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(54) **HEAT EXCHANGER PORT INSERT**

(57) A heat exchanger port insert (38, 40) is provided. It comprises a tubular portion (42, 56) and a flange (44) projecting from an outside (52, 58) of the tubular portion (42, 56). The heat exchanger port insert (38, 40) is characterized in that the flange (44) comprises an annular inner portion (46) and a first fastening projection (48) having an outer contour (60). The inner portion (46) comprises an annular inner edge (50) along which the inner portion (46) joins the tubular portion (42, 56). The first fastening projection (48) protrudes from an annular outer edge (54) of the inner portion (46) so as to give the flange (44) a locally increased width at the first fastening projection (48).

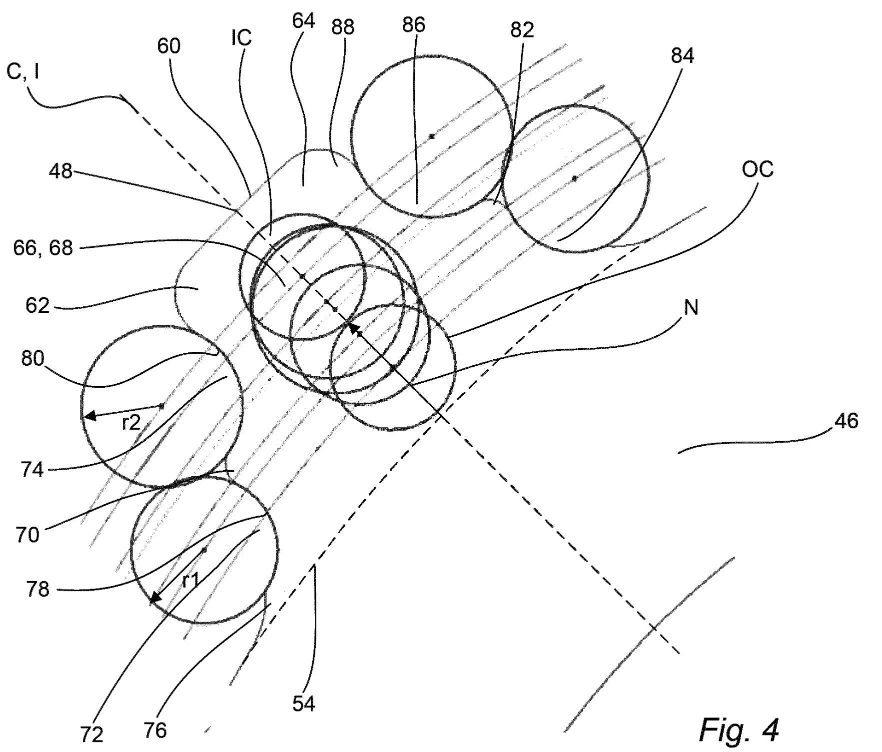

Fig. 4

EP 4 095 470 A1

Description

Technical Field

[0001] The invention relates to a port insert for a heat exchanger.

Background Art

[0002] Plate heat exchangers, PHEs, typically comprise two end plates in between which a number of heat transfer plates are arranged in an aligned manner, i.e. in a stack or pack.

[0003] In one type of well-known PHEs, the so called gasketed PHEs, gaskets are arranged between the heat transfer plates in gasket grooves pressed in the heat transfer plates. The end plates, and therefore the heat transfer plates, are pressed towards each other by some kind of tightening means, whereby the gaskets seal between the heat transfer plates. Parallel flow channels, defined by the gaskets, are formed between the heat transfer plates, one channel between each pair of adjacent heat transfer plates. Two fluids of initially different temperatures, which are fed to/from the PHE through portholes of the endplates, may flow alternately through every second channel for transferring heat from one fluid to the other. The fluids enter/exit the channels through inlet/outlet portholes in the heat transfer plates which form inlet/outlet ports of the PHE communicating with the portholes of the endplates.

[0004] Thus, at least some of the portholes of the end plates of the PHE are feeding portholes used to feed the fluids to and from the PHE, while the rest of the portholes are blind portholes not used for fluid feed. A set of connection means, such as studbolts, is provided for each of the portholes of the endplates. Typically, the studbolts are arranged equidistantly around the portholes and project from an outside of the endplates to enable connection of external fluid connections for the feeding portholes and blind covers for the blind portholes.

[0005] To prevent fibers and solids contained in the fluids from entering the channels and cause fouling of the PHE, filters may be arranged in the inlet ports of the PHE. A known filter arrangement for a PHE port comprises two port inserts. A first one of the port inserts includes a tubular filter and an annular flange extending radially from an outside of the tubular filter. A second one of the port inserts includes a short tube and an annular flange extending radially from an outside of the tube. The first port insert is inserted, from one side of the PHE, into the porthole of one of the endplates and further into the corresponding port such that the tubular filter is arranged inside the port and the flange abuts a gasket which, in turn, abuts the outside of the end plate. The second port insert is inserted, from the other side of the PHE, into the corresponding porthole of the other one of the end plates and further into the port such that the tube is arranged inside the port and the flange abuts a gasket which, in turn, abuts the outside of the end plate. Arranged like that, the tube of the second port insert will project into the filter of the first port insert, and the filter will, along a short end section thereof, surround the tube. To center the filter inside the port, the flanges of the first and second port inserts should typically be concentrically arranged with the respective portholes of the end plates. The flanges are therefore dimensioned after the positioning of the studbolts around the portholes of the endplates such as to enable for the studbolts to be positioned around, and engage with an outer edge of, the flanges to position them properly with respect to the portholes.

[0006] Normally, each PHE model has a plurality of different connection standards, each connection standard having its specific positioning, size and number of the studbolts. This means that a great number of different filter arrangement with different flange dimeters must be provided, typically one filter arrangement for each connection standard.

[0007] Further, for example in connection with maintenance of the PHE, removal of the filter, and thus the first and second port inserts, may be necessary. To facilitate this removal, the first and second port inserts of the known filter arrangement comprises handles in the form of bars welded to an inner edge of, and extending diametrically within, the flanges of the first and second port inserts. Sometimes, these bars come loose when they are pulled, which makes removal of the filter difficult.

[0008] In view of the above, there is room for improvement within the field of filter arrangements for PHEs.

Summary

[0009] An object of the present invention is to provide a port insert for a heat exchanger which reduces the number of different filter arrangements that must be provided for a certain PHE model, and which also removes the need for handles for easy removal of the port insert. The basic concept of the invention is to give the port insert a design that fits different connection standards and that enable simple and non-destructive pulling of the port insert. The port insert is defined in the appended claims and discussed below.

[0010] A heat exchanger port insert, hereinafter also referred to as just "port insert", according to the invention comprises a tubular portion and a flange projecting from an outside of the tubular portion. The heat exchanger port insert is characterized in that the flange comprises an annular inner portion and a first fastening projection. The first fastening projection has an outer contour. The inner portion comprises an annular inner edge along which the inner portion joins the tubular portion. The first fastening projection protrudes from an annular outer edge of the inner portion so as to give the flange a locally increased width at the first fastening projection.

