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(54) Heat transfer plate for a plate-and-shell heat exchanger

(57) A heat transfer plate configured to be arranged in a plate-and-shell type plate heat exchanger. The heat transfer plate comprises an inlet port (7) and an outlet port (8). The inlet port (7) has a first inlet section (71) that faces the outlet port (8) and comprises a first fluid blocker (74), for distribution of at least a part of a flow of fluid (F11) over a second inlet section (72) of the inlet port (7). The outlet port (8) has a first outlet section (81) that faces the inlet port (7) and comprises a second fluid blocker (84), for distribution of at least a part of the flow of fluid (F11) over a second outlet section (82) of the outlet port (8). Corrugations (9) are arranged intermediate the inlet port (7) and the outlet port (8).

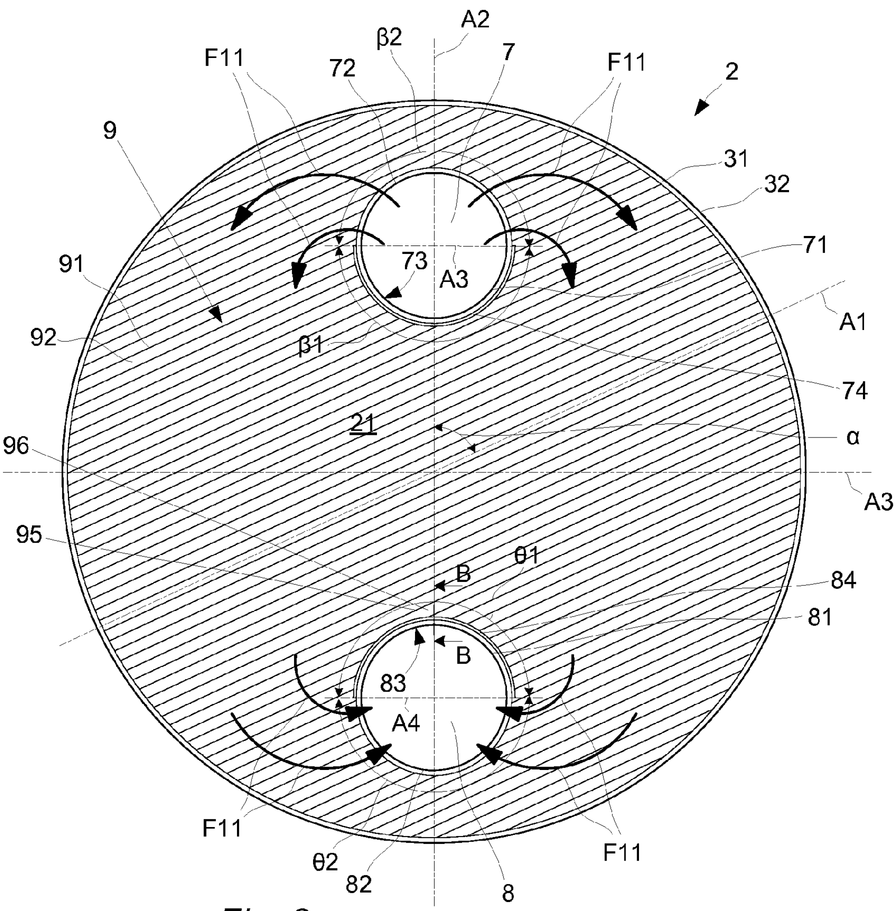

Fig. 3

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Description

Technical Field

[0001] The invention relates to a heat transfer plate configured to be arranged in a plate-and-shell heat exchanger. It also relates to a stack of such heat transfer plates and to a plate-and-shell heat exchanger.

Background Art

[0002] Plate heat exchangers are used throughout industry as equipment for heating, cooling, heat recovery, condensation and evaporation. Heat exchangers may be of different types and designs, depending on e.g. the type of medium to be heated or cooled and on which application system the plate heat exchanger is part of.

[0003] One type of plate heat exchanger is the so-called plate-and-shell type of heat exchanger, often referred to as a "plate-and-shell heat exchanger" or as a "circular plate heat exchanger". This type is well suited for uses that involve high pressures and high temperatures.

[0004] The plate-and-shell heat exchanger comprises a stack of corrugated, circular or elliptical heat transfer plates that are made of metal and arranged in a vessel. The heat transfer surface of the plate-and-shell heat exchanger is formed by the heat transfer plates, which are welded adjacent each other such that typically two channels are formed between the heat transfer plates.

[0005] The two channels are accomplished by alternatively welding the heat transfer plates at an outer circumference of the plates and at portholes of the plates, thereby creating alternate fluid channels. Fluid of one of the channels is then led through the stack of heat transfer plates via the portholes in the heat transfer plates, while fluid of the other channel is led through the stack of heat transfer plates via an outer circumference of the plates. The flow of the fluids may be a counter-current, a co-current or a cross flow type.

[0006] The arrangement of the heat transfer plates renders the plate-and-shell heat exchanger resistant to thermal expansion, which makes it ideal for use at high-pressure and high-temperature conditions. At high pressures, typically more than 80-100 bars, the design of the heat transfer plate must be taken carefully into consideration, even if the principal design of a plate-and-shell heat exchanger per se provides for high-pressure resistance (stress-resistance). The design of the heat transfer plate is also important for how efficiently the plate transfers heat. However, if heat transfer is improved pressure-resistance is generally reduced, and vice versa.

[0007] There are various techniques for providing more pressure resistant plate-and-shell heat exchangers. For example, US6474408 and US7004237 describe how stress-resistance is improved by taking thermal expansion into account. However, it is estimated that the combination of stress-resistance and heat transfer capability of a plate-and-shell heat exchanger is still not optimal, in particular when the plate-and-shell heat exchanger is used in high-pressure applications.

