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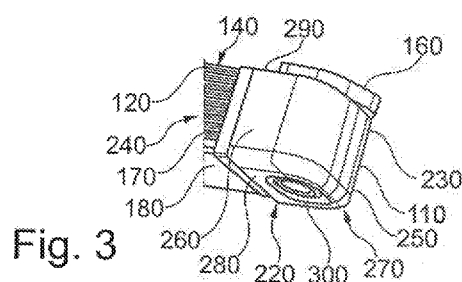


Fig. 3

(57) Abstract: A guiding/directing apparatus to direct a fluid flow through a heat exchanger core has a shell-like main body that installs over stacked tube plates of the heat exchanger core at an end of the heat exchanger core corresponding to an inlet end for the fluid flow, with the heat exchanger core extending through an opening of the apparatus. The apparatus is configured so that the fluid flow enters into the main body through an inlet and is directed through the opening with minimal bypassing of the heat exchanger core by the fluid.



GUIDING/DIRECTING APPARATUS FOR FLUID FLOW

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to German Patent Application No. 10 2017 000 183.9 filed January 12, 2017, the entire contents of which are hereby incorporated by reference herein

FIELD OF THE INVENTION

[0002] The present invention relates to a guiding/directing apparatus for a first fluid flow which flows through a heat exchanger core in the flow direction, and to a heat exchanger core having a guiding/directing apparatus of this type.

BACKGROUND

[0003] In the case of heat exchanger cores which are configured, for example, as a plate stack and are inserted into a housing for operational purposes, gaps can be formed between the heat exchanger core and the housing, for example, on account of tolerances in said components, which gaps lead to bypass flows of a fluid flow. Bypass flows of this type flow past the heat exchanger core, although the fluid flow should actually flow through the heat exchanger core completely in the flow direction. Because the heat exchanger core therefore cannot be inserted with an accurate fit and in a sealing manner on the edge side into the housing, inter alia on account of the tolerances and, for example, on account of different designs of the housing and the heat exchanger core, the bypass flows which flow on the edge side between the heat exchanger core and the housing can reduce the efficiency of the heat exchange in an undesired manner.

[0004] In order to prevent bypass flows of this type, it is customary, as known, for example, from DE 40 207 54 C2, to surround the heat exchanger core transversely with respect to the flow direction with sealing elements, such as sealing lips, sealing blades, sealing rings or more extensive sealing apparatuses, in order that the gaps between the heat exchanger core and the housing can be sealed. On account of gaps which are sealed in this way, the first fluid flow is then forced to flow mainly through the heat exchanger core and to enter into a heat exchange with the latter. Here, sealing elements of this type or more extensive sealing apparatuses are preferably positioned centrally, it being

possible for the sealing apparatus to surround the heat exchanger core at least partially or even completely, transversely with respect to the flow direction.

[0005] On account of the very wide variety of housing shapes and heat exchanger core variants, and the very wide variety of applications, for example in the field of oil cooling, there is still a requirement for improved or at least alternative embodiments, by means of which bypass flows can be prevented or can at least be reduced considerably.

SUMMARY

[0006] Some aspects of the invention are concerned with the problem of specifying an improved or at least an alternative embodiment for a guiding/directing apparatus of a fluid flow through a heat exchanger core, and also an improved or at least an alternative embodiment for the said heat exchanger core, which embodiment can be distinguished, in particular, by a structurally simple form, a relatively high independence from the housing shape and/or an increased reduction in the bypass flow in the case of a heat exchanger core which is inserted into a housing.

[0007] Therefore, in one aspect of the invention, a guiding/directing apparatus for a first fluid flow which flows through a heat exchanger core in the flow direction is proposed, the heat exchanger core being constructed from a plurality of tube plates which conduct at least one second fluid flow and are stacked in the stack direction, including a shell-like main body which, in the installed position on the heat exchanger core, is arranged in an inflow region of the first fluid flow into the heat exchanger core, with an opening, through which, in the installed position, the heat exchanger core extends in the flow direction, and with an inlet opening for the first fluid flow, the shell-like main body having at least one rear-side part section which lies opposite the opening in the flow direction and extends in the inflow region from a lower-side edge of a lower side of the heat exchanger core to an upper-side edge of an upper side of the heat exchanger core in the circumferential direction.