[0011] The tubular portion may be a filter or a solid tube.

[0012] The tubular portion may have any suitable cross section, constant or varying, such as a circular, oval or smooth triangular cross section, typically depending on the design of the ports of the heat exchanger that the port insert is arranged to be used in. Similarly, the flange may have any suitable design. Typically, the design of the inner portion of the flange, and especially the inner edge of the inner portion, is adapted to the design of the tubular portion. Further, typically, the design of the inner portion of the flange is adapted to the design of the portholes in the endplates of the heat exchanger that the port insert is arranged to be used in.

[0013] The inner portion of the flange may have an essentially constant width along its annular extension.

[0014] The width of the flange may be measured perpendicular to an annular extension of the inner portion of the flange.

[0015] The inner portion and the first fastening projection of the flange may be integrally formed. Alternatively, the first fastening projection may be fixed to the inner portion by welding, screws or any other suitable method.

[0016] The first fastening projection is arranged to engage with connection means arranged around one of the portholes of one of the endplates of the heat exchanger that the port insert is arranged to be used in. Thereby, the flange of the port insert is fixed or attached to the endplate while the tubular portion is centered in the corresponding port inside the heat exchanger. The first fastening projection may be designed in an endless number of ways to enable use of one and the same port insert for heat exchangers having different positionings, numbers, types, etc. of connection means. In that the first fastening projection protrudes from the inner portion of the flange, it may easily be grabbed and pulled, for example to remove the port insert from the plate heat exchanger.

[0017] The first fastening projection may be arranged to engage with connection means in the form of bolts or pins, threaded or not. Then, the port insert may be so designed that the first fastening projection comprises a first bolt, or pin, reception space. Such a design may enable a reliable attachment of the port insert to heat exchangers of conventional designs.

[0018] As said above, the first fastening projection may have many different configurations. According to one embodiment, the first fastening projection branches into a first and a second projection portion extending in a direction away from the inner portion of the flange. Further, the first bolt reception space comprises a cavity defined by the first and the second projection portion. Thus, the cavity of the first bolt reception space extends between the first and the second projection portion. The first and second projection portions may be separated as from a distance ≥ 0 from the outer edge of the inner portion of the flange. The first and second projection portions may merge again so as to form a closed cavity. This embodiment may allow reliable and strong containment of a connection means, such as a bolt, from more than one direction, in a mechanically straightforward way.

[0019] The cavity may be designed in many different ways. According to one embodiment of the invention the cavity has a finite number of symmetry axes, which means that the cavity, when the port insert is viewed from above, has another shape than a circular one. The connection means of a plate heat exchanger typically have a circular cross section. Thus, this embodiment of the invention may enable a tight engagement between an inner edge of the cavity, which is defined by the first and second projection portions, and connection means of different sizes and/or positionings.

[0020] As an example, the cavity may have a maximum of two symmetry axes, which may enable a well-defined engagement between the inner edge of the cavity and connection means of different sizes and/or positionings.

[0021] The port insert may be such that a longitudinal extension of the cavity, which is measured in a normal direction of the outer edge of the inner portion, is larger than a transverse extension of the cavity. The transverse extension of the cavity is perpendicular to the longitudinal extension of the cavity. This configuration may enable a tight engagement between the inner edge of the cavity and connection means arranged on different distances from a center of a porthole of an endplate.

[0022] The transverse extension of the cavity may be varying along the longitudinal extension of the cavity. This configuration may enable a tight engagement between the inner edge of the cavity and connection means of different sizes arranged on different distances from a center of a porthole of an endplate.

[0023] The port insert may be so designed that a shape, and thus the inner edge, of the cavity is defined by an outer contour of an object formed by a plurality of, i.e. two or more, imaginary circles of different diameters. The circles are aligned along an imaginary straight line, and each two adjacent ones of the circles are partly overlapping. The imaginary straight line may be parallel to said normal direction of the outer edge of the inner portion. This design may enable a well-defined and tight engagement between the inner edge of the cavity and connection means of different sizes and positionings.

[0024] The first fastening projection may comprises a second bolt, or pin, reception space comprising a first recess in a first outer edge portion of the first fastening projection. Such a design may enable a reliable fixing of the port insert in heat exchangers of conventional designs.

[0025] The above referenced first outer edge portion may be arranged anywhere along an outer edge of the first fastening projection, such as along, and at a distace from, the outer edge of the inner portion of the flange. However, according to one embodiment of the invention, the first outer edge portion extends from the outer edge of the inner portion of the flange in a direction away from the inner portion. This arrangement may enable a mechanically straightforward design of port insert.

[0026] According to one embodiment of the inventive port insert, a first contour portion of the outer contour of the first fastening projection, which first contour portion defines the above referenced first recess in the first outer edge portion of the first fastening projection, has the essential shape of a circular arc of a circle of radius r1. As said above, the connection means of a plate heat exchanger typically have a circular cross section. Thus, this embodiment may enable a well-defined and tight engagement between the first recess and a connection means and, thus, a strong and reliable attachment of the port insert to the endplate of a heat exchanger.

[0027] The port insert may be so designed that the second bolt reception space further comprises a second recess in said first outer edge portion of the first fastening projection. The first recess may be arranged between second recess and the outer edge of inner portion of flange. The provision of this second recess besides the first recess may enable a well-defined engagement between the first outer edge portion of the first fastening projection and connection means arranged on different distances from a center of a porthole of an endplate.

[0028] A second contour portion of the outer contour of the first fastening projection, which second contour portion defines the second recess, may have the essential shape of a circular arc of a circle of radius r2. The radius r2 may, or may not, be equal to the above referenced radius r1. This design may enable a well-defined and tight engagement between the first outer edge portion of the first fastening projection and connection means, possibly of different sizes, arranged on different distances from a center of a porthole of an endplate.

[0029] The port insert may be such that the first fastening projection comprises a third bolt reception space comprising a third recess in a second outer edge portion of the first fastening projection. The third recess may be designed in a corresponding way as the first recess. The provision of the third recess may enable an increased engagement between the port insert and the connection means of a plate heat exchanger and/or even further increase the number of connection standards that fits with the port insert.

[0030] The second outer edge portion may extend from the outer edge of the inner portion of the flange in a direction away from the inner portion. Thus, the first outer edge portion referred to above and the second outer edge portion may extend along each other and be opposite edge portions of the first fastening projection.

[0031] The first fastening projection may have a symmetry axis coinciding with said normal direction of the outer edge of the inner portion.

[0032] The third bolt reception space may further comprise a fourth recess in said second outer edge portion of the first fastening projection. The fourth recess may be designed in a corresponding way as the second recess.

[0033] The port insert may be so designed that the flange further comprises a second fastening projection. The second fastening projection may protrude from the annular outer edge of the inner portion so as to give the flange a locally increased width at the second fastening projection. The second fastening projection may be separated from, and designed like, the first fastening projection. The first and second fastening projections may be oppositely arranged so as to give the flange a symmetry axis which may coincide with said normal direction of the outer edge of the inner portion. Naturally, the flange may comprise even further fastening projections, possibly an even number to allow flange symmetry. The fastening projections of the flange may be equidistantly arranged along the outer edge of the inner portion.