Summary

[0008] It is an object of the invention to at least partly overcome one or more of the above-identified limitations of the prior art. In particular, it is an object to provide a more stress-resistant plate-and-shell heat exchanger while still ensuring that the heat transfer is kept at a relatively high level.

[0009] To fulfill these objects a heat transfer plate is provided, which is configured to be arranged in a plate-and-shell heat exchanger. The heat transfer plate comprises an inlet port and an outlet port arranged at a distance from the inlet port. The inlet port has a first inlet section that faces the outlet port and comprises a first fluid blocker, for distribution of at least a part of a flow of fluid over a second inlet section of the inlet port. The outlet port has a first outlet section that faces the inlet port and comprises a second fluid blocker, for distribution of at least a part of a flow of fluid over a second outlet section of the outlet port. The heat transfer plate comprises corrugations arranged intermediate the inlet port and the outlet port.

[0010] That the heat transfer plate comprises corrugations means that the heat transfer plate is corrugated, or that it has a corrugated profile.

[0011] The section of the inlet port that faces the outlet port represents a part of the inlet port that is closest to the outlet port, while the section of the outlet port that faces the inlet port represents a part of the outlet port that is closest to the inlet port. Thus, since the facing sections comprise a respective fluid blocker, no or a relatively small amount of fluid may flow from the part of the inlet port that is closest to the outlet port. In a corresponding manner, no or a relatively small amount of fluid may flow over a part of the outlet port that is closest to the inlet port.

[0012] This means that all or a relatively large amount of fluid that flows from the inlet port to the outlet port is forced to flow over sections of the ports that do not comprise the mentioned fluid blockers. In this manner, the flow can be prevented from taking a "short-cut" over the heat transfer plate when it flows from one port to the other. This is advantageous in the heat transfer of the plate may be kept at relatively high level even if, for example, the ports are arranged relatively close to each other. A high heat transfer is then accomplished by the fluid blockers which "force" the fluid to flow at the side(s) of the fluid blockers, and typically over a greater section of the heat transfer that include corrugations, i.e. over a corrugated section of the heat transfer plate. As will be described further on, arranging the ports relatively close to each other typically provides a heat transfer plate that is more stress-resistant.

[0013] The corrugations may comprise elongated ridges and grooves that are parallel to a first axis that is inclined by an angle of 15-75° in relation to a second axis that extends through a centre of the inlet port and through a centre of the outlet port. Such an arrangement of the corrugations provides an efficient transfer of heat through the heat transfer plate. In detail, all ridges and grooves of the corrugations may be parallel to the first axis. Additionally or alternatively, the corrugations may surround the inlet port and the outlet port.

[0014] A first abutment section may be arranged around a periphery of a first side of the heat transfer plate. A second abutment section may be arranged around the inlet port and a third abutment section may be arranged around the outlet port, at a second side of the heat transfer plate that is opposite the first side. The first abutment section is then configured to be joined with a corresponding abutment section of a first, similar heat transfer plate that is arranged at the first side. The second and third abutment sections are configured to be joined with corresponding abutment sections of a second, similar heat transfer plate at the second side.

[0015] The heat transfer plate may be configured to be joined with the first, similar heat transfer plate and the second, similar heat transfer plate by welding.

[0016] The first and the second fluid blockers may be arranged on the first side of the heat transfer plate.

[0017] The heat transfer plate, the inlet port and the outlet port may have circular shapes, and the fluid blockers may have the shape of circular arcs.

[0018] At least one of the fluid blockers may comprise openings such that an amount of fluid may flow past the fluid blocker.

[0019] The fluid blockers may be pressed into the heat transfer plate, such they form a respective fluid-blocking ridge.

[0020] The inlet port may be positioned at least 4 cm from a peripheral edge of the heat transfer plate.

[0021] The heat transfer plate may be configured to distribute the flow of fluid at a pressure of at least 80 bars.

[0022] According to another aspect a stack of heat transfer plates is provided, which comprises a number of heat transfer plates that include any of the above-described features.

[0023] According to another aspect a plate-and-shell heat exchanger is provided, which comprises a number of heat transfer plates that include any of the above-described features.

[0024] Still other aspects as well as objectives, features and advantages of the invention will appear from the following detailed description as well as from the drawings.

Brief Description of the Drawings

[0025] Embodiments of the invention will now be described, by way of example, with reference to the accompanying schematic drawings, in which

Fig. 1 is a perspective view of a plate-and-shell heat exchanger,

Fig. 2 is a partial, cross-sectional view of the heat exchanger of Fig. 1,

Fig. 3 is a view of a first side of a heat transfer plate that is used for the heat exchanger of Fig. 1,

Fig. 4 is a partial, cross-sectional view along section B-B of the heat transfer plate of Fig. 3,

Fig. 5 is a view of an enlarged section of Fig. 3,

Fig. 6 is a view of a second side of the heat transfer plate of Fig. 3, and

Fig. 7 is a view of an enlarged section of Fig. 6.

Detailed description

[0026] With reference to Fig. 1 a plate-and-shell heat exchanger 1 is illustrated. The heat exchanger 1 comprises a shell 5, a first end plate 3 and a second end plate 4. The shell 5 is in this example circular but other shapes are conceivable, such as an elliptical shape. The plate-and-shell heat exchanger 1 has four ports 11, 12, 13, 14 that constitute either inlet ports or outlet ports of the heat exchanger 1, depending its use and configuration. In the illustrated example, the port 11 is an inlet port and the port 12 is an outlet port for a first flow of fluid F1, while the port 13 and is inlet port and the port 14 is an outlet port for a second flow of fluid F2.