[0008] On account of a shell-like main body of this type which is arranged in an inflow region of the first fluid flow into the heat exchanger core, said first fluid flow can advantageously already be guided and directed in a desired way in the region of the inflow of the first fluid flow into the heat exchanger core. A throughflow of the heat

exchanger core can be forced on account of the inflow path brought about by way of the shell-like main body, which throughflow can prevent or at least considerably reduce a bypass flow between the heat exchanger core and a housing, into which the heat exchanger core is inserted.

[0009] Since, in addition, a guiding/directing apparatus of this type is provided only in the inflow region, material can be saved in comparison with a central arrangement of other bypass prevention apparatuses or bypass sealing apparatuses in accordance with the prior art.

[0010] Moreover, a guiding/directing apparatus of this type which is arranged in the inflow region is less dependent on the tolerances of the heat exchanger core and, above all, considerably less dependent on the tolerances of the housing. Since the reduction in the bypass flow is not based on the seal of the gaps between the housing and the heat exchanger core, but rather on the flow direction which is already configured in the inflow region of the first fluid flow, a guiding/directing apparatus of this type can be designed with less consideration of the shapes and any tolerances of the heat exchanger core and the housing, in particular in the region of the gaps between the housing and the heat exchanger core.

[0011] Here, a heat exchanger core is understood to mean a plurality of tube plates which are stacked in the stack direction and are flowed through by a second fluid flow, whereas the tube plates are flowed around by a first fluid flow. To this extent, the first fluid flow is in heat exchange with the second fluid flow in the heat exchanger core via the tube plate walls. In order that the first fluid flow can flow through the heat exchanger core and/or can flow around the tube plates in a targeted manner, the heat exchanger core is usually inserted into a housing which is flowed through by the first fluid flow. Here, the heat exchanger core is also flowed through by the first fluid flow and/or the tube plates of the heat exchanger core are flowed around during the throughflow of the housing by way of the first fluid flow. If, however, gaps occur between the heat exchanger core and the housing, it can occur that the first fluid flow does not flow completely through the heat exchanger core, but rather forms a bypass flow in the region of the gaps, which bypass flow leads past the heat exchanger core. Said bypass flow is then no longer available for a heat exchange, with the result that the efficiency of the heat exchanger core is reduced in

an undesired manner.

[0012] Here, a cooling fluid which comprises water, glycol, antifreeze or the like can be used as first fluid, whereas oil which can be cooled by way of the first fluid in at least some operating states can be used as second fluid. Here, transmission oil, internal combustion engine oil or other oil can be used as oil, which can be used during the lubrication of components in a motor vehicle and/or in an internal combustion engine.

[0013] It is also conceivable, however, that a cooling fluid which comprises water, glycol, antifreeze or the like is used as first fluid, whereas a refrigerant, such as R134a, R1234yf, R245fa, CO₂ or ammonia is used as second fluid, which refrigerant is evaporated by way of the absorption of heat from the cooling fluid at least in one operating state of the heat exchanger core. In this case, the heat exchanger core can be configured as an evaporator and/or can be used as an evaporator in a cooling circuit system.

[0014] With regard to the heat exchanger core and the housing, the installed position is understood to mean that the heat exchanger core is inserted into the housing, with the result that both the housing and the heat exchanger core can be flowed through by way of the first fluid flow. With regard to the guiding/directing apparatus and the heat exchanger core, the term “installed position” denotes the situation, in which the heat exchanger core is inserted into the guiding/directing apparatus, with the result that the heat exchanger core is surrounded at least partially by the guiding/directing apparatus at least in the inflow region, with the result that the guiding/directing apparatus guides the first fluid flow in a predefined way through the heat exchanger core.

[0015] A shell-like main body is to be understood to mean a component which surrounds the heat exchanger core in the inflow region at least partially, for example made from plastic, synthetic material, metal or the like, which component is capable of guiding and directing a first fluid flow, which enters into the inlet opening of the shell-like main body, in the inflow region in such a way that the first fluid flow is guided and directed substantially by way of the heat exchanger core on the other side of the inflow region.

[0016] The inflow region is understood here to mean that region in the flow direction at the start of the heat exchanger core, in which region the first fluid flow enters into the

heat exchanger core. Therefore, the entire edge-side region, via which the first fluid flow enters into the heat exchanger core, can be called the inflow region. From a broader perspective, the inner region of the heat exchanger core, which inner region is surrounded by the edge-side region, can also be included by the term “inflow region”.

