT FOR A HEAT EXCHANGER PLATE, A HEAT EXCHANGER PLATE WITH AN EDGE PORTION AND A PLATE HEAT EXCHANGER**

(57) The disclosure relates to a retaining means (60) for a heat exchanger plate (200), gasket arrangement (250) comprising the retaining means (60) and a gasket (220), heat exchanger plate (250) comprising the retaining means and a plate heat exchanger (100) comprising the heat exchanger plate. The retaining means comprises a first gripping portion (61) and a second gripping portion (62), arranged parallelly and at a transversal distance from each other, each of the first and second gripping portions comprising a longitudinally extending finger member (65, 66) configured to be engaged with a surface of a heat exchanger plate edge (200). the finger

members being attached at one end to a respective first transversal portion (63) and second transversal portion (64), wherein the transversal distance (d3) between the first and second transversal portions (d2) is shorter than the transversal distance between the longitudinally extending finger members, whereby an open compartment (70) is formed. The compartment is limited by the two parallel longitudinal finger members (65, 66) and the extensions of the first and second transversal portions (63, 64), the formed compartment (70) being configured to retain an object within the compartment.

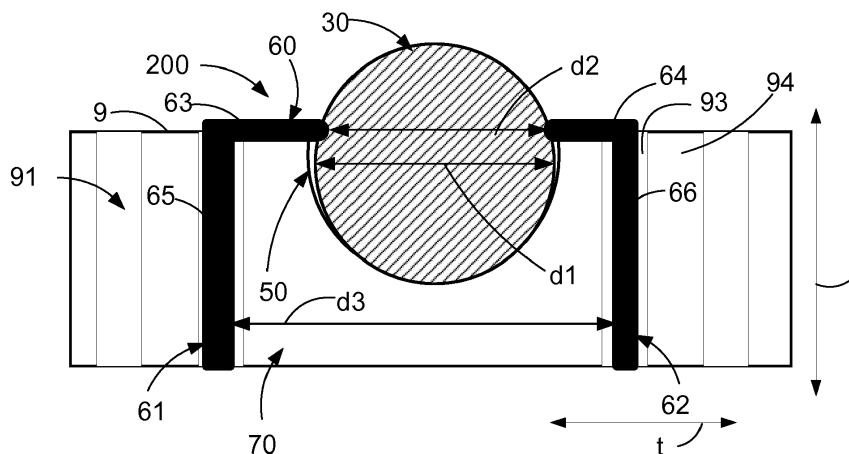


Fig. 4

Description

Field of the invention

[0001] The present invention relates to a retaining means for a heat exchanger plate, a gasket arrangement for a heat exchanger plate, a heat exchanger plate with an edge portion and a plate heat exchanger. More specifically, the disclosure relates to a retaining means for a heat exchanger plate, a gasket arrangement for a heat exchanger plate, a heat exchanger plate with an edge portion and a plate heat exchanger as defined in the introductory parts of the independent claims attached herein.

Background art

[0002] Plate heat exchangers, or PHEs, typically consist of two end-pieces or plates in between which a number of heat transfer plates are arranged in an aligned manner, in a package. In one type of well-known PHEs, the so called gasketed plate heat exchangers (GPHE), gaskets are arranged between the heat transfer plates. The end plates, also called pressure plates, and the heat transfer plates, are pressed towards each other whereby the gaskets function as a seal between the heat transfer plates. The gaskets define flow channels between the heat transfer plates through which channels fluids of initially different temperatures can flow for transferring heat from one fluid to the other.

[0003] When assembling the plate heat exchanger, a carrying bar for supporting the pressure plates as well as the heat transfer plates is arranged to extend from an upper or lower part of the frame plate through a recess in the heat exchange plates. The heat transfer plates may either stand or hang on the carrying bar, and thus be supported by the carrying bar. The carrying bar is arranged to extend in a direction which is perpendicular to a plane of a longitudinal and transversal extension of the heat transfer plates.

[0004] On plates where round carrying and/or guiding bars are used, the plates are often designed with a recess or opening having a snap-on function to retain the carrying bar within the recess provided on the edge of each heat transfer plate in a package. In this way a safeguard is provided against the risk that the plates will fall and/or glide during assembly. The solution works by arranging an opening or recess to an edge of each heat exchanger plate. The opening is narrower than the diameter of the bar at an outer edge of the plate and wider towards the center of the plate so that the bar can be accommodated in the recess. However, to provide the recess with the outer edge with a narrower diameter, the extension of the recess is usually arranged to be longer than the accommodation of the carrying bar requires and is often arranged by having the plate extend beyond the longitudinal center axis of the bars and by reducing the extension of the opening in the plate so that it is more narrow

than the diameter of the bar. This however often requires that the heat exchanger plate needs to be longer than required for the heat exchange process. However, due to increasing environmental requirements, it is desirable to decrease the use of non-renewable raw materials in heat exchangers. Therefore, there is a desire to decrease the amount of raw materials used in the heat exchanger plates and reduce the costs for the plate.

Summary

[0005] It is an objective of the present invention to mitigate, alleviate or eliminate one or more of the above-identified disadvantages in the prior art and provide solutions for heat exchanger plates whereby the use of non-renewable raw materials can be decreased. It is also an objective to reduce the costs for the plates.

[0006] Additionally, there is a desire to increase the area used for heat exchanging process of the plate. Therefore, it is a further objective of the present invention to enable an increased utilization of a plate area for heat exchange.

[0007] The above-mentioned objectives are attained by the present invention as defined in the appended claims.

[0008] According to a first aspect, there is provided a retaining means for a heat exchanger plate, the retaining means having a longitudinal extension and a transversal extension perpendicular to the longitudinal extension, the retaining means comprising a first gripping portion and a second gripping portion, which are arranged parallelly at a transversal distance from each other. Each of the first and second gripping portions comprises a respective longitudinally extending finger member configured to be engaged with a surface of a heat exchanger plate. Each finger member is attached at one end to a respective first transversal portion or second transversal portion. According to the invention, the transversal distance between the first and second transversal portions is shorter than the transversal distance between the longitudinally extending finger members, whereby an open compartment is formed. The compartment is limited in the transversal direction by the two longitudinally extending finger members and at least partly in the longitudinal direction by the first and second transversal portions, the formed compartment being configured to retain an object comprising a transversal extension, which has a larger transversal extension than the transversal distance between the first and second transversal portions, within the compartment.

[0009] Through the present retaining means a simple and robust retaining means can be provided for objects having a larger transversal extension than the transversal distance between the first and second transversal portions, within a compartment. By the present retaining means it is possible to replace the retaining means obtained by the shape of the plate by cheaper materials, and thus reduce the use of metallic raw materials used

for heat exchange plates. Due to large amounts of materials used in heat exchanger plates, the small dimensional design change leads to large material savings, which is a huge advantage from both environmental and economical point of view. At the same time, sufficient support for carrying bars used in the assembly of heat exchangers can be provided by the retaining means as claimed in the appended claims.

[0010] Each of the first gripping portion and second gripping portion may comprise at least two longitudinally extending finger members, which can be used for engaging an edge of a heat exchanger plate. Thus, a stronger engagement of the retaining means with the plate and more stable retaining means can be obtained. The finger members may be configured to be positioned at opposite sides of the plate. In this way, a snap-on function may be retained even if the plate moves backwards-forwards, i.e. in the plane perpendicular to the plane of the longitudinal axis of the plate. The transversal portions may be configured to rest against the plate edge, whereby the movement of the transversal portions in the longitudinal direction can be limited.