[0027] The inlet port 11 and the outlet port 12 for the first flow of fluid F1 are arranged at the first end plate 3, relatively close to an outer edge of the first end plate 3 and at opposite sides of a centre of the first end plate 3. The inlet port 13 and outlet port 14 for the second flow of fluid F2 are arranged on the shell 5, at opposite sides of the shell 5.

[0028] The end plates 3 and 4 are rigidly joined to the shell 5, such that the end plates 3, 4 and the shell 5 have a cylindrical shape that allows a high pressure within an enclosure formed by the joined end plates 3, 4 and shell 5. The end plates 3, 4 may be welded to the shell 5 or fixed to the shell 5 by means of bolts (not shown). Two supports 17, 18 are attached to the end plates 3, 4 for allowing the plate-and-shell heat exchanger 1 to be placed on a foundation.

[0029] With reference to Fig. 2, a cross-section of the plate-and-shell heat exchanger 1 is illustrated. The first flow of fluid F1 and the second flow of fluid F2 is led through a stack 10 of heat transfer plates that is arranged within the enclosure formed by the end plates 3, 4 and the shell 5. The stack 10 of heat transfer plates typically includes 10-300 or even a greater number of heat transfer plates.

[0030] The first flow of fluid F1 and the second flow of fluid F2 are conveyed via two channels that are accomplished by alternatively welding the heat transfer plates in the stack 10 at an outer circumference of the plates and at inlet and outlet ports of the plates, thereby creating alternate fluid channels. The first flow of fluid F1 is then led through the stack 10 of heat transfer plates via the ports in the heat transfer plates while the second flow of fluid F2 is led through the stack 10 of heat transfer plates via an outer circumference of the plates. The heat transfer plates of the stack 10 are typically similar or even identical and are joined to each other by welding, even if other methods of joining may be used, such as brazing.

[0031] In detail, an inlet channel 111 for the flow of the first fluid F1 is formed through a first set of ports (inlet ports) in the heat transfer plates. An outlet channel 121 for the flow of the first fluid F1 is formed through a second set of ports (outlet ports) in the heat transfer plates. The inlet channel 111 and the outlet channel 121 extend along a respective axis A7, A8 that are parallel to a main axis A6. The flow of the first flow of fluid F1 passes into the inlet channel 111 and further in between heat transfer plates that are welded to each other at an outer circumference, such as between heat transfer plate 2 and an adjacent, similar heat transfer plate 101. Thus, the first flow of fluid F1 may be seen as divided into different fluid flow parts that pass between every second heat transfer plate in the stack 10, such as fluid flow part F11 that passes between plate 2 and plate 101. When the fluid flow parts exit the heat transfer plates they "aggregate" into the first flow of fluid F1, in the outlet channel 121.

[0032] The flow of the second flow of fluid F2 reaches the stack 10 of heat transfer plates via the inlet 13 and passes further in between heat transfer plates that are welded to each other at ports (inlet and outlet ports) of the plates. For example, the second flow of fluid F2 passes between heat transfer plate 2 and an adjacent, similar heat transfer plate 102. A heat exchange between the first flow of fluid F1 and the second flow of fluid F2 may then take place.

[0033] The second flow of fluid F2 may also be seen as divided into different fluid flow parts that pass between every second heat transfer plate, such as fluid flow part F21 that passes between plate 2 and 102. When these fluid flow parts exit the heat transfer plates they "aggregate" into the second flow of fluid F2 and exit via the outlet port 14.

[0034] The heat transfer plate 101 may be seen as a first adjacent heat transfer plate 101 that is arranged at a first side 21 of the heat transfer plate 2, while the heat transfer plate 102 may be seen as a second adjacent heat transfer plate 102 that is arranged at a second side 22 of the heat transfer plate 2. The first side 21 and the second side 22 of the heat transfer plate 2 form opposite sides of the heat transfer plate 2.

[0035] A so-called compensation plate stack 19 may be positioned between the first end plate 3 and the stack 10 of heat transfer plates. The compensation plate stack 19 allows the heat transfer plates in the stack 10 to expand or shrink due to temperature changes, without imposing thermal fatigue to joints between the stack 10 of heat transfer plates and the end plates 3, 4.

[0036] With reference to Fig. 3, the exemplified heat transfer plate 2 in the stack 10 of heat transfer plates is illustrated as seen from its first side 21. Most or even all of the heat transfer plates in the stack 10 may be identical with the heat transfer plate 2, including the first 21 and the second 22 adjacent heat transfer plates.

[0037] The heat transfer plate 2 has an inlet port 7 and an outlet port 8 that is arranged at a distance from the inlet port 7. The inlet port 7 forms in combination with inlet ports of similar heat transfer plates the inlet channel 111 discussed above, while the outlet port 8 forms the outlet channel 121 together with outlet ports of similar heat transfer plates.

[0038] The inlet port 7 has a first inlet section 71 that faces, i.e. is closest to or is directed towards, the outlet port 8. The first inlet section 71 comprises a first fluid blocker 74 that distributes at least a part F11 of the first flow of fluid F1 over a second inlet section 72 of the inlet port 7. The inlet port 7 has a circular shape and the first inlet section 71 forms a circular arc, i.e. the first inlet section 71 is a segment of a circumference of the inlet port 7. The length of the arc formed by the first inlet section 71 equals an angle of $\beta 1$, as measured from a centre of the inlet port 7. Since the first fluid blocker 74 is arranged at the first inlet section 71, the first fluid blocker 74 has also the shape on a circular arc. From this follows that the first inlet section 71 and the second inlet section 72 define a respective part of an opening that forms the inlet port 7.The first fluid blocker 74 has the same angular length as the length of the arc that defines the first inlet section 71, i.e. an angular length of $\beta 1$. $\beta 1$ may have various angular values, such as a value of 180 ° or a value between 90° and 270°.