[0034] Still other objectives, features, aspects and advantages of the invention will appear from the following detailed description as well as from the drawings.

Brief Description of the Drawings

[0035] The invention will now be described in more detail with reference to the appended schematic drawings, in which

Fig. 1 is a perspective view of a plate heat exchanger and a filter arrangement,

Fig. 2a is a front view of a first port insert of the filter arrangement,

Fig. 2b is a cross sectional/side view of the first port insert in Fig. 2a,

Fig. 3a is a front view of a second port insert of the filter arrangement,

Fig. 3b is a cross sectional view/side view of the second port insert in Fig. 3a,

Fig. 4 schematically illustrates studbolt engagement positions for a fastening projection,

Fig. 5 schematically illustrates engagement between a studbolt and a fastening projection,

Fig. 6 schematically illustrates engagement between two studbolts and a fastening projection, and

Fig. 7 schematically illustrates engagement between a flange and different studbolt configurations.

Detailed Description

[0036] In Fig. 1 a gasketed plate heat exchanger 2 like the one described by way of introduction is illustrated. It comprises a first end plate 4 and a second end plate 6, which sometimes are referred to as frame plate and pressure plate, respectively. The end plates 4 and 6 are here made of carbon steel but they can be made of any suitable material. The end plate 4 has an inside 8 and an outside 10 and comprises four portholes 12, 14, 16 and 18. Similarly, the end plate 6 has an inside 20 and an outside 22 and comprises four portholes 24, 26, 28 and 30. As illustrated in Fig. 1, the endplates 4 and 6 comprise a stainless steel lining for each of the portholes 12-30. Further, a set of studbolts 32 is provided for each of the portholes 12-30. The studbolts 32 are fixed to the endplates 4 and 6 and project from the outsides 10 and 22 of the endplates in a normal direction thereof. The studbolts 32 of each of the sets are arranged equidistantly around the associated porthole and on the same distance from a center of the porthole.

[0037] The plate heat exchanger 2 further comprises a pack of aligned heat transfer plates 34 separated by gaskets (not illustrated). The heat transfer plates 34 each comprises four portholes (not illustrated). The portholes of the heat transfer plates 34 form four ports extending through the plate pack and aligned with the portholes 12-30 of the endplates 4 and 6. The lower port aligned with the portholes 16 and 28 of the endplate 4 and 6, respectively, is an inlet port provided with a filter arrangement 36 (illustrated separately and dismounted in Fig. 1). The plate heat exchanger 2 can be provided with additional filter arrangements.

[0038] The filter arrangement 36 is illustrated in more detail in Figs. 2a and 2b, which illustrate a first port insert 38 of the filter arrangement 36, and Figs. 3a and 3b, which illustrate a second port insert 40 of the filter arrangement 36.

[0039] The first port insert 38 comprises a tubular portion 42 and a flange 44, which here are made of stainless steel but which may be of any suitable material, such titanium or SMO. The tubular portion 42 is a circular cylindrical perforated pipe while the flange 44 is a plate comprising an annular inner portion 46 and a number, here four but it could be more or less, fastening projections 48. The inner portion 46 has an essentially constant width along its annular extension and a circular inner edge 50 with a slightly larger diameter than an outside 52 of the tubular portion 42. The flange 44 is welded to an end of the tubular portion 42 and projects perpendicularly from the outside 52 of the tubular portion 42. The fastening projections 48 are integrally formed with the inner portion 46 and project from a circular outer edge 54 thereof. Further, the fastening projections 48 have a similar design and are equidistantly arranged so as to make the flange 44 symmetric with respect to two perpendicular center axes of the flange 44, which center axes each extends through two opposing ones of the fastening projections 48.

[0040] The second port insert 40 comprises a tubular portion 56 and a flange 44 designed as discussed above (even if the dimensions of the flanges 44 of the first and second port inserts 38 and 40 may differ). The tubular portion 56 is a pipe with circular cross section, which pipe here is made of stainless steel but which may be of any suitable material, such titanium or SMO. The tubular portion 56 is tapered, and thus conical, at a free end. A maximum diameter of an outside 58 of the tubular portion 56 is slightly smaller than the diameter of the inner edge 50 of the flange 44, and slightly smaller than an inner diameter of the tubular portion 42 of the first insert 38. The flange 44 is welded to another end of the tubular portion 56 and projects perpendicularly from the outside 58 of the tubular portion 56.

[0041] With reference to Figs. 1, 2a-2b and 3a-3b, the first port insert 38 is inserted into the porthole 28 of the endplate 6 and further into the corresponding port such that the tubular portion 42 extends inside the port and the flange 44 abuts a porthole gasket (not illustrated) which, in turn, abuts the outside 22 of the endplate 6. Similarly, the second port insert 40 is inserted into the porthole 16 of the endplate 4 and further into the corresponding port such that the tubular portion 56 extends inside the port and the flange 44 abuts a porthole gasket (not illustrated) which, in turn, abuts the outside 10 of the endplate 4. When the filter arrangement 36 is properly mounted, the tubular portion 56 of the second port insert 40 will further project into the tubular portion 42 of the first port insert 38, which will result in an overlap of the tubular portions 42 and 56.

[0042] To center the first and second port inserts 38 and 40 in the portholes 28 and 16 of the endplates 6 and 4, respectively, and in the corresponding port, and to attach them to the plate heat exchanger 2, the flange 44 of the first port insert 38 is arranged to engage with the studbolts 32 arranged around the porthole 28, while the flange 44 of the second port insert 40 is arranged to engage with the studbolts 32 arranged around the porthole 16. The engagement between the flanges 44 and the studbolts 32 may differ depending on the size, number and positioning of the studbolts, which, in turn, depends on the connection standard of the plate heat exchanger 2.

[0043] In Fig. 4, one of the fastening projections 48 of one of the flanges 44 of the first and second port inserts 38 and 40 is illustrated in more detail. The fastening projection 48 has an outer contour 60 defining its extension from the inner portion 46 of the port insert. The border between the fastening projection 48 and the inner portion 46 is illustrated with a broken line. The fastening projection 48 is symmetric with respect to a center axis C of the fastening projection 48 which coincides with one of the above referenced center axes of the corresponding flange 44, and with a normal direction N of the outer edge 54 of the inner portion 46. It comprises first and second projection portions 62 and 64, respectively, the border between which is defined by the center axis C. Close to the inner portion 46 the first and second projection portions 62 and 64 are integrally formed. Then, they are separated from each other to create a first bolt reception space 66 in the form of a cavity 68 before they are merged again to close the cavity 68.