[0011] The finger members in the respective first and second gripping portions may have different lengths. Thus, material can be saved in the retaining means.

[0012] The finger members of the respective first and second gripping portions may be attached to the respective first and second transversal portions at an angle of 10-70°, in respect of the direction of the longitudinal extension of the retaining means. In this way, the supporting force of the transversal portions may be further improved.

[0013] The retaining means may comprise a connecting section adapted to connect the first and second gripping portions with each other. Thereby an integrated design for the retaining means can be obtained. The connecting section may be attached to the first and second transversal portions or the connecting section may be attached to the finger members at an end opposite to the end attached to the respective first and second transversal portions.

[0014] The present invention also relates to a gasket arrangement for a heat exchanger plate comprising a gasket comprising a fluid sealing loop and a retaining means as defined above. In a similar manner as defined above the retaining means has a longitudinal extension and a transversal extension perpendicular to the longitudinal extension. The retaining means comprises a first gripping portion and a second gripping portion, which are arranged parallelly at a transversal distance from each other. Each of the first and second gripping portions comprises a respective longitudinally extending finger member configured to be engaged with a surface of a heat exchanger plate. Each finger member is attached at one end to a respective first transversal portion or second transversal portion. According to the invention, the transversal distance between the first and second transversal portions is shorter than the transversal distance between the longitudinally extending finger members, whereby an

open compartment is formed. The compartment is limited in the transversal direction by the two longitudinally extending finger members and at least partly in the longitudinal direction by the first and second transversal portions, the formed compartment being configured to retain an object comprising a transversal extension, which is larger than the transversal distance between the first and second transversal portions, within the compartment.

[0015] By having a gasket arrangement which includes both the fluid loop and the retaining means, a simple and robust arrangement is provided, while raw-material savings of plate material can be achieved.

[0016] Each of the first gripping portion and second gripping portion may comprise at least two longitudinally extending finger members for engaging an edge of a heat exchanger plate edge, the finger members being attached at one end to a respective first transversal portion and second transversal portion.

[0017] The finger members may have different lengths in the longitudinal direction of the retaining means. Thus, mounting of the gasket arrangement may be facilitated and material savings achieved.

[0018] According to a variant, the longer finger members may be connected or integrated to the gasket. Thereby, a one-piece integrated gasket arrangement can be obtained. In this way mounting of the gasket arrangement can be facilitated. The gasket and the retaining means may however be connected to or integrated with each other to form a one piece construction. When the gasket and the retaining means are connected to each other, they may be provided as separate components, but be connected together before or during mounting. Thus, when the parts are provided as separate parts connected to each other, in case of breakage of one part only this part needs to be replaced by a new part.

[0019] A section of the gasket may be configured to function as a connecting portion for the first gripping portion and the second gripping portion. In this way, a simple integrated construction may be achieved.

[0020] The retaining means and the gasket may comprise or consist of the same or different materials. For example, if the gasket material is of an integrated construction, it may be advantageous from the manufacturing point of view to use the same material for both the retaining means and gasket. In the other hand, it may be advantageous to use different materials, since in this way material characteristics may be adapted to either the sealing function or the retaining function in respective portions. The material used in the retaining means and/or the gasket may be an elastic material, whereby mounting of the retaining means and the gasket on the heat exchange plates is facilitated.

[0021] The present invention also relates to a heat exchanger plate having two opposite side surfaces, an extension in a longitudinal, transversal and thickness direction of the plate, and comprises an edge portion comprising a recess configured to fit a carrying bar. The heat exchanger plate comprises the retaining means as de-

scribed above or the gasket arrangement comprising the retaining means as described above. The retaining means is arranged such that the first gripping portion and the second gripping portion are arranged at a respective lateral side of the recess and such that at least one of the transversal portions has a transversal extension adapted to extend over an edge of the recess.

[0022] By the retaining means, the usage of plate material can be reduced, and it is possible to utilize a larger area of the plate for heat exchanging, since no excessive plate material is needed for providing a snap-on function for a carrying bar during mounting of a heat exchanger.

[0023] The heat exchanger plate may have a substantially rectangular shape and the plate comprises an upper edge, lower edge, two side edges and a groove for the gasket on at least one side surface thereof, and wherein the recess is arranged at the upper or lower edge of the plate. Thus, a carrying bar can be fitted to the recess to support the plates during mounting of a heat exchanger.

[0024] The retaining means may comprise at least two finger members, which are arranged to engage the edge of the heat exchanger plate such that at least one of the finger members is positioned on each side of the two opposite side surfaces of the plate, and wherein the transversal portions of the retaining means are adapted to extend in proximity to or along the edge of the plate. In this way, a snap-on function may be retained even if the plate moves backwards-forwards, i.e. in the plane perpendicular to the plane of the longitudinal axis of the plate. The two finger members on opposite sides of the plate may additionally act as gripping members for the retaining means by engaging the edge of the plate. The transversal portions may be configured to rest against the plate edge, whereby the movement of the transversal portions in the longitudinal direction can be limited.

[0025] The heat exchanger plate may comprise a corrugated edge portion, which comprises a series of crests and troughs in an area extending outwards of the recess along the edge of the plate. The finger members may be adapted to be positioned in the troughs. Thus, the finger members may be fitted to grip the plate edge such that the thickness of the plate will not increase substantially. Also the troughs grip the finger members and prevent lateral movement of the finger members.

[0026] The finger members may have two different lengths, wherein the shorter finger members are adapted to be positioned on one side of the plate and the longer finger members are adapted to be positioned on the opposite side of the plate comprising the gasket. Thus, material savings can be achieved while the mounting of the retaining means can be facilitated.

[0027] The recess may have a semi-circular shape to adapt to the shape of the carrying bar. However, any cross sectional shape, which may correspond to the shape of the carrying bar is conceivable.

[0028] The retaining means may comprise a connecting section, which has a shape adapted to surround the periphery of the recess. In this way increased fastening

surface can be provided. Additionally, increased support for the gripping portions can be provided, e.g. because the connecting section is located in proximity of the carrying bar fitted in the recess.

[0029] The present invention also relates to a plate heat exchanger comprising a frame and a plurality of stacked heat exchanger plates as defined above, wherein the plates are supported by at least one carrying bar adapted to be fitted in the recess of each heat exchanger plate. The carrying bar may be adapted to be fitted into the recess at an upper edge of each heat exchanger plate.

[0030] The present invention will become apparent from the detailed description given below. The detailed description and specific examples disclose the invention by way of illustration only. Those skilled in the art understand from guidance in the detailed description that changes and modifications may be made within the scope of the invention defined in the appended claims.

Brief descriptions of the drawings

[0031] The above objectives, as well as additional objectives, features and advantages of the present invention, will be more fully appreciated by reference to the following illustrative and non-limiting detailed description of example embodiments of the present invention, when taken in conjunction with the accompanying drawings.

Figure 1 shows schematically a plate heat exchanger comprising a stack of heat exchanger plates;

Figure 2 shows a prior art heat exchanger plate;

Figure 3 shows a portion of a prior art heat exchanger plate with an edge portion in which a carrying bar is fitted.