[0039] The second inlet section 72 has also the form of a circular arc, i.e. the second inlet section 72 is a segment of a circumference of the inlet port 7. The length of the arc formed by the second inlet section 72 equals an angle of $\beta 2$, as measured from a centre of the inlet port 7. The flow F11 that is distributed over the second inlet section 72 is a part of the first flow of fluid F1 that enters plate-and-shell heat exchanger 1 via the inlet 11. Corresponding parts of the first flow of fluid F1 are distributed over other, similar heat transfer plates, and the sum of distributed parts of fluid equals the first flow of fluid F1.

[0040] The outlet port 8 has a first outlet section 81 that faces, i.e. is closest to or is directed towards the inlet port 7. The first outlet section 81 comprises a second fluid blocker 84 that distributes the part F11 of the first flow of fluid F1 over a second outlet section 82 of the outlet port 8. The outlet port 8 has a circular shape and the first outlet section 81 form a circular arc, i.e. the first outlet section 81 is a segment of a circumference of the outlet port 8. The length of the arc formed by the first outlet section 81 equals an angle of $\theta 1$, as measured from a centre of the outlet port 8. Since the second fluid blocker 84 is arranged at the first outlet section 81, the second fluid blocker 84 has also the shape on a circular arc. From this follows that the first outlet section 81 and the second outlet section 82 define a respective part of an opening that forms the outlet port 8. In this embodiment where the is only one inlet port and one outlet port, the flow over the second inlet section 72 has the same rate as the flow over the second outlet section 82.The second fluid blocker 84 has the same angular length as the length of the arc that defines the second inlet section 81, i.e. an angular length of θ1. θ1 may have the same or a different angular value than β1.

[0041] The second outlet section 82 has also the form of a circular arc, i.e. the second outlet section 82 is a segment of a circumference of the outlet port 8. The length of the arc formed by the second outlet section 82 equals an angle of θ2, as measured from a centre of the outlet port 8.

[0042] The fluid blockers 74, 84 typically have the form of ridges that are pressed into the heat transfer plate 2. The ridges then acts as fluid blockers that reduces or prevents a flow of fluid.

[0043] As indicated, the distribution of the part F11 of the first flow of fluid F1 over the second inlet section 72 of the inlet port 7 is accomplished by the first fluid blocker 74. The distribution of the part F11 of the first flow of fluid F1 over the second outlet section 82 of the outlet port 8 is accomplished by the second fluid blocker 84.

[0044] The heat transfer plate 2 has elongated corrugations 9 arranged intermediate the inlet port 7 and the outlet port 8. The corrugations 9 comprise a number of elongated ridges and grooves, where two of the ridges are indicated by reference numerals 91 and 95 and two of the grooves are indicated by reference numerals 92 and 96. The elongated ridges and grooves are parallel to a first axis A1 that is inclined by an angle α of 20-90° in relation to a second axis A2, where the second axis A2 extends through a centre of the inlet port 7 and through a centre of the outlet port 8. All ridges and grooves of the corrugations 9 may be parallel to the first axis A1. The second axis A2 may extend through a centre of the heat transfer plate 2. The corrugations are typically continuous in the sense that they are free from flat sections.

[0045] The exemplified inlet port 7 and the outlet port 8 are symmetrically arranged about a center of the heat transfer plate 2. As may be seen, the inlet port 7 and the outlet port 8 are arranged at a respective distance from a peripheral edge 32 of the heat transfer plate 2. This allows the corrugations 9 to surround the inlet port 7 and the outlet port 8. In detail, the inlet port 7 and/or the outlet port 8 may be positioned at least 4 cm from the peripheral edge 32. Arranging the ports 7, 8 at a distance from the peripheral edge 32 is advantageous in that the stress-resistance of the heat transfer plate 2 is improved. Still, efficient heat transfer is not hampered, since corrugations 9 are arranged between the ports 7, 8. Arranging the corrugations 9 around the ports 7, 8 further improves efficient transfer of heat.

[0046] For joining the plates the first side 21 of the heat transfer plate 2 has at the peripheral edge 32 a first abutment section 31. The first abutment section 31 is joined with a corresponding abutment section of the first, similar heat transfer plate 101. The first abutment section 31 may comprise a flat surface or a folded edge that faces a similar flat surface or folded edge of the first, similar heat transfer plate 101.

[0047] With reference to Fig. 4, a partial cross-section B-B of the second fluid blocker 84 is illustrated. The second fluid blocker 84, which is similar to the first fluid blocker 74, has the form of a ridge 841 that extends along the first outlet section 81. An indentation 843 extends along the ridge 841. Some of the ridge and groves of the corrugations 9 may also be seen in Fig. 4, such as ridge 95 and groove 96. The first fluid blocker 74 and the second 84 fluid blocker are arranged on the same side as the first abutment section 31, i.e. on the first side 21 of the heat transfer plate 2. The fluid blockers 74, 84 efficiently cause the flow of fluid to be distributed over a larger section of the heat transfer plate 2 by preventing it from taking a short-cut between the ports 7, 8, i.e. preventing the flow of fluid from taking the shortest way from the inlet port 7 to the outlet port 8. Efficient distribution of the flow of fluid improves the heat transfer of the plate 2.