[0044] The cavity 68 has one symmetry axis only which coincides with the center axis C. The cavity 68 is elongate with a longitudinal extension of the cavity 68 being measured in the normal direction N and a transverse extension of the cavity 68 being perpendicular to the longitudinal extension. As illustrated in Fig. 4, the cavity 68 has a shape defined by an outer contour OC of an object formed by a plurality, here five, imaginary circles IC of different diameters arranged with mutual partial overlaps along an imaginary straight line (illustrated dashed), which here coincides with the center axis C. Thereby, the the transverse extension of the cavity 68 is varying along the longitudinal extension of the cavity 68. Each of the imaginary circles IC defines a possible position in the cavity 68 for a studbolt 32 received in the first bolt reception space 66. Since there are five imaginary circles IC of different diameters, the cavity 68 is arranged to engage with studbolts 32 of five different diameters arranged on five different distances from a center of a porthole in an endplate.

[0045] The fastning projection 48 further comprises a second bolt reception space 70. In turn, the second bolt reception space 70 comprises a first recess 72 and a second recess 74 in a first outer edge portion 76 of the fastening projection 48. The first outer edge portion 76 extends from the outer edge 54 of the inner portion 46 of the flange 44, and the first recess 72 is arranged between the the inner portion 46 and the second recess 74. The first recess 72 is defined by a first contour portion 78 of the outer contour 60 of the fastening projection 48. As illustrated in Fig. 4, the first contour portion 78 has the shape of a circular arc of a circle of a first radius r1. The second recess 74 is defined by a second contour portion 80 of the outer contour 60 of the fastening projection 48. As illustrated in Fig. 4, the second contour portion 80 has the shape of a circular arc of a circle of a second radius r2. Each of the first and second recesses 72 and 74 defines a possible position for a studbolt 32 received in the second bolt reception space 70. Since the second radius r2 is larger than the first radius r1, the second recess 74 is adapted for engagement with a studbolt 32 of larger diameter than the first recess 72 is. Further, since the second recess 74 is arranged on an outside of the first recess 72, it is adapted for engagement with a studbolt 32 arranged on a larger distance from a center of a porthole in an endplate than a studbolt 32 arranged to engage with the first recess 72.

[0046] The fastning projection 48 further comprises a third bolt reception space 82. In turn, the third bolt reception space 82 comprises a third recess 84 and a fourth recess 86 in a second outer edge portion 88 of the fastening projection 48. The second outer edge portion 88 is opposing the first outer edge portion 76 and extends from the outer edge 54 of the inner portion 46 of the flange 44. The third and fourth recesses 84 and 86 of the third bolt reception space 82 corresponds to the first and second recesses 72 and 74 of the second bolt reception space 70. Further, the third bolt reception space 82 is a mirroring, along the center axis C of the fastening projection 48, of the second bolt reception space 70. Consequently, each of the third and fourth recesses 84 and 86 define a possible position for a studbolt 32 received in the third bolt reception space 82, the fourth recess 86 being adapted for engagement with a studbolt 32 of larger diameter, on a larger distance from a porthole center, than the third recess 84 is.

[0047] Thus, each of the fastening projections 48 defines a plurality of, here nine, different positions for engagement with studbolts 32 on different positions and of different sizes to adapt the first and second port inserts 38 and 40 for use with plate heat exchangers of different connection standards.

[0048] Fig. 5 illustrates the engagement between one of the fastening projections 48 and a studbolt 32 positioned and sized according to one connection standard, wherein the studbolt 32 is received in one of the five positions in the cavity 68. The diameter of the studbolt 32 is just slightly smaller than the diameter of the imaginary circle IC (Fig. 4) defining the position of the studbolt 32. Therefore, since an inner edge of the cavity 68 will extend on opposite sides of, and close to, possibly even in contact with, the studbolt 32, the flange 44 will be rotationally and radially locked by the studbolt 32.

[0049] Fig. 6 illustrates the engagement between one of the fastening projections 48 and two studbolts 32 positioned and sized according to another connection standard, wherein the studbolts 32 are received in a respective one of the first and third recesses 72 and 84, respectively. The diameter of the studbolts is just slightly smaller than double the first radius r1 (Fig. 4). Since the studbolts 32 will be arranged on opposite sides of, and close to, possibly even in contact with, the fastening projection 48, the flange 44 will be rotationally and radially locked by the studbolts 32.

[0050] Thus, when the cavity 68 of the fastening projections 48 are used to fasten the corresponding flange 44 to one of the end plates 4 and 6 of the plate heat exchanger 2, one studbolt 32 is received in one of the five positions in the cavity 68 of each one of the fastening projections 48. On the other hand, when the recesses 72, 74, 84 and 86 are used to fasten the corresponding flange 44 to one of the end plates 4 and 6 of the plate heat exchanger 2, two studbolts 32 are received in a respective one of the first and the third recesses 72 and 84, or in a respective one of the second and fourth recesses 74 and 86. Thus, the flange 44 is adaped for use with a total of seven different studbolt configurations, i. e. seven different connection standards of the plate heat exchanger 2, which are illustrated in Fig. 7.

[0051] Besides for making the filter arrangement 36 (Fig. 1) usable for different plate heat exchanger connection standards, the fastening projections 48 also makes it easy to grab and pull the the first and second port inserts 38 and 40 of the filter arrangement 36, which may facilitate removal of the filter arrangement 36 from the plate heat exchanger 2, for example in connection with maintenance.

[0052] In line with what was described by way of introduction, at least some of the portholes 12, 14, 16, 18, 24, 26, 28 and 30 of the end plates 4 and 6 of the plate heat exchanger 2 are feeding portholes used to feed the fluids to and from the PHE, while the rest of the portholes are blind portholes not used for fluid feed. The studbolts 32 together with suitable gaskets and nuts may be used to connect external fluid connections to the feeding portholes and blind covers to the blind portholes.

[0053] The above described embodiment of the present invention should only be seen as an example. A person skilled in the art realizes that the embodiment discussed can be varied in a number of ways without deviating from the inventive conception.

[0054] As an example, the fastening projections need not all be similarly designed, and the flange could comprise more or less fastening projections than four.

[0055] The tubular portion of the first port insert need not be a circular cylindrical perforated pipe but it could be formed in any suitable way, such as of mesh, net or coarse filter cloth stretched over a frame.

[0056] The fastening projections need not be symmetrical with reference to their respective center axes. Consequently, the third bolt reception space need not be a mirroring, along the center axis of the corresponding fastening projection, of the second bolt reception space. Further, one or both of the second and third bolt reception spaces could comprise more than two recesses.

[0057] In the above described embodiment, when the outer recesses of the fastening projections are used to fasten the corresponding flange to one of the end plates of the plate heat exchanger, two studbolts are received in two opposing ones of the recesses. In an alternative embodiment, the flange is attached by means of one recess and one studbolt only per fastening projection.

[0058] The flange need not be welded to the tubular portion but it could be attached to the tubular portion in any suitable way. The flange and the tubular portion could also be integrally formed.

[0059] Finally, the present invention could be used in connection with other types of plate heat exchangers than purely gasketed ones, e.g. plate heat exchangers comprising permanently joined heat transfer plates.

[0060] It should be stressed that the attributes first, second, third, etc. is used herein just to distinguish between species of the same kind and not to express any kind of mutual order between the species.

[0061] It should be stressed that a description of details not relevant to the present invention has been omitted and that the figures are just schematic and not drawn according to scale. It should also be said that some of the figures have been more simplified than others. Therefore, some components may be illustrated in one figure but left out on another figure.