[0017] An opening of the shell-like main body is to be understood to mean that opening of the shell-like main body, into which the heat exchanger core is inserted in the installed position. Therefore, in the installed position, the heat exchanger core extends through the opening in the flow direction, with the result that the heat exchanger core is surrounded in the circumferential direction at least in sections by the shell-like main body in the region of the opening. From a supplementary or alternative perspective, the opening can also be understood to be an outflow opening, from which, in the installed position with the heat exchanger core, the second fluid flow flows out of the shell-like main body.

[0018] Here, the flow direction is understood to mean the macroscopic flow direction which extends from the inlet region of the first fluid flow into the heat exchanger core to the outlet region of the first fluid flow out of the heat exchanger core. Accordingly, the term “flow direction” is to be understood to mean substantially the macroscopic flow direction and not the microscopic flow directions, for example the turbulences, in the heat exchanger core. As an alternative, the macroscopic flow direction can also be determined on the basis of the entry of the first fluid flow into the housing and the exit of the first fluid flow out of the housing, the macroscopic flow direction in this case extending before the entry of the first fluid flow into the housing as far as the exit of the first fluid flow out of the housing. A flow transverse direction is arranged substantially transversely, in particular perpendicularly, in relation to the flow direction of the first fluid flow. The stack direction is to be understood to mean the direction, in which the tube plates are stacked. The circumferential direction runs along the narrow sides of the tube plates and can be determined by virtue of the fact that the course of the tube plate is followed along the narrow side or the edge of the flat side. Although the circumferential direction can be determined by means of the tube plate, it can also be transferred to the heat exchanger core. In addition, the circumferential direction or the plane which is defined by the circumferential direction can be oriented perpendicularly with respect to the stack direction. In the case of a heat exchanger core of elongate configuration, a longitudinal direction of the heat exchanger core is to be understood to mean the direction along the

longest axis of the heat exchanger core, it being possible for the longitudinal direction of the heat exchanger core to run parallel to the circumferential direction or to the plane which is defined by the circumferential direction.

[0019] The upper side and lower side of the heat exchanger core is to be understood to mean substantially the region of the two outermost tube plates, it being possible for a region or an outermost tube plate to spontaneously be selected as the upper side, and the lower side resulting in a manner which is dependent on the upper side which is selected. The front side of the heat exchanger core is the side of the inflow region, whereas the rear side of the heat exchanger core is arranged in the region of the outflow region of the first fluid flow out of the heat exchanger core. If, for example, the inlet of the second fluid is positioned in the region of an outermost tube plate, the region of the outermost tube plate, on which the inlet of the second fluid is arranged, can be defined as the upper side.

[0020] A rear-side part section of the shell-like main body is to be understood to mean that section of the shell-like main body which is spaced apart furthest from the opening, through which the heat exchanger core extends in the flow direction in the installed position.

[0021] The right-hand and left-hand side of the shell-like main body are defined relative to the upper side and lower side of the heat exchanger core, and run from the rear-side part section along the stacked tube plates in a manner which follows the circumferential direction as far as the opening of the shell-like main body. In the narrower sense, the right-hand side and left-hand side of the shell-like main body are oriented parallel to one another, it being possible for the delimitation between the right-hand side and the left-hand side and the rear side to be performed by way of the parallel nature of the right-hand side with respect to the left-hand side. Accordingly, in the narrower sense, the mutually parallel part sections of the shell-like main body which run at least in the circumferential direction are the left-side part section and the right-side part section of the shell-like main body. In said narrower sense, the rear-side part section is arranged at least in the circumferential direction between the left-side part section and the right-side part section. Therefore, the rear-side part section begins when the mutually parallel regions of the shell-like main body end at least in the circumferential direction.

[0022] The respective edge of the lower side and the upper side of the heat exchanger

core are to be understood to mean substantially the edge regions of the outermost tube plates. Here, the edge or the edge region can extend beyond the edge of the outermost tube plates into the upper side and lower side. In particular, the edge or edge region extends radially by up to 40% of the radius and/or in the flow transverse direction by up to 20% of the extent of the heat exchanger core into the upper side and lower side.