Figure 4 shows an example of a heat exchanger plate with an edge portion in which a carrying bar is fitted and retained by means of the retaining means according to the present disclosure;

Figure 5 shows another example of a heat exchanger plate with an edge portion in which a carrying bar is fitted and retained by means of the retaining means according to the present disclosure;

Figure 6 shows backside of a heat exchanger plate with an edge portion illustrated in Fig. 5;

Figure 7 shows another example of a retaining means from a backside engaged with a heat exchanger plate according to the present disclosure;

Figure 8 shows a further example of a retaining means from a front side engaged with a heat exchanger plate according to the present disclosure;

Figure 9 shows backside of a heat exchanger plate with an edge portion illustrated in Fig. 8;

Figure 10 shows schematically an example heat exchanger plate comprising a gasket arrangement according to the present disclosure.

Detailed description

[0032] The present invention will now be described with reference to the accompanying drawings, in which examples of the invention are shown. The invention may, however, be embodied in other forms and should not be construed as limited to the herein disclosed embodiments. The disclosed embodiments are provided to fully convey the scope of the invention to the skilled person.

[0033] Figure 1 shows an example of a plate heat exchanger 100 according to the present disclosure comprising a plurality of stacked gasketed heat-exchanger plates 200. The plate heat exchanger 100 may be aimed for the treatment of a fluid medium. The treatment may be for example heating, cooling, heat recovery, evaporation and condensation. The fluid may be a liquid, such as water, for example seawater, or air. According to a variant, the plate heat exchanger is used for treatment of seawater to desalinate the seawater, but is not limited thereto.

[0034] The plate heat exchanger 100 comprises a plurality of gasketed heat exchanger plates 200, which may be for example compression moulded. The heat exchanger plates 200 are provided stacked in parallel to each other and successively in such a way that they form a plate package 2. The plate package 2 is provided between a frame plate 3 and a pressure plate 4. Between the heat exchanger plates 200, first plate interspaces 5 and second plate interspaces 6 are formed. The first plate interspaces 5 and the second plate interspaces 6 are provided in an alternating order in the plate package 2 in such a way that substantially each first plate interspace 5 is surrounded by two second plate interspaces 6, and substantially each second plate interspace 6 is surrounded by two first plate interspaces 5. Different sections in the plate package 2 are delimited from each other by means of gaskets 220 in each plate interspace 5, 6, which is to be explained more closely below.

[0035] An example of a prior art gasketed heat exchanger plate 200' comprising a gasket 220' of a known type is illustrated in Fig. 2. As illustrated in the drawing, the heat exchanger plate 200' has an extension in a longitudinal direction l, and transversal direction t. The plate 200' has two opposite substantially parallel side edges 7, 8, an upper edge 9 and a lower edge 10. A centre axis C extends substantially centrally between the two side edges 7 and 8, and substantially longitudinally. The centre axis C extends vertically when the plate package 2 is located in a normal position of use. The plate package 2, i.e. the heat exchanger plates 200' and the gaskets 220' provided there between, is kept together by means

of schematically indicated tie bolts 11 in a manner known per se. The gasket 220' defines flow channels 21, 22, 23, 24 between the heat transfer plates through which channels fluids, for example of initially different temperatures, can flow and transfer heat from one fluid to the other. Fig. 2 discloses one side of the heat exchanger plate 1, which faces one of the first plate interspaces 5 substantially arranged to form a passage for the medium to be treated; for example seawater to be desalinated. The opposite side of the plate 1 faces one of the second plate interspaces 6. In each of the first plate interspaces 5 and the second plate interspaces 6, there is a main gasket 220' extending around the liquid medium channels 21, 22, 23 and 24 in the proximity of plate edges 7, 8, 9 and 10. The upper edge 9 and the lower edge 10 of the heat exchanger plate 200' comprise a recess 50' with a snap-on function to fit and retain a carrying bar. The carrying bar has a purpose of supporting the plates during assembly or mounting of a heat exchanger.

[0036] A recess 50' of the similar type as in Fig. 2 is schematically and enlarged shown in Fig. 3. Thus, Fig. 3 schematically illustrates a portion of the upper edge 10 of a prior art heat exchanger plate 200' that comprises the recess 50' with a snap-on function for the carrying bar. The recess 50' comprises a semi-circular main portion 51' and a lengthened upper portion 52'. The recess 50' is configured to fit a carrying bar 30. The illustrated carrying bar 30 has a circular cross-section, but generally for carrying bars discussed in this disclosure, any other cross-section shape could be used. The transversal distance d2 between the opposite lengthened upper portions 52' is smaller than the broadest cross-sectional extension, which in this case is a diameter d1, of the carrying bar 30. Due to the lengthened upper portions 52', the carrying bar is retained in the recess, and substantial movement of the carrying bar in the longitudinal direction is prevented. However, as mentioned above, the design of the illustrated type requires that the plate is longer than necessary.

[0037] Examples of a retaining means according to the present disclosure are now to be explained more closely with reference to Figs. 4 to 8.

[0038] Each of Fig. 4-9 illustrate schematically examples of a retaining means according to the present disclosure. By retaining means is meant a component or device comprising one or several parts and having a design configured to substantially retain an object in a certain position.

[0039] Reference is first made equally to each Fig. 4-9 to describe common features of each example shown. Generally, the retaining means has a longitudinal extension in the longitudinal direction l and a transversal extension in the transversal direction t, perpendicular to the longitudinal extension. The illustrated retaining means 60 is provided for retaining a carrying bar 30 (not shown in Fig. 8 and Fig. 9) in a recess 50 located at an upper edge 9 of a heat exchanger plate 200.

[0040] The retaining means 60 comprises two opposite

gripping portions, i.e. a first gripping portion 61 and a second gripping portion 62, which are arranged at a transversal distance d_2 from each other. This distance may be pre-defined and adapted to the shape and dimensions of the recess and the carrying bar 30, which is to be retained within the recess 50. Each of the first and second gripping portions 61 and 62 comprises a respective transversally extending portion 63 and 64 and longitudinally extending finger member 65 and 66 attached to the respective transversal portion 63 and 64. The finger members 65 and 66 are configured to be engaged with a first surface 91 of the heat exchanger plate 200. The first surface 91 may be the surface on which a gasket 220 of the plate is mounted and thus corresponds to a front surface of the plate.

[0041] According to the invention, the transversal distance d_2 between the first and second transversal portions 63 and 64 is shorter than the transversal distance d_3 between the longitudinally extending finger members 65 and 66, whereby an open compartment 70 is formed. By open compartment is meant a section, which is not completely surrounded by outer bounds, but is instead partially limited by outer bounds. The compartment 70 is limited in the transversal direction t by the two longitudinally extending finger members 65 and 66 and at least partly in the longitudinal direction by the first and second transversal portions 63 and 64. The formed compartment 70 is thus configured to retain an object comprising a transversal extension, for example extension d_1 of the carrying bar 30, which is larger than the transversal distance d_2 between the first and second transversal portions 63 and 64, within the compartment 70. The object is thus retained in the compartment by preventing the movement of the object at least in one longitudinal direction, which is the drawings shown is vertically upwards.

[0042] In the example shown in Fig. 4, the retaining means comprises only two longitudinal finger members 65 and 66, which may be attached to the plate surface 91 for example by means of gluing, hot melting the retaining means material or by welding.

[0043] The present retaining means is simple in construction and robust. By the present retaining means it is possible to replace the lengthened upper portions 52' used in the known heat exchange plates. The retaining means of the present invention may be manufactured of materials which are cheaper than the plate material. Thereby more economical retaining means can be obtained while the use of valuable metallic raw materials can be decreased.