Claims

1. A heat exchanger port insert (38, 40) comprising a tubular portion (42, 56) and a flange (44) projecting from an outside (52, 58) of the tubular portion (42, 56), **characterized in that** the flange (44) comprises an annular inner portion (46) and a first fastening projection (48) having an outer contour (60), the inner portion (46) comprising an annular inner edge (50) along which the inner portion (46) joins the tubular portion (42, 56), and the first fastening projection (48) protruding from an annular outer edge (54) of the inner portion (46) so as to give the flange (44) a locally increased width at the first fastening projection (48).

2. A heat exchanger port insert (38, 40) according to claim 1, wherein the first fastening projection (48) comprises a first bolt reception space (66).

3. A heat exchanger port insert (38, 40) according to claim 2, wherein the first fastening projection (48) branches into a first and a second projection portion (62, 64) extending in a direction away from the inner portion (46) of the flange (44), wherein the first bolt reception space (66) comprises a cavity (68) defined by the first and the second projection portion (62, 64).

4. A heat exchanger port (38, 40) insert according to claim 3, wherein the cavity (68) has a har finite number of symmetry axes.

5. A heat exchanger port insert (38, 40) according to any of claim 3-4, wherein the cavity (68) has ≤ 2 symmetry axes.

6. A heat exchanger port insert (38, 40) according to any of claims 3-5, wherein a longitudinal extension of the cavity (68), which is measured in a normal direction (N) of the outer edge (54) of the inner portion (46), is larger than a transverse extension of the cavity (68), the transverse extension of the cavity (68) being perpendicular to the longitudinal extension of the cavity (68).

7. A heat exchanger port insert (38, 40) according to claim 6, wherein the transverse extension of the cavity (68) is varying along the longitudinal extension of the cavity (68).

8. A heat exchanger port insert (38, 40) according to any of claims 3-7, wherein a shape of the cavity (68) is defined by an outer contour (OC) of an object formed by a plurality of imaginary circles (IC) of different diameters, which circles (IC) are aligned along an imaginary straight line (I), each two adjacent ones of the circles (IC) being partly overlapping.

9. A heat exchanger port insert (38, 40) according to any of the preceding claims, wherein the first fastening projection (48) comprises a second bolt reception space (70) comprising a first recess (72) in a first outer edge portion (76) of the first fastening projection (48).

10. A heat exchanger port insert (38, 40) according to claim 9, wherein the first outer edge portion (76) extends from the outer edge (54) of the inner portion (46) of the flange (44) in a direction away from the inner portion (46).

11. A heat exchanger port insert (38, 40) according to any of claims 9-10, wherein a first contour portion (78) of the outer contour (60) of the first fastening

projection (48), which first contour portion defines the first recess (72), has the essential shape of a circular arc of a circle of a first radius (r1).

12. A heat exchanger port insert (38, 40) according to any of claims 9-11, wherein the second bolt reception space (70) comprises a second recess (74) in said first outer edge portion (76) of the first fastening projection (48).

13. A heat exchanger port insert (38, 40) according to any of claims 9-12, wherein the first fastening projection (48) comprises a third bolt reception space (82) comprising a third recess (84) in a second outer edge portion (88) of the first fastening projection (48).

14. A heat exchanger port insert (38, 40) according to claim 13, wherein the second outer edge portion (88) extends from the outer edge (54) of the inner portion (46) of the flange (44) in a direction away from the inner portion (46).

15. A heat exchanger port insert (38, 40) according to any of the preceding claims, wherein the flange (44) further comprises a second fastening projection (48) protruding from the annular outer edge (54) of the inner portion (46) so as to give the flange (44) a locally increased width at the second fastening projection (48).