[0048] With reference to Fig. 5, in one embodiment the first fluid blocker 74 comprises openings 751 that allow an amount of fluid to flow past or through the first fluid blocker 74. The openings 751 are relatively small such that the main part of fluid that enters via the inlet port 7 is still forced to pass over the second inlet section 72. The openings 751 may extend in a radial direction of the inlet port 7, and may assist in properly distributing pressure levels over the first inlet section 71. The second fluid blocker 84 may comprise corresponding openings.

[0049] With reference to Fig. 6, the heat transfer plate 2 is illustrated as seen from its second side 22. The heat transfer plate 2 is in this figure flipped 180° around the axis A2, in comparison with the illustration of Fig. 3. The corrugations 9 are then "reversed", such that a groove on the first side 21 now forms a ridge like ridge 93 on the second side 22, while a ridge on the first side 21 now forms a groove like groove 94 on the second side 22. The part F21 (see Fig. 2) of the second flow of fluid F2 that flows over the second side 22 of the heat transfer plate 2 enters and exits the heat transfer plate 2 at opposite sides of the peripheral edge 32.

[0050] A second abutment section 73 is arranged around the inlet port 7 and a third abutment section 83 is arranged around the outlet port 8, at the second side 22 of the heat transfer plate 2. The second 73 and third 83 abutment sections are joined with corresponding abutment sections of the adjacent second, similar heat transfer plate 102 (see Fig. 2). The second abutment section 73 and third abutment section 83 may comprise a respective flat surface or folded edge that faces a similar flat surface or folded edge of the second, similar heat transfer plate 102.

[0051] Thus, in the stack 10 of heat transfer plates every second heat transfer plate is flipped 180° around the axis A2. However, it is possible that every second heat transfer plate 2 instead is flipped 180° around an axis A3 (see Fig. 3) that is perpendicular to the axis A2 and extends through a centre of the heat transfer plate 2. In either case the second and third abutment sections are considered as joined with corresponding abutment sections of a similar heat transfer plate, even if the arrangement of the ports may be asymmetrical when plates are flipped about the axis A3.

[0052] With reference to Fig. 7, an enlarged, partial view of the inlet port 7 is illustrated. The inlet port 7 has a diameter D2 [cm] that generally is related to a diameter D1 [cm] (see Fig. 6) of the heat transfer plate 2.

[0053] Typically, $W \propto k1 \cdot P \cdot D2 + k2$, where W [cm] is the distance at which the inlet port 7 is arranged from the peripheral edge 32 of the heat transfer plate 2, P [bar] is a pressure of a fluid passing through the heat exchanger, k1 [bar^{-1}] is a first constant and k2 [cm] is a second constant. Suitable values for k1 and k2 may be calculated for giving the heat transfer plate 2 a predetermined stress-resistance, or may be empirically determined. Also, often $W \geq D1/20$. However, W is typically at least 4 cm. The relationships between W and D1 and D2 as well as the value of W have in various tests shown suitable for obtaining a stress-resistant heat transfer plate while still assuring that the heat transfer is maintained at acceptable levels. As indicated above, the fluid blockers assist in maintaining acceptable heat transfer levels, even if the ports 7, 8 are arranged relatively close to each other. The described heat transfer plate 2 is capable of distributing over its corrugations 9 flows of fluid at pressure levels of at least 80 bars. This applies for a flow over the first side 21 and/or for a flow over the second side 22.

[0054] The heat transfer plates in the plate-and-shell heat exchanger 1 are typically made of metal, such as stainless steel. When welding is used for forming the joints, i.e. when the joint are welds, laser welding may be used as well as other welding techniques, such as resistance welding. A heat transfer plate may per se be manufactured from a steel sheet that is pressed with a press tool that forms the corrugations and the fluid blockers. A cutting machine thereafter cuts out the inlet port, the outlet port and the periphery of the plate.

[0055] From the description above follows that, although various embodiments of the invention have been described and shown, the invention is not restricted thereto, but may also be embodied in other ways within the scope of the subject matter defined in the following claims. For example, the shell, the end plates and the heat transfer plates may have a elliptical shapes. Such elliptical shapes are in the context of this description comprised in the term "circular". The heat exchanger may also have additional flow channels, and the end plate(s) and shell may then have more than one respective inlet and outlet port.

Claims

1. A heat transfer plate configured to be arranged in a plate-and-shell heat exchanger (1), the heat transfer plate comprising an inlet port (7) and an outlet port (8) arranged at a distance from the inlet port (7),
the inlet port (7) having a first inlet section (71) that faces the outlet port (8) and comprises a first fluid blocker (74), for distribution of at least a part of a flow of fluid (F11) over a second inlet section (72) of the inlet port (7),
the outlet port (8) having a first outlet section (81) that faces the inlet port (7) and comprises a second fluid blocker (84), for distribution of at least a part of the flow of fluid (F11) over a second outlet section (82) of the outlet port (8), wherein
the heat transfer plate comprises corrugations (9) arranged intermediate the inlet port (7) and the outlet port (8).

2. A heat transfer plate according to claim 1, wherein the corrugations (9) comprise elongated ridges (91) and grooves (92) that are parallel to a first axis (A1) that is inclined by an angle (α) of 15-75° in relation to a second axis (A2) that extends through a centre of the inlet port (7) and through a centre of the outlet port (8).

3. A heat transfer plate according to claim 2, wherein all ridges (91) and grooves (92) of the corrugations (9) are parallel to the first axis (A1).

4. A heat transfer plate according to any one of claims 1 -3, wherein the corrugations (9) surround the inlet port (7) and the outlet port (8).