[0044] In Fig. 5 a further example of the retaining means 60 according to the present disclosure is shown. In the shown example, each of the first gripping portion 61 and second gripping portion 62 comprises two longitudinally extending finger members 65, 67, and 66, 68, respectively, on the front surface 91 of the plate 200.

[0045] In Fig. 6, which shows the retaining means 60 from the backside 92 of the plate 200, it is illustrated that each of the first gripping portion 61 and second gripping

portion 62 comprises one further finger member 691 and 692 on the second, i.e. backside, surface 92 of the plate 200.

[0046] The finger members 65-68 and 691, 692 illustrated in Fig. 5 and Fig. 6 can be used for engaging an edge 9 of the heat exchanger plate 200 by gripping the edge 9 by the finger members on both sides of the plate 200. The transversal portions 63, 64 may be configured to rest against the plate edge 9, whereby the movement of the transversal portions in the longitudinal direction can be limited. The finger members 65, 67, 66, 68 and 691, 692 in the respective first and second gripping portions 61, 62 may have different lengths. Suitably, the finger members on the respective sides 91 and 92 have different lengths, for example such that the finger members 691 and 692 on the backside 92 are shorter than the finger members 65, 67, 66, 68 engaged with the front surface 91 of the plate. Thus, material can be saved in the retaining means.

[0047] By using at least two finger members in each gripping portion, a stronger engagement of the retaining means with the plate can be achieved. The amount of finger members may vary, and can be for example from 1-10, but is not limited thereto. When the finger members are positioned at opposite sides of the plate, the retaining means is held tightly at its position, even if the plate moved backwards-forwards, i.e. in the plane perpendicular to the plane of the longitudinal axis of the plate.

[0048] In Fig. 7 it is illustrated that the retaining means 60 may comprise a connecting section 80 adapted to connect the first and second gripping portions 61 and 62 with each other. Thereby an integrated design for the retaining means can be obtained. The connecting section 80 may be attached to the first and second transversal portions 63, 64 on the backside 92 of the plate 200 as illustrated in Fig. 7.

[0049] In Fig. 8 and 9 a further example of the retaining means 60 according to the present disclosure is illustrated. The finger members 65, 67, 691, 693 and 66, 68, 692, 694 of the respective first and second gripping portions 61, 62 may be attached to the respective first and second transversal portions 63, 64 at an angle of $10-70^\circ$, in respect of the longitudinal extension of the retaining means. By providing the finger means at an angle, the supporting force of the transversal portions may be further improved. The finger members 691-694 located on the backside 92 of the plate may be shorter than the finger members 65-69 on the front side 91 of the plate 200. Additionally, a connecting section 80 may be attached to the finger members 65-68 at an end opposite to the end attached to the respective first and second transversal portions 63, 64. As shown in the illustrated example the connecting section is also located on the front side 91 of the plate 200. The connecting section 80 may be a part of a gasket 220 of the plate 200. By providing finger members engaged with both side surfaces 91 and 92 of the plate and by connecting the retaining means with the gasket, the retaining means may be used

as an attachment means for the gasket, which is a further advantage.

[0050] The present invention also relates to a gasket arrangement 250 for a heat exchanger plate 200. An example of a gasket arrangement 250 is schematically illustrated in Fig. 10. The gasket arrangement 250 comprises a gasket 220 comprising a fluid sealing loop and a retaining means 60 as described in the examples above. By fluid sealing loop is meant that the gasket is formed to seal at least two separate fluid channels. The retaining means 60 is configured to retain a carrying bar 30 in a recess 50 of the plate 200. In the illustrated example, the retaining means corresponds to the retaining means described in connection with Fig. 4, but could be of the type comprising at least two longitudinally extending finger members for engaging an edge of the heat exchanger plate edge and as described in connection with Fig. 5-9.

[0051] In the illustrated examples above and generally, the longer finger members may be connected or integrated to a gasket to form a one piece construction. When the gasket and the retaining means are connected to each other, they may be provided as separate components, but be connected together before or during mounting. Thus, when parts are provided as separate parts connected to each other, it will be possible to replace only one part in case of breakage of the part in question.

[0052] The retaining means and the gasket may comprise or consist of the same or different materials. For example, if the gasket material is of an integrated construction, it may be advantageous from the manufacturing point of view to use the same material for both the retaining means and gasket. On the other hand, it may be advantageous to use different materials, since in this way material characteristics may be adapted to either the sealing function or the retaining function in respective portions. The material used in the retaining means and/or the gasket may be an elastic material, whereby mounting of the retaining means and the gasket on the heat exchange plates is facilitated. In some cases, the material for the retaining means may be chosen to be stiffer than for the gasket. Examples of suitable materials for the gaskets and/or the retaining means include, but are not limited to, rubber, polymeric materials and metals.

[0053] The present invention also relates to a heat exchanger plate 200 having two opposite side surfaces 91 and 92, an extension in a longitudinal, transversal and thickness direction of the plate, and comprises an edge portion 9 comprising a recess 50 configured to fit a carrying bar 30, and reference is made to Fig. 4-10. The heat exchanger plate 200 comprises the retaining means 60 as described above or the gasket arrangement 250 comprising the retaining means as described above. The retaining means is arranged such that the first gripping portion and the second gripping portion are arranged at a respective lateral side of the recess 50 and such that at least one of the transversal portions 63, 64 has a trans-

versal extension adapted to extend over an edge of the recess 50.

[0054] By the retaining means, the usage of plate material can be reduced, and it is possible to utilize a larger area of the plate for heat exchanging, since no excessive plate material is needed for providing a snap-on function for a carrying bar needed during mounting of a heat exchanger.

[0055] The heat exchanger plate 200 may have a substantially rectangular shape and the plate comprises an upper edge, lower edge, two side edges and a groove for the gasket on at least one side surface thereof. The recess 50 is arranged at the upper or lower edge of the plate. Thus, a carrying bar can be fitted to the recess to support the plates during mounting of a heat exchanger.

[0056] The heat exchanger plate 200 may comprise a corrugated edge portion 9 comprising a series of crests 94 and troughs 93 in an area extending outwards of the recess 50 along the edge 9 of the plate 200, wherein the reference signs are shown in Fig. 4. The finger members 65-69 and 691-694 may be adapted to be positioned in the troughs 93. Thus, the finger members may be fitted to grip the plate edge such that the thickness of the plate will not increase substantially. Also the troughs grip the finger members and prevent lateral movement of the finger members.

[0057] The finger members may have two different lengths, wherein the shorter finger members are adapted to be positioned on one side of the plate and the longer finger members are adapted to be positioned on the opposite side of the plate comprising the gasket. Thus, material savings can be achieved while the mounting of the retaining means can be facilitated.

[0058] The recess 50 may have a semi-circular shape to adapt to the shape of the carrying bar. However, any cross sectional shape, which may correspond to the shape of the carrying bar is conceivable.

[0059] The retaining means may comprise a connecting section, which has a shape adapted to surround the periphery of the recess. In this way increased fastening surface can be provided. Additionally, increased support for the gripping portions can be provided, e.g. because the connecting section is located in proximity of the carrying bar fitted in the recess.

[0060] The present invention also relates to a plate heat exchanger comprising a frame and a plurality of stacked heat exchanger plates as defined above and as generally shown in Fig. 1. The plates are supported by at least one carrying bar adapted to be fitted in the recess of each heat exchanger plate. The carrying bar may be adapted to be fitted into the recess at an upper edge of each heat exchanger plate.