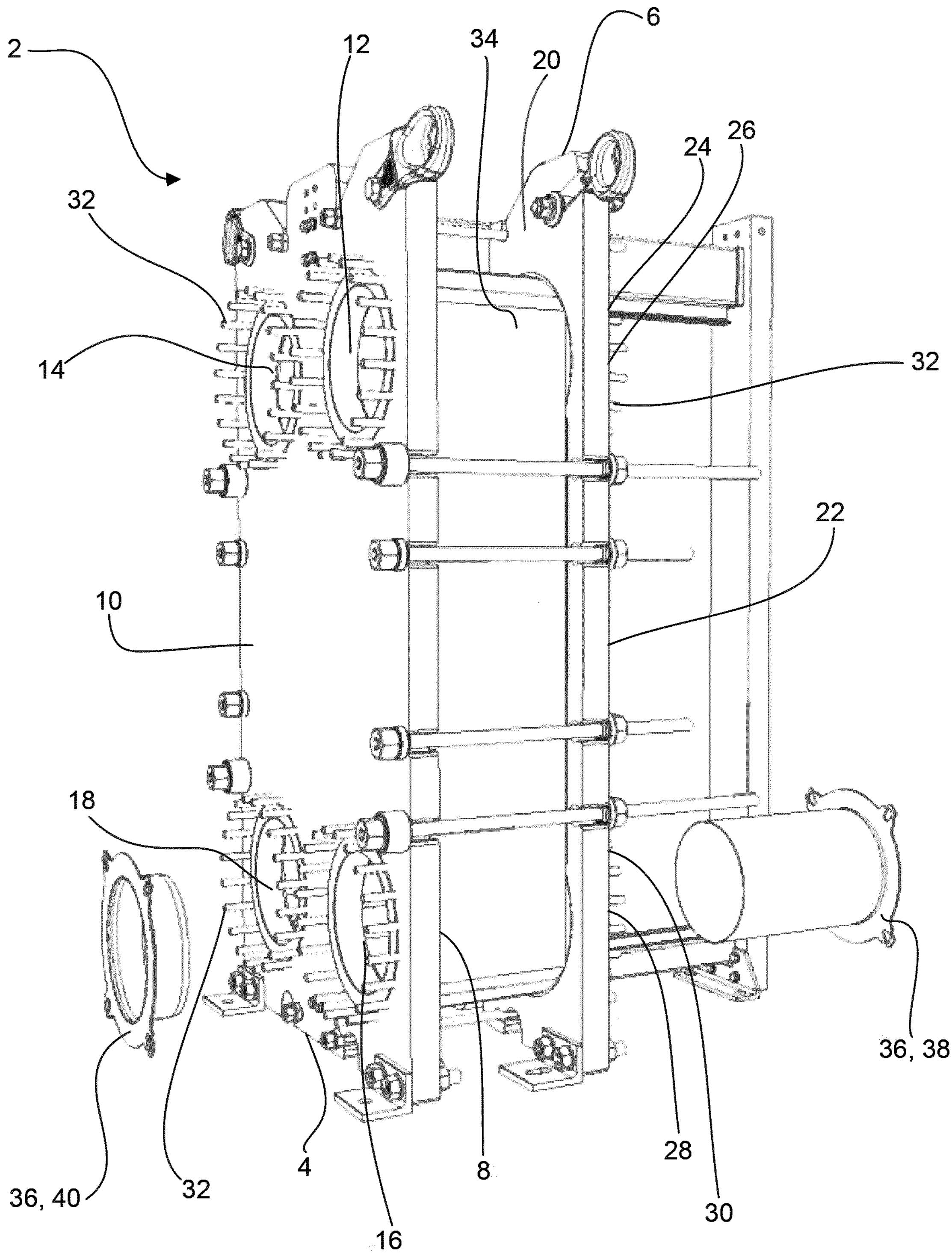

Fig. 1

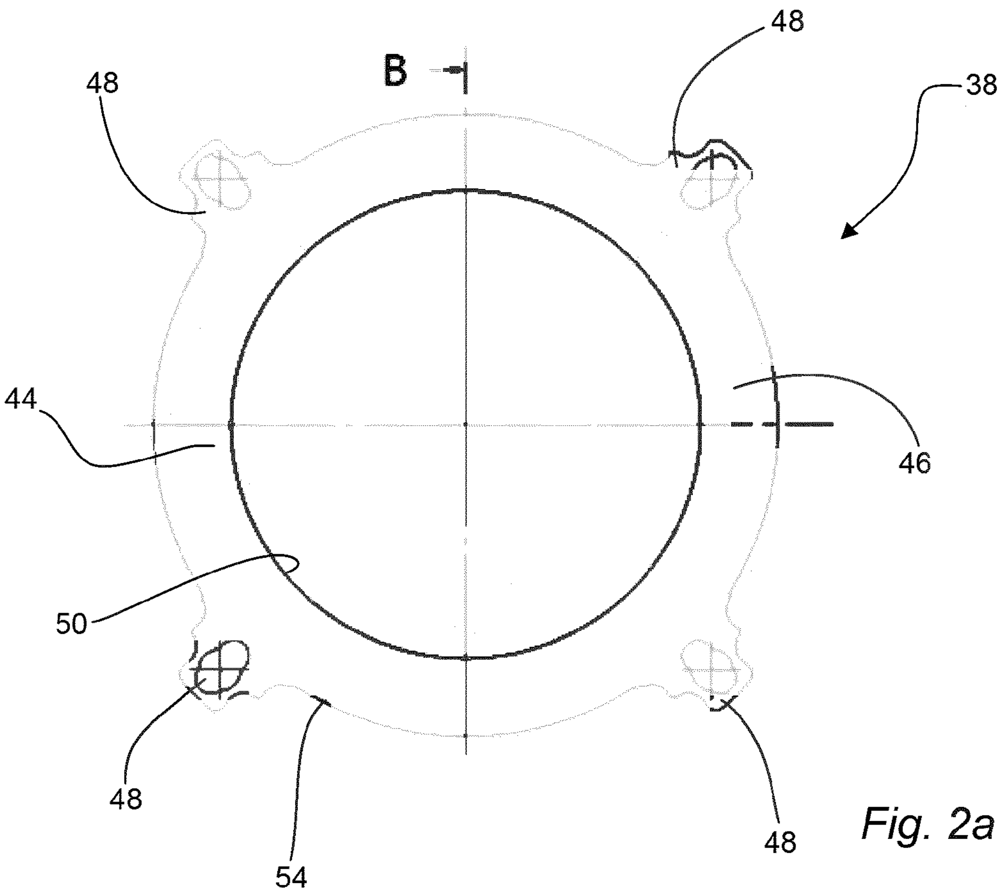

Fig. 2a

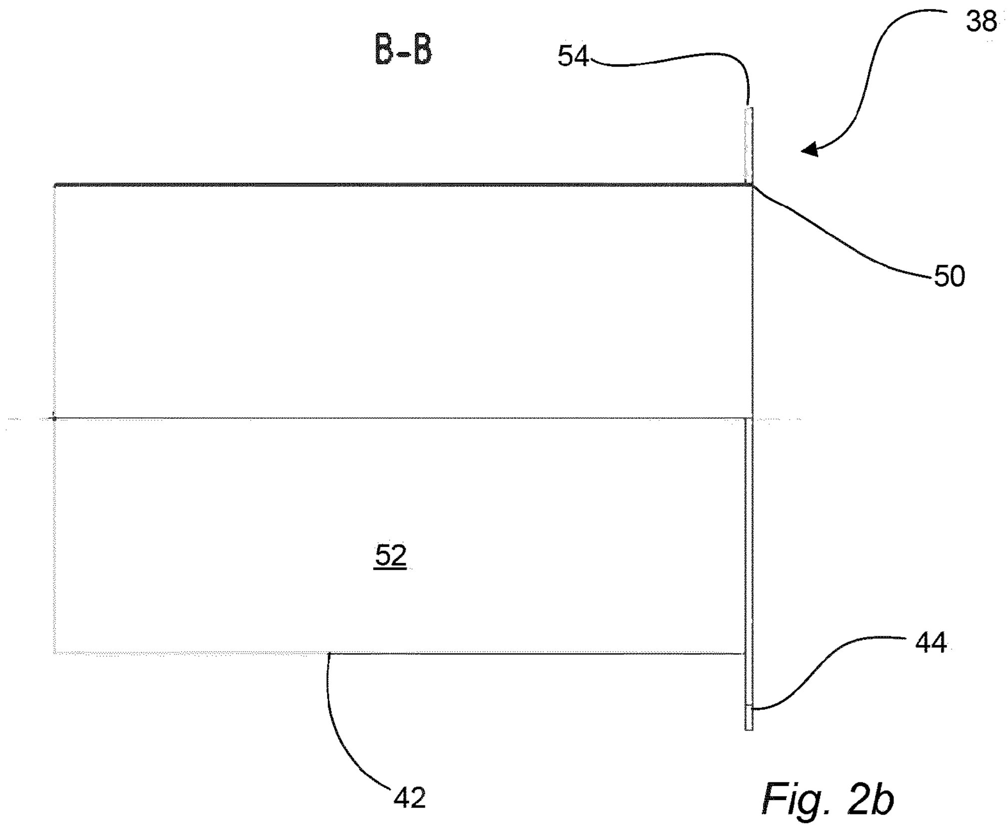

Fig. 2b

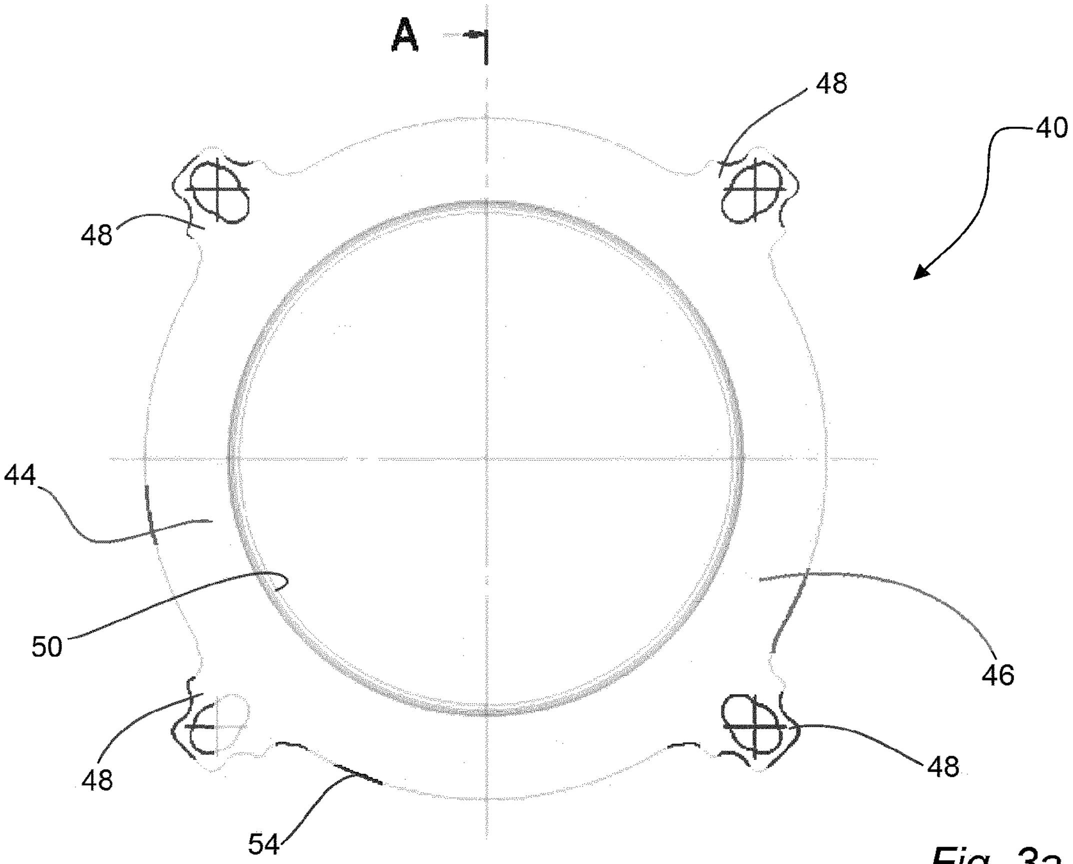

Fig. 3a

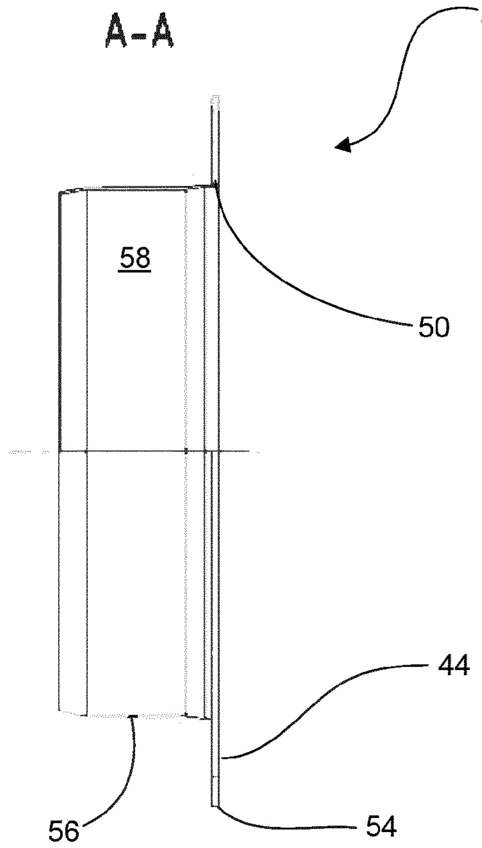