5. A heat transfer plate according to any one of claims 1 - 4, wherein
a first abutment section (31) is arranged around a periphery of a first side (21) of the heat transfer plate, a second abutment section (73) is arranged around the inlet port (7) and a third (83) abutment section is arranged around the outlet port (8), at a second side (22) of the heat transfer plate that is opposite the first side (21),
the first abutment section (31) is configured to be joined with a corresponding abutment section of a first, similar heat transfer plate (101) that is arranged at the first side (21), and
the second (73) and third (83) abutment sections are configured to be joined with corresponding abutment sections of a second, similar heat transfer plate (102) at the second side (22).

6. A heat transfer plate according to claim 5, configured to be joined with the first, similar heat transfer plate (101) and the second, similar heat transfer plate (102) by welding.

7. A heat transfer plate according to claim 5 or 6, wherein the first (74) and the second (84) fluid blockers are arranged on the first side (21) of the heat transfer plate.

8. A heat transfer plate according to any one of claims 1 - 7, wherein the heat transfer plate, the inlet port (7) and the outlet port (8) have circular shapes, and the fluid blockers (74, 84) have the shape of circular arcs.

9. A heat transfer plate according to any one of claims 1 - 8, wherein at least one of the fluid blockers (74, 84) comprises openings (751) such that an amount of fluid may flow through the fluid blocker (74).

10. A heat transfer plate according to any one of claims 1 - 9, wherein the fluid blockers (74, 84) are pressed into the heat transfer plate, such they form a respective fluid-blocking ridge.

11. A heat transfer plate according to any one of claims 1 - 10, wherein the inlet port (7) is positioned at least 4 cm from a peripheral edge (32) of the heat transfer plate.

12. A heat transfer plate according to any one of claims 1 -11, configured to distribute the flow of fluid (F11) at a pressure of at least 80 bars.

13. A stack of heat transfer plates comprising a number of heat transfer plates according to any one of claims 1 - 12.

14. A plate-and-shell heat exchanger comprising a number of heat transfer plates according to any one of claims 1 - 12.

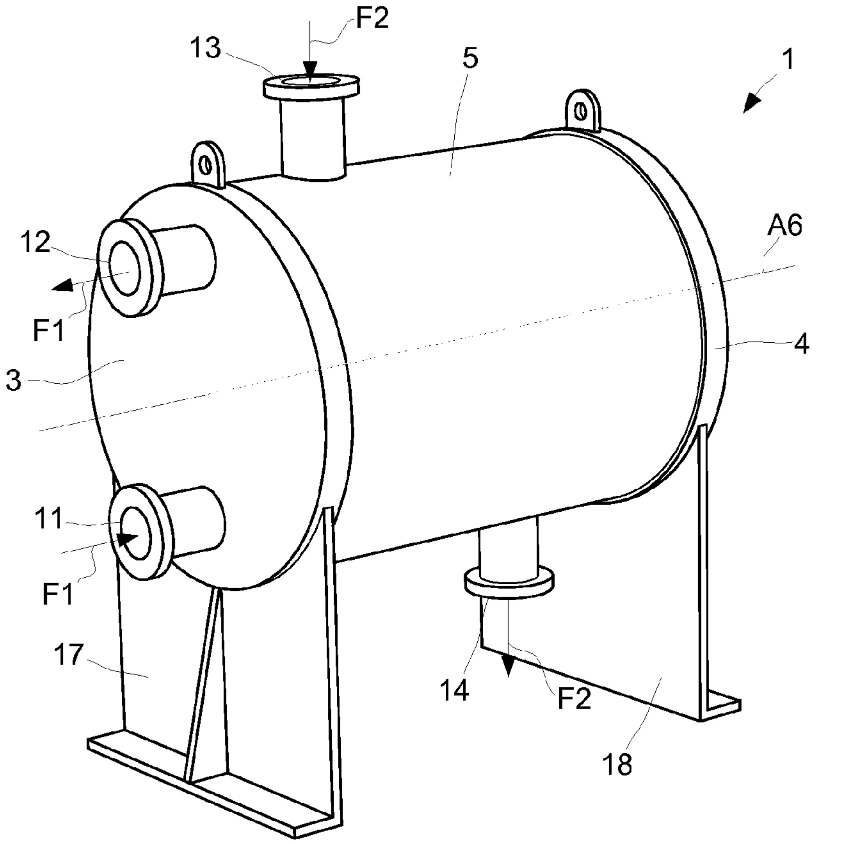
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Fig. 1

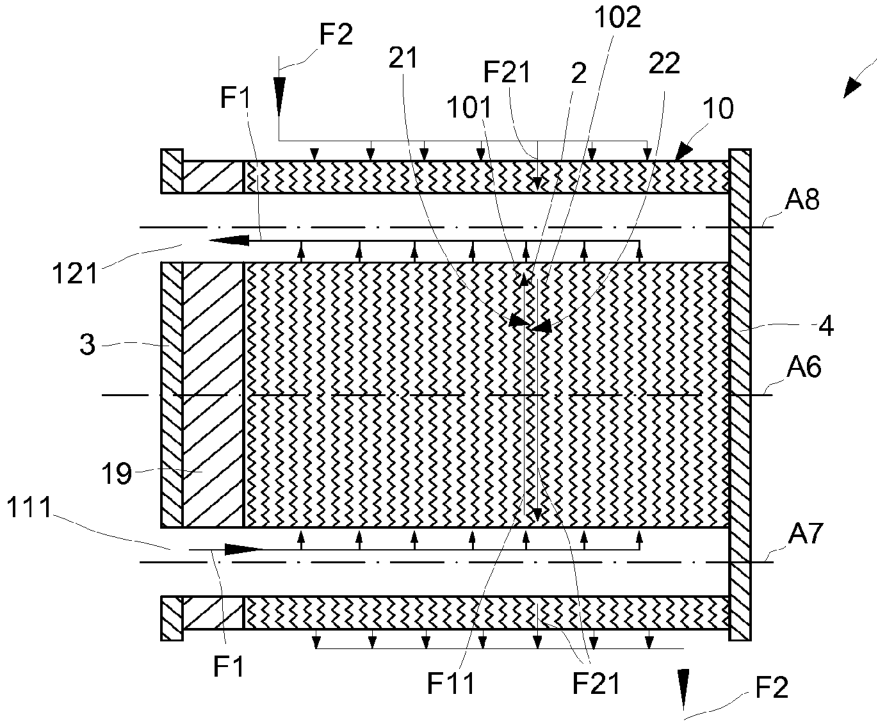
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Fig. 2