[0061] The person skilled in the art realizes that the present invention is not limited to the examples described above. The person skilled in the art further realizes that modifications, combinations and variations are possible within the scope of the appended claims. Additionally, variations to the disclosed embodiments can be under-

stood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims.

Claims

1. A retaining means (60) for a heat exchanger plate (200), the retaining means (60) having a longitudinal extension (l) and a transversal extension (t) perpendicular to the longitudinal extension, the retaining means (60) comprising a first gripping portion (61) and a second gripping portion (62) arranged parallelly at a transversal distance from each other, each of the first and second gripping portions (61; 62) comprising a respective longitudinally extending finger member (65; 66) configured to be engaged with a surface (91) of a heat exchanger plate (200), each finger member (65; 66) being attached at one end to a respective first transversal portion (63) or second transversal portion (64), wherein the transversal distance (d2) between the first and second transversal portions (63; 64) is shorter than the transversal distance (d3) between the longitudinally extending finger members (65; 66), whereby an open compartment (70) is formed, the compartment (70) being limited in the transversal direction (t) by the two longitudinally extending finger members (65; 66) and at least partly in the longitudinal direction (l) by the first and second transversal portions (63; 64), the formed compartment (70) being configured to retain an object (30), which has a larger transversal extension (d1) than the transversal distance (d2) between the first and second transversal portions (63; 64), within the compartment (70).
2. The retaining means (60) of claim 1, wherein each of the first gripping portion (61) and second gripping portion (62) comprises at least two longitudinally extending finger members (65, 67; 66, 68) for engaging an edge 9 of a heat exchanger plate (200).
3. The retaining means of claim 2, wherein the finger members (65-69; 691-694) in the respective first and second gripping portions (61; 62) have different lengths.
4. The retaining means (60) of claim 1, 2 or 3, wherein the finger members (65-69; 691-694) of the respective first and second gripping portions (61; 62) are attached to the respective first and second transversal portions at an angle of 10-70°, in respect of the direction of the longitudinal extension (l) of the retaining means (60).
5. The retaining means of any one of the preceding claims, wherein the retaining means (60) comprises a connecting section (80) adapted to connect the first and second gripping portions (61; 62) with each other.
6. A gasket arrangement (250) for a heat exchanger plate (200) comprising a gasket (220) comprising a fluid sealing loop and a retaining means (60) according to any one of claims 1 to 5.
7. The gasket arrangement of claim 6, wherein the finger members (65-69; 691-694) have different lengths in the longitudinal direction (l) of the retaining means (60) and the longer finger members are connected or integrated to the gasket (220).
8. The gasket arrangement according to any one of claims 6-7, wherein the gasket (220) and the retaining means (60) are connected to or integrated with each other to form a one-piece construction.
9. The gasket arrangement according to any one of claims 6-8, wherein a section of the gasket (220) is configured to function as a connecting portion (80) for the first gripping portion (61) and the second gripping portion (62).
10. The gasket arrangement according to any one of claims 6-9, wherein the retaining means (60) and the gasket (220) comprise or consist of the same or different materials.
11. A heat exchanger plate (200) having two opposite side surfaces (91; 92), an extension in a longitudinal (l), transversal (t) and thickness (d) direction of the plate (200), and comprising an edge portion (9) comprising a recess (50) configured to fit a carrying bar (30), wherein the heat exchanger plate (200) comprises the retaining means (60) of any one of claims 1 to 5 or the gasket arrangement (250) of any one of claims 6-10, wherein the retaining means (60) is arranged such that the first gripping portion (61) and the second gripping portion (62) are arranged at a respective lateral side of the recess (50) and such that at least one of the transversal portions (63; 64) has a transversal extension adapted to extend over an edge of the recess (50).
12. The heat exchanger plate according to claim 11, wherein the heat exchanger plate (200) has a substantially rectangular shape and comprises an upper edge (9), lower edge (10), two side edges (7, 8) and a groove for the gasket (220) on at least one side surface (91) thereof, and wherein the recess (50) is arranged at the upper (9) or lower edge (10) of the plate.
13. The heat exchanger plate according to claim 11 or 12, wherein the retaining means (60) comprises at least two finger members (65-69; 691-694), which

are arranged to engage the edge (9) of the heat exchanger plate (200) such that at least one of the finger members (65-69; 691-694) is positioned on each side of the two opposite side surfaces (91; 92) of the plate (200), and wherein the transversal portions (63; 64) of the retaining means (60) are adapted to extend in proximity to or along the edge (9) of the plate. 5

14. The heat exchanger plate according to any one of claims 11 to 13, wherein the heat exchanger plate (200) comprises a corrugated edge portion (9) comprising a series of crests (94) and troughs (93) in an area extending outwards of the recess (50) along the edge (9) of the plate (200), and wherein the finger members (65-69; 691-694) are adapted to be positioned in the troughs (93). 10 15

15. The heat exchanger plate according to any one of claims 11 to 14, wherein the finger members (65-69; 691-694) have two different lengths, wherein the shorter finger members are adapted to be positioned on one side (92) of the plate (200) and the longer finger members are adapted to be positioned on the opposite side (91) of the plate (200) comprising the gasket (220). 20 25

16. The heat exchanger plate according to any one of claims 11 to 15, wherein the retaining means (60) comprises a connecting section (80), which has a shape adapted to surround the periphery of the recess (50). 30

17. A plate heat exchanger (100) comprising a frame and a plurality of stacked heat exchanger plates (200) of any one of claims 11 to 16, wherein the plates are supported by at least one carrying bar (30) adapted to be fitted in the recess (50) of each heat exchanger plate (200). 35 40

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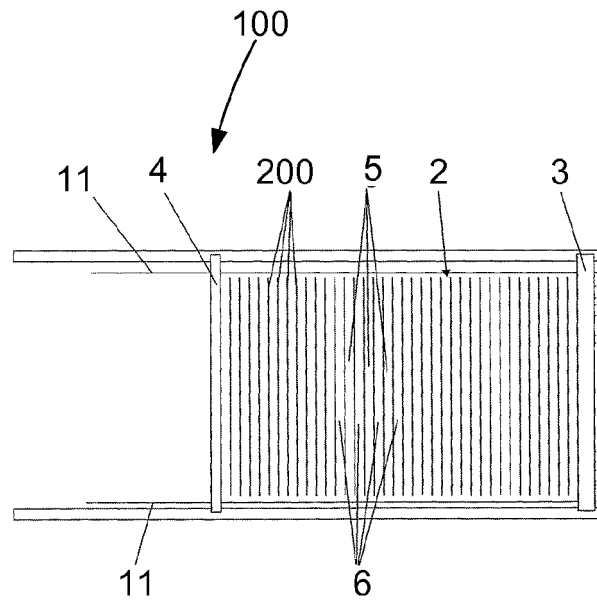
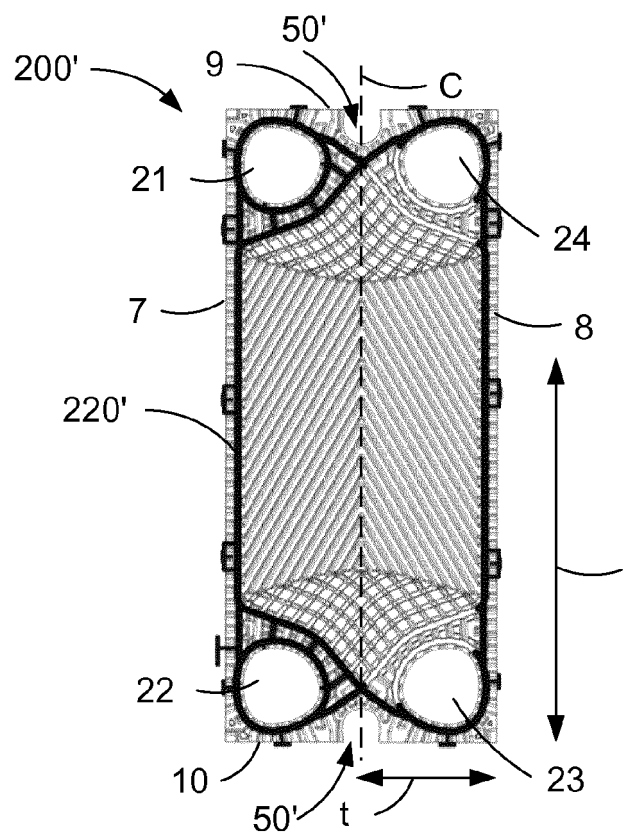