Fig. 3b

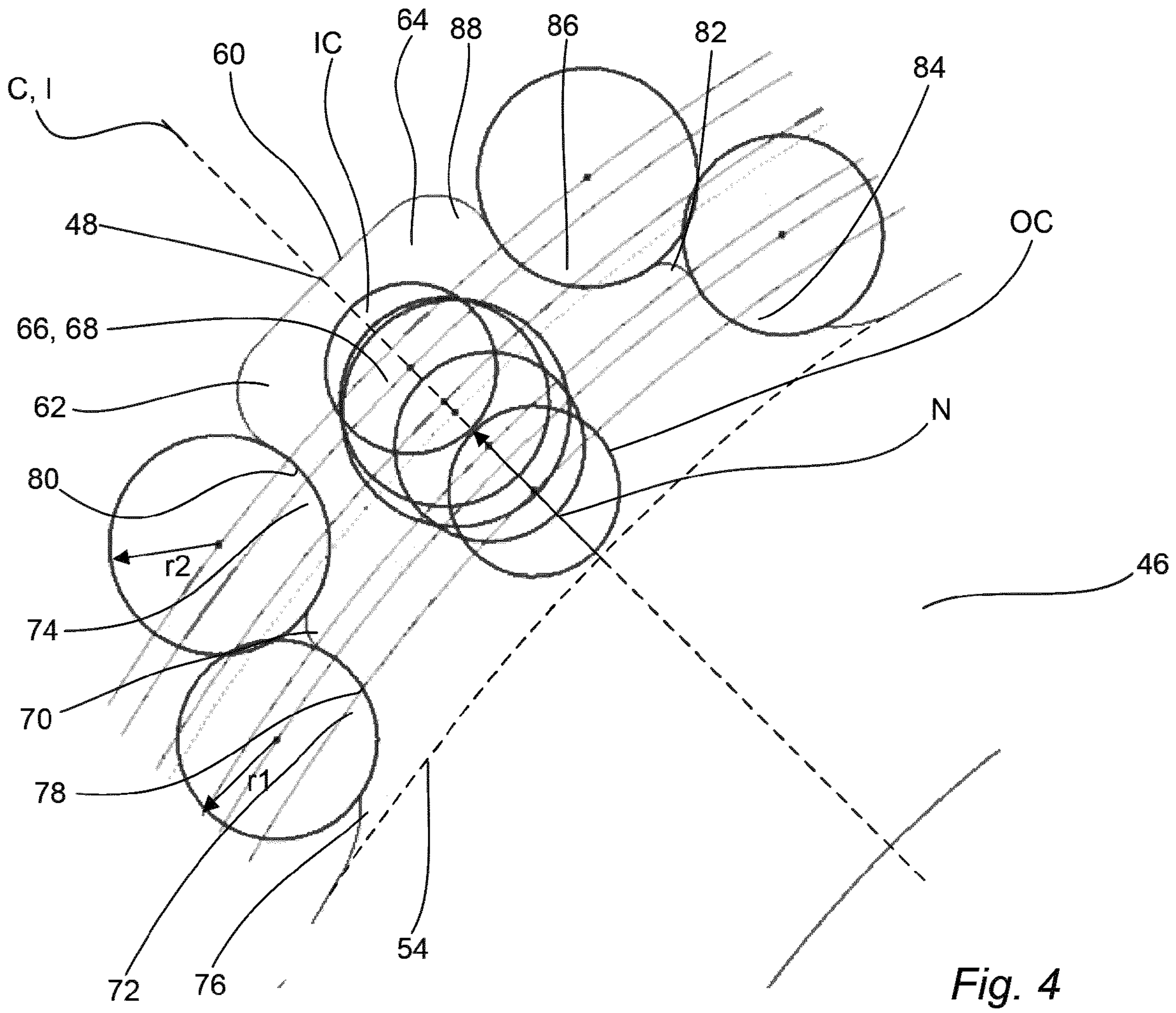

Fig. 4

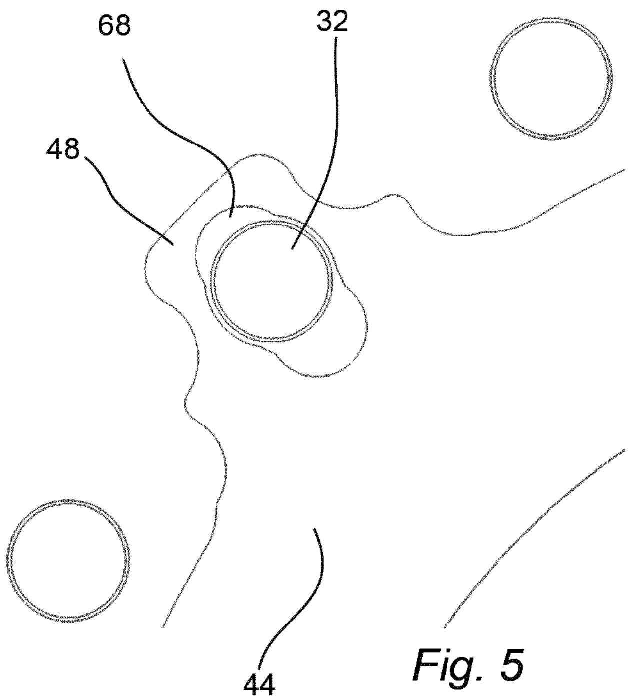

Fig. 5

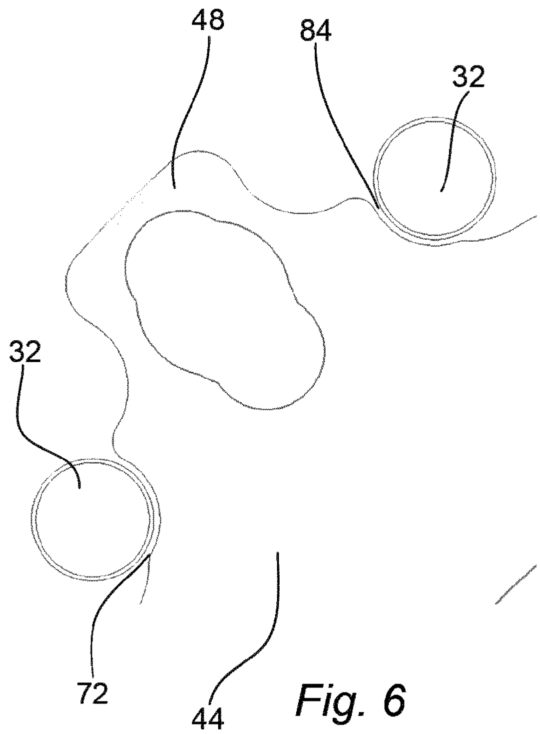

Fig. 6

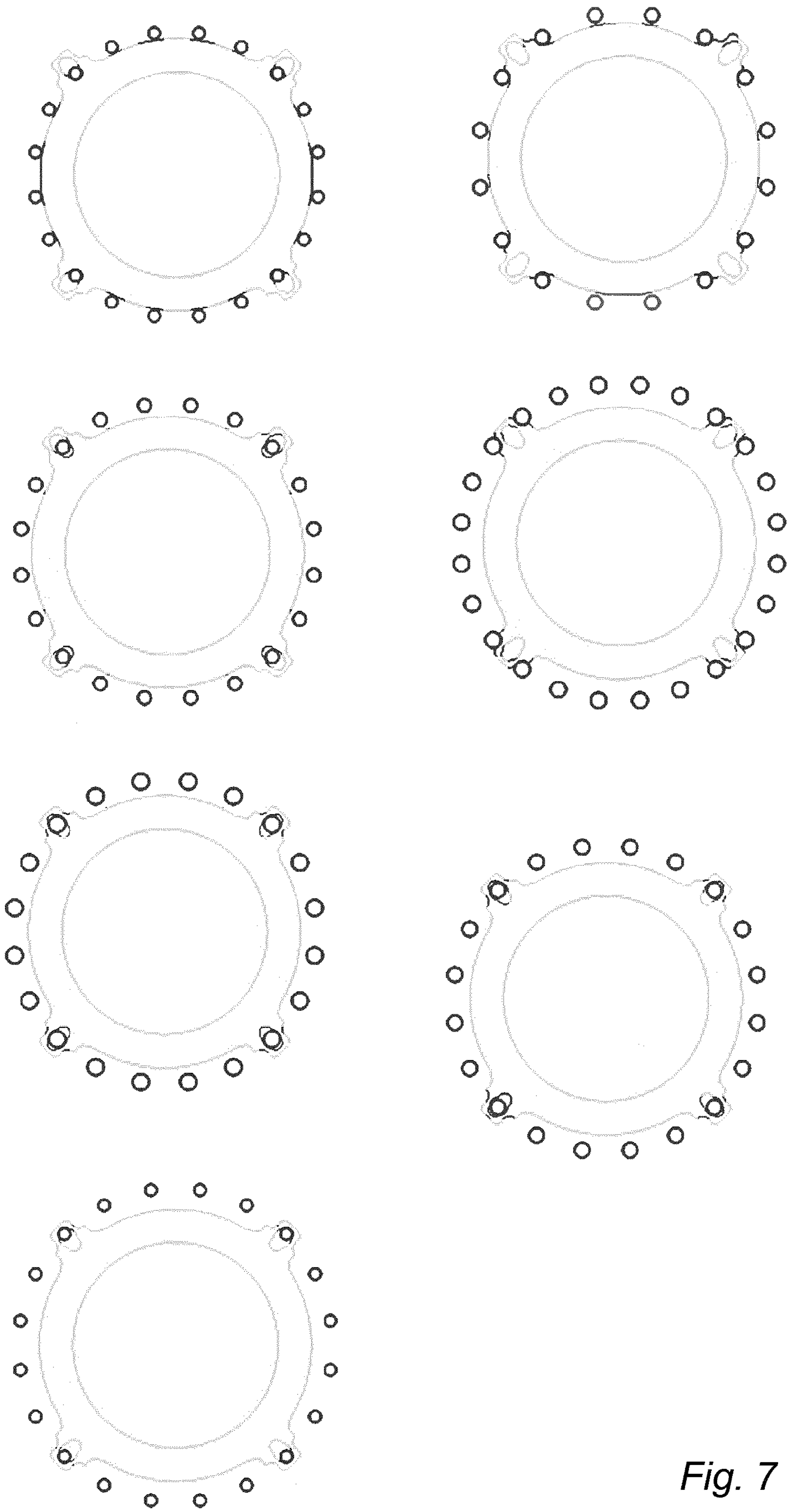

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 6433

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Place of search	Date of completion of the search	Examiner
Munich	27 October 2021	Bloch, Gregor

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