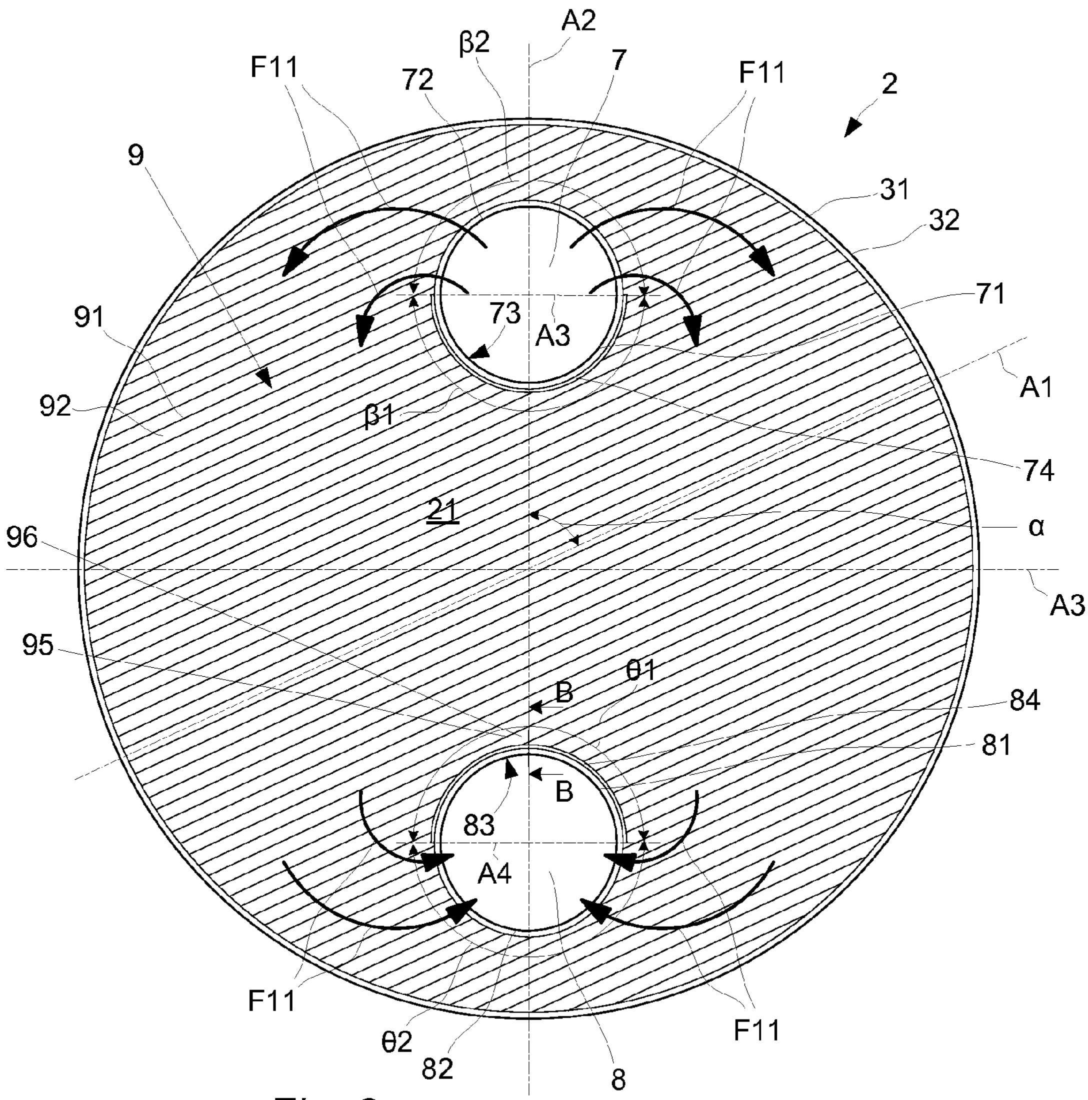

Fig. 3

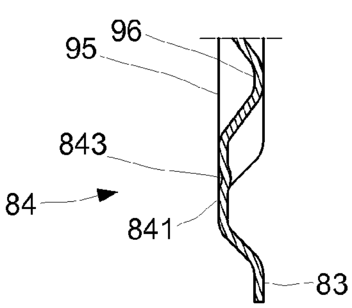

Fig. 4 (B-B)