Fig. 1



PRIOR ART

Fig. 2

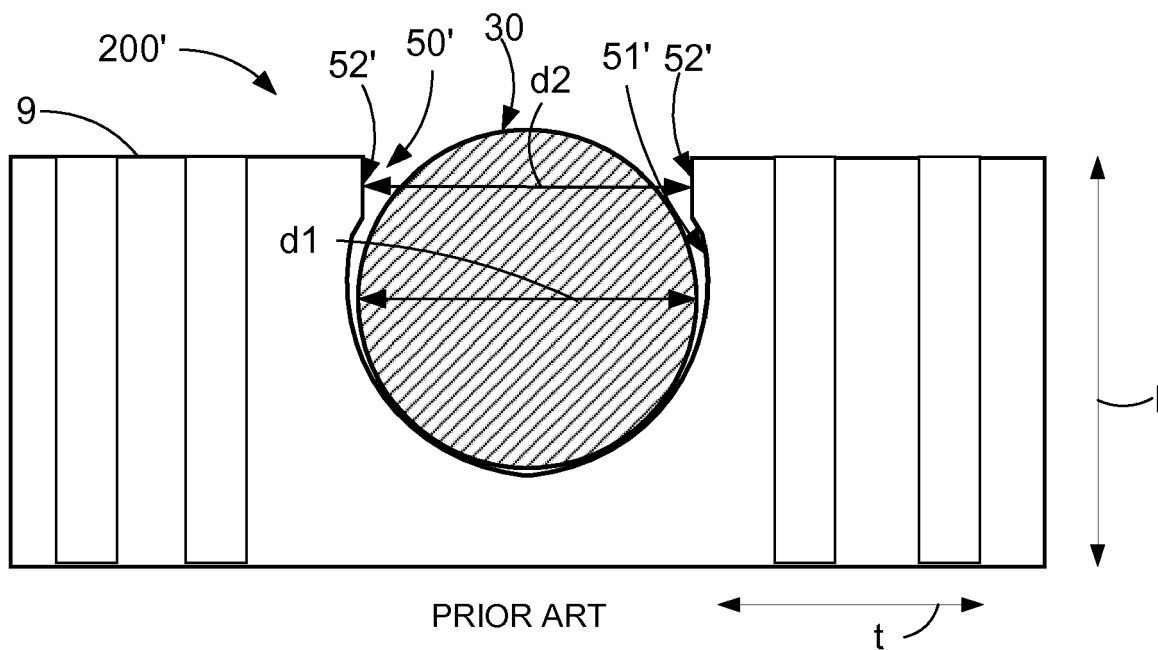


Fig. 3

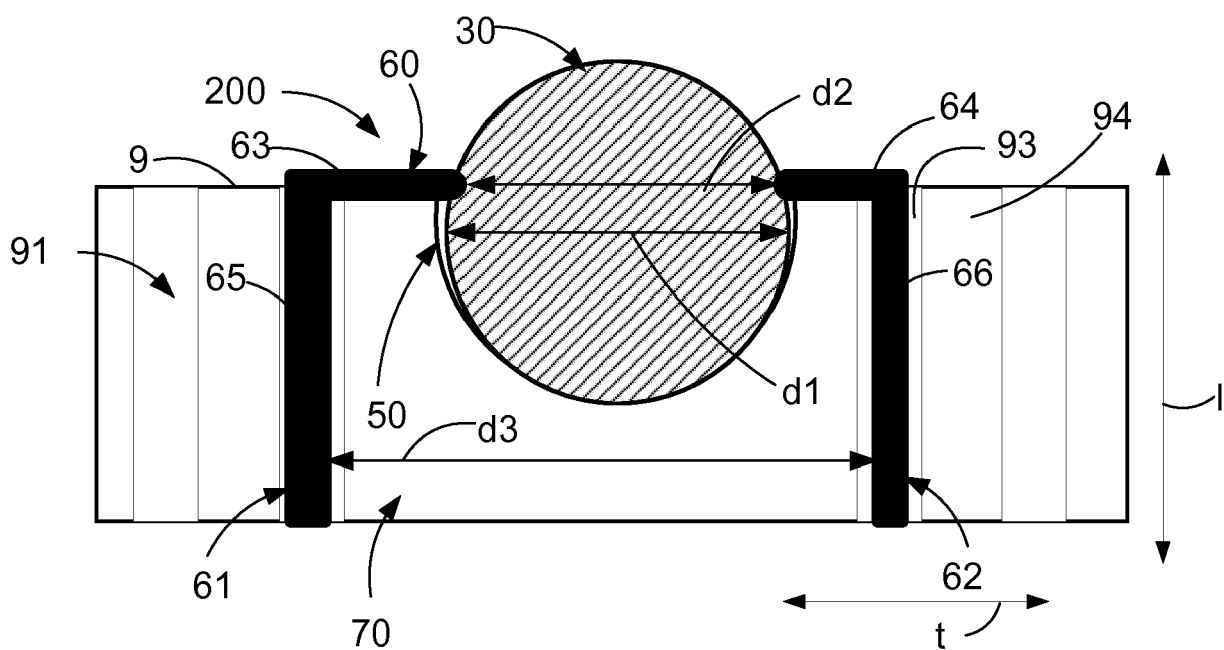


Fig. 4

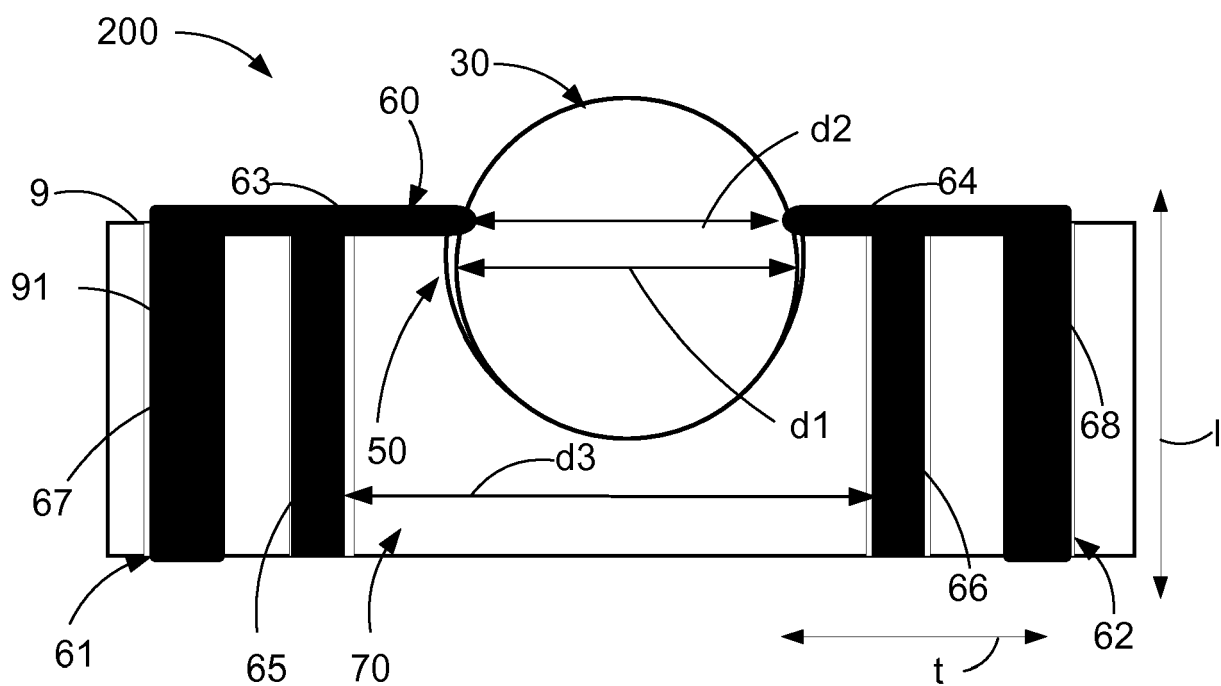


Fig. 5

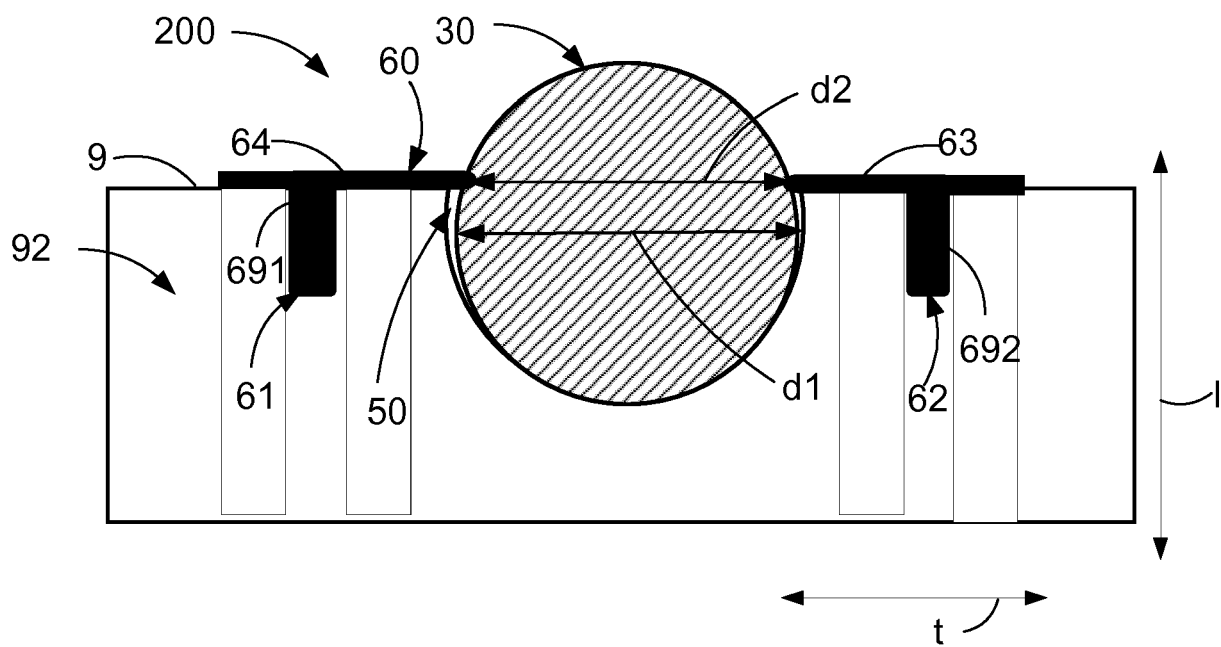
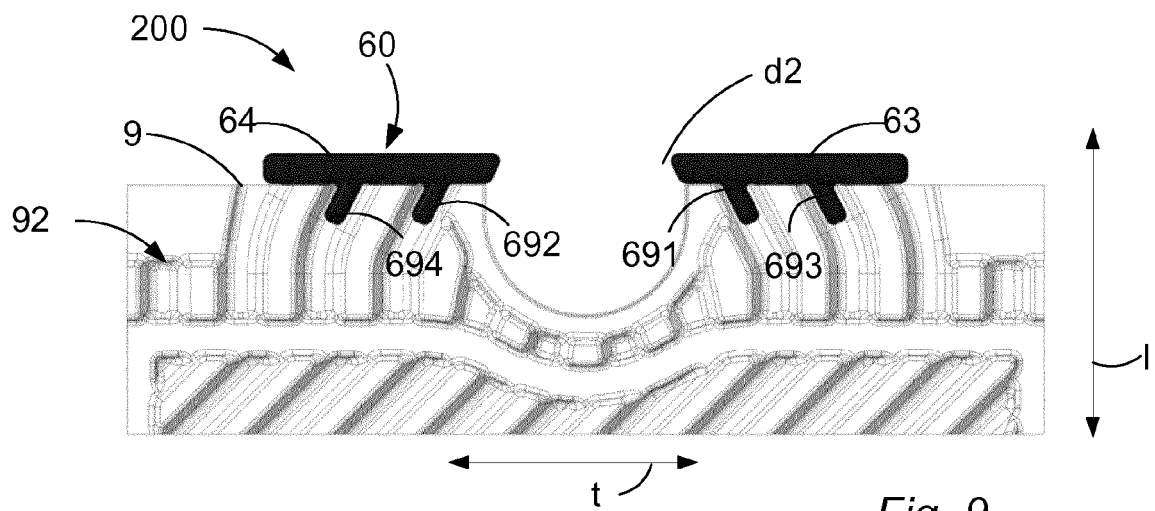
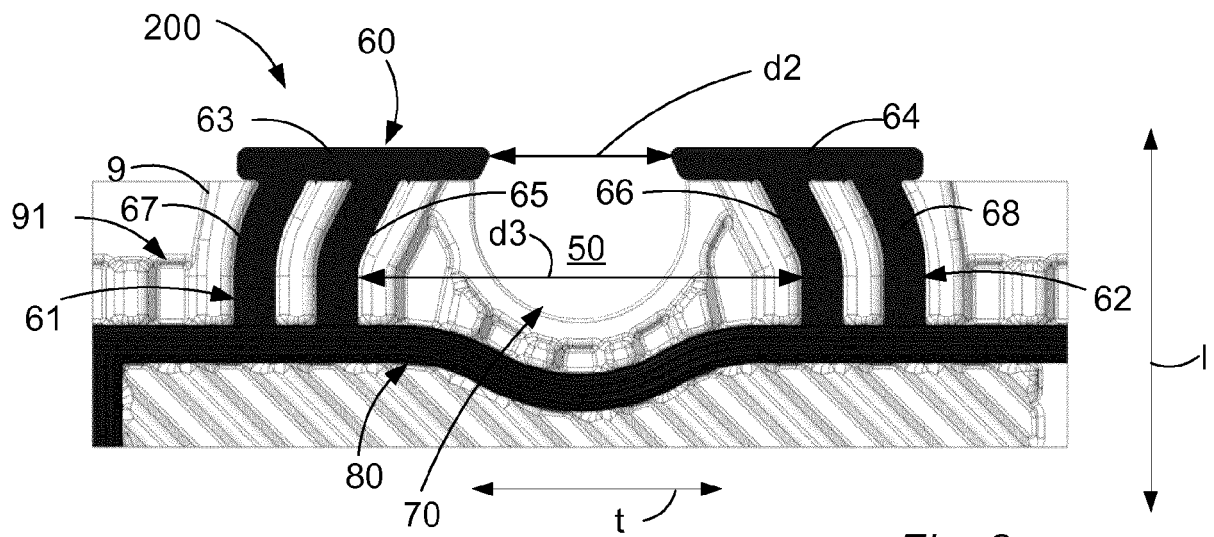
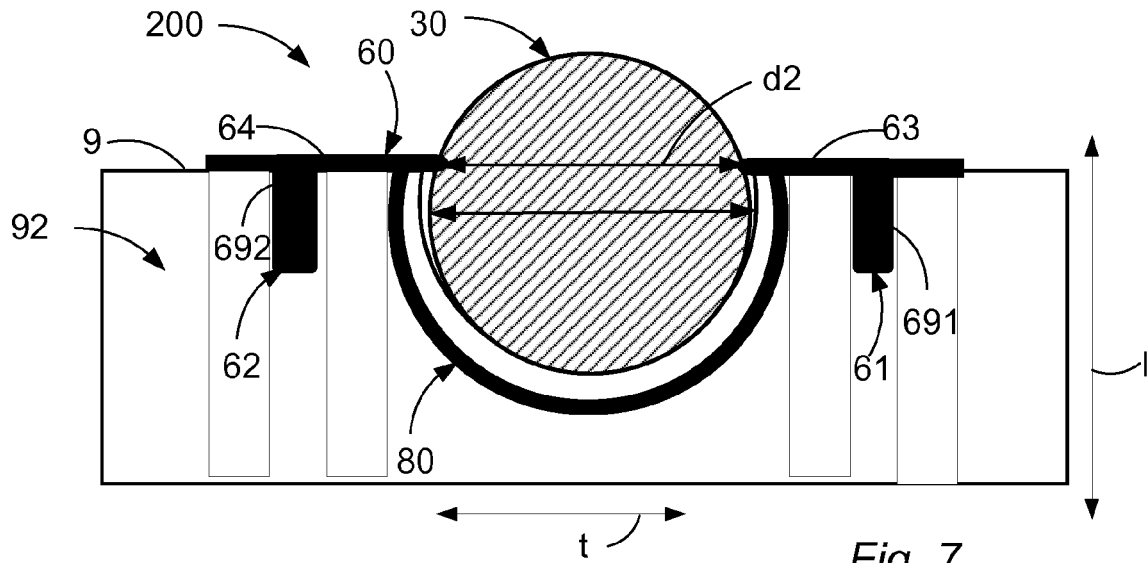