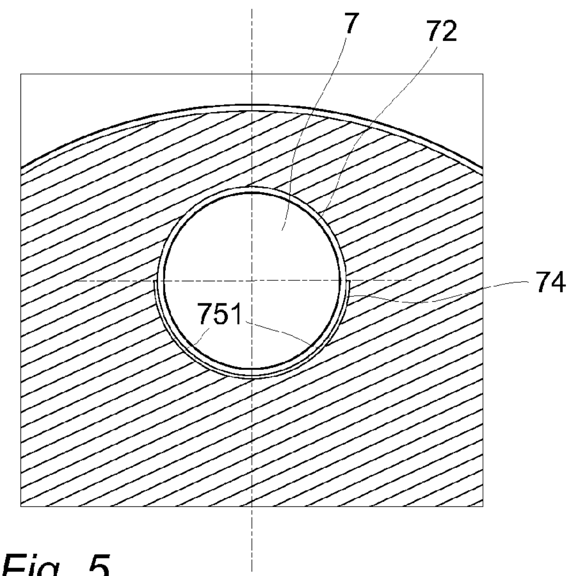

Fig. 5

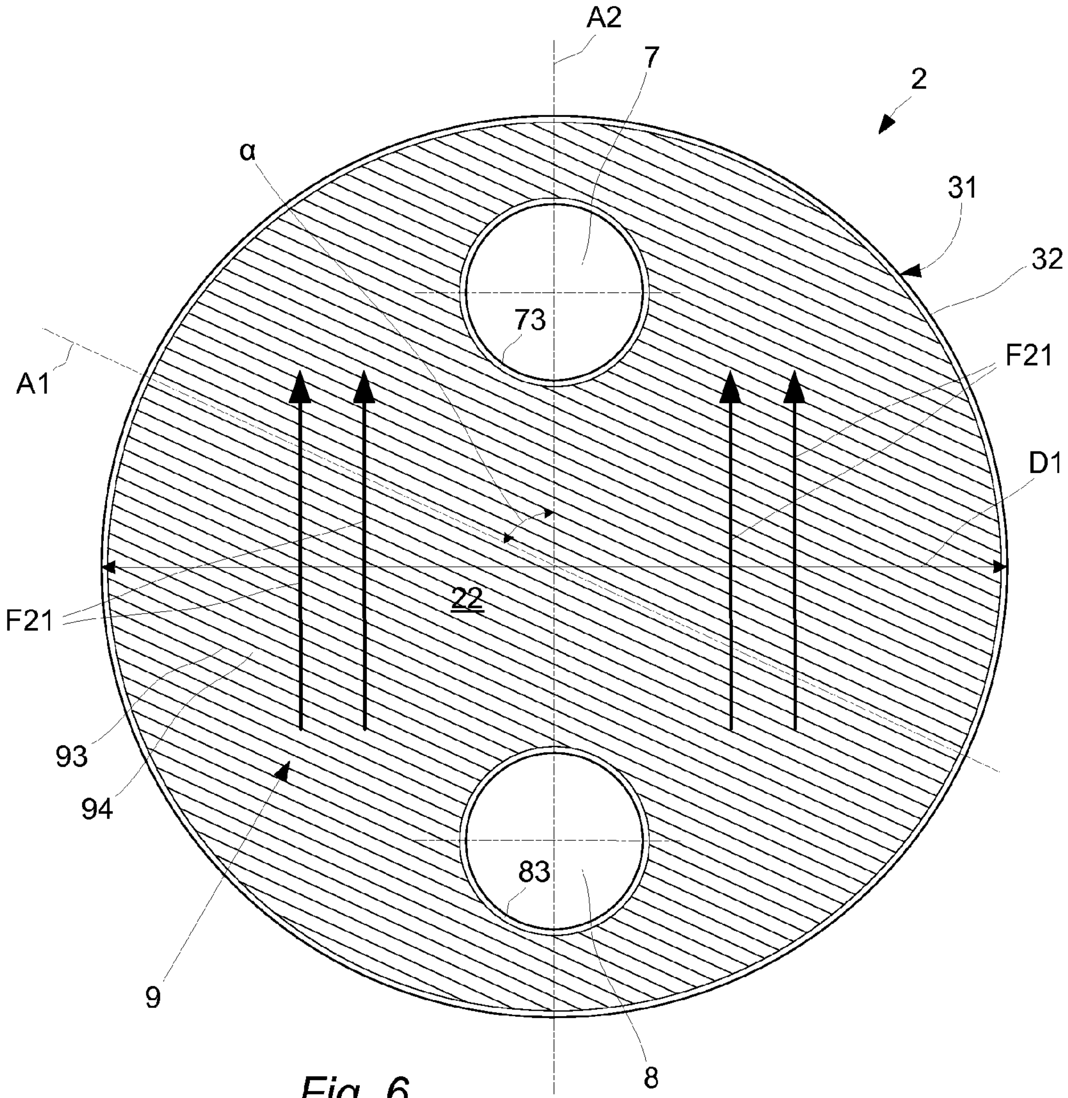

Fig. 6

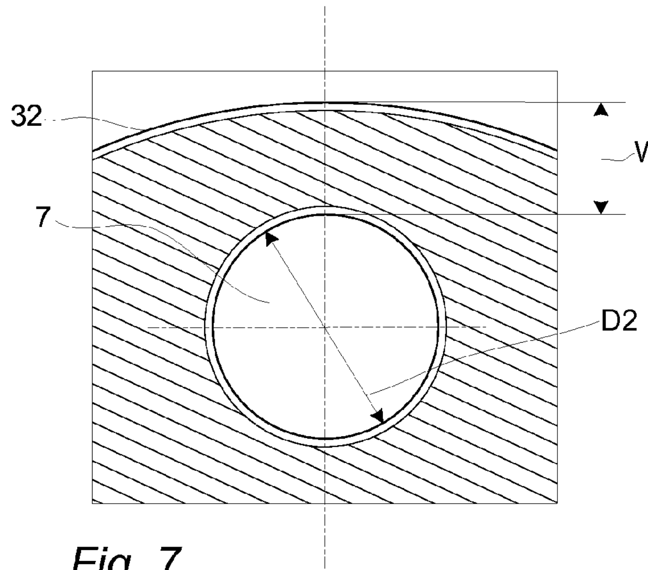

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 7448

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Place of search	Date of completion of the search	Examiner
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