Fig. 6



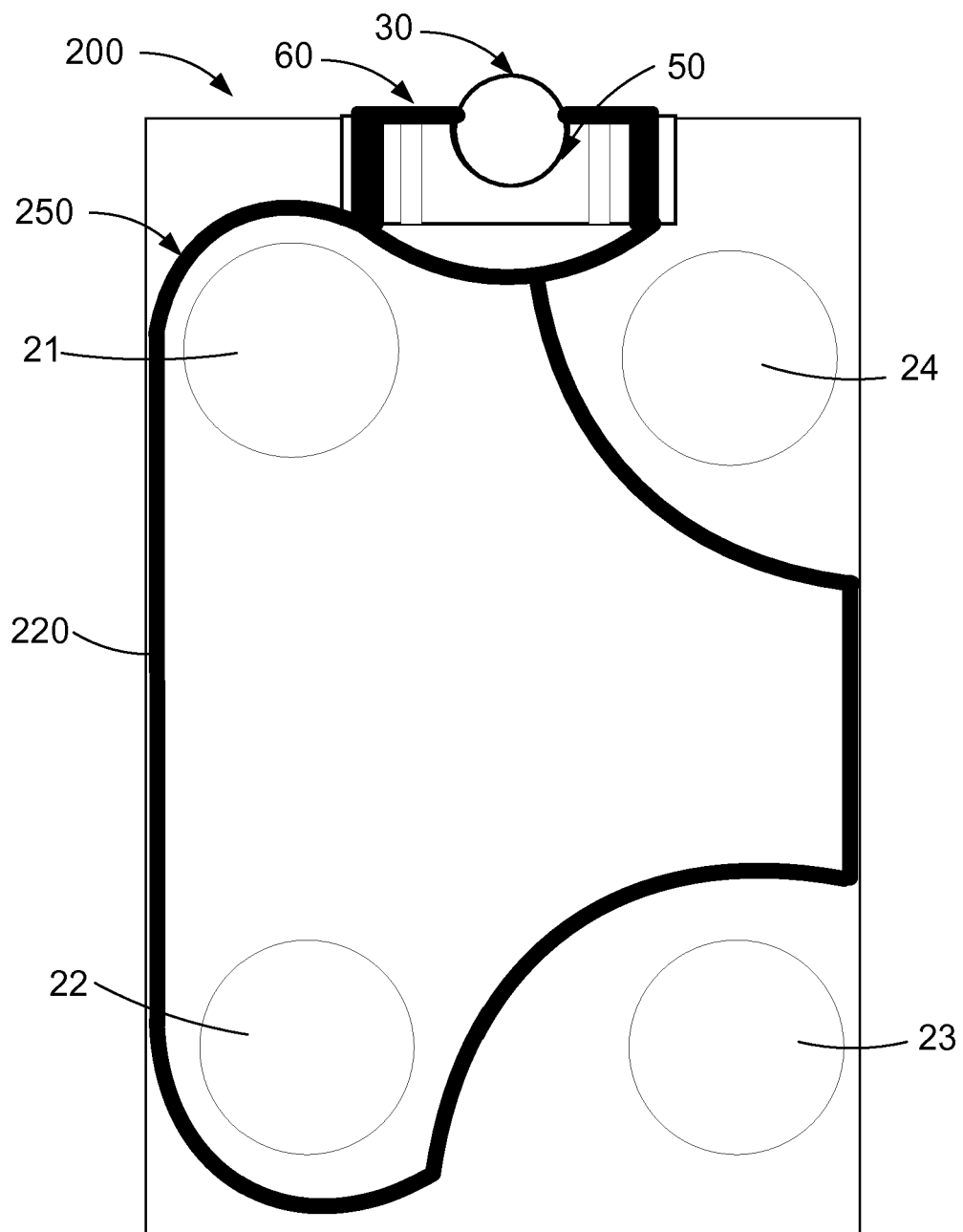


Fig. 10



EUROPEAN SEARCH REPORT

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Place of search Munich		Date of completion of the search 19 February 2020	Examiner Vassoille, Bruno
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