[0023] It can also be the case that the edge or edge region extends radially by up to 30% of the radius, in particular by up to 20% of the radius, optionally by up to 15% of the radius and, for example, by up to 10% of the radius into the upper side and lower side of the heat exchanger core.

[0024] It can also be the case, furthermore, that the edge or edge region extends in the flow transverse direction by up to 15% of the extent of the heat exchanger core, in particular by up to 10% of the extent of the heat exchanger core, possibly by up to 7.5% of the extent of the heat exchanger core and, for example, by up to 5% of the extent of the heat exchanger core into the upper side and lower side of the heat exchanger core.

[0025] Furthermore, the shell-like main body can extend in the circumferential direction over from 5% to 50% of the circumference of the heat exchanger core in the circumferential direction.

[0026] A section of the heat exchanger core which is selected to be sufficiently great can advantageously be used by way of an extent of this type of the shell-like main body in the circumferential direction to guide and to direct the first fluid flow in the desired way and direction.

[0027] It is also conceivable that the shell-like main body extends in the circumferential direction over from 5% to 40%, in particular over from 5% to 35%, possibly over from 10% to 30% and, for example, over from 10% to 25% of the circumference of the heat exchanger core in the circumferential direction.

[0028] In the case of an elongate heat exchanger, in which the inflow region is arranged on the one short side and the outflow region is arranged on the other short side, the shell-like main body can be arranged in the front third in relation to the longitudinal direction of the heat exchanger core, in particular in the front quarter, possibly in the front fifth

and, for example, in the front sixth of the heat exchanger core in relation to the longitudinal direction. Here, the respective front region is arranged in the inflow region.

[0029] Furthermore, the shell-like main body can have a right-side part section which extends in the circumferential direction from the rear-side part section to the right in the inflow region, and extends from the lower-side edge to the upper-side edge of the heat exchanger core in the stack direction.

[0030] The guidance and direction of the first fluid flow can advantageously also be assisted on the right-hand side in the inflow region at least in sections by way of a right-side part section of this type. In addition, it can be prevented that a bypass flow of the first fluid flow is already formed in said region.

[0031] Furthermore, the shell-like main body can have a left-side part section which extends in the circumferential direction from the rear-side part section to the left in the inflow region and from the lower-side edge to the upper-side edge of the heat exchanger core in the stack direction.

[0032] The guidance and direction of the first fluid flow can advantageously also be assisted on the left-hand side in the inflow region at least in sections by way of a left-side part section of this type. In addition, it can be prevented that a bypass flow of the first fluid flow is already formed in said region.

[0033] If both right-side and left-side part sections are provided, two-sided guidance of the first fluid flow can be continued and assisted beyond the rear-side part section, with the result that the first fluid flow mainly flows through the heat exchanger core even downstream of the part sections, a bypass flow of the first fluid at least being reduced or being prevented completely.

[0034] Furthermore, the shell-like main body can have an upper-side part section which is arranged on the upper side and extends from the opening to at least the rear-side part section.

[0035] The heat exchanger core can advantageously also be surrounded by the shell-like main body in the inflow region on the upper side or the upper-side last tube plate by way of an upper-side part section of this type, with the result that slipping of the shell-like

main body from the heat exchanger core can be prevented as far as possible. In addition, the formation of a bypass flow can also be prevented or at least reduced on the upper side of the heat exchanger by way of the upper-side part section.

[0036] Furthermore, the shell-like main body can have a lower-side part section which is arranged on the lower side and extends from the opening to at least the rear-side part section.

[0037] The heat exchanger core can advantageously also be surrounded by the shell-like main body in the inflow region on the lower side or the lower-side last tube plate by way of a lower-side part section of this type, with the result that slipping of the shell-like main body from the heat exchanger core can be prevented as far as possible. In addition, the formation of a bypass flow can also be prevented or at least reduced on the lower side of the heat exchanger by way of the lower-side part section.

[0038] Furthermore, at least one part section selected from the following group, the rear-side part section, the upper-side part section, the lower-side part section, the right-side part section, the left-side part section, or the shell-like main body, can be configured so as to bear tightly, in particular sealingly, against the upper side and/or against the lower side on the edge side.

[0039] The respective part section can advantageously be configured so as to bear tightly against the upper side or against the lower side by way of a tight, in particular sealing configuration on the edge side of this type, in such a way that an edge-side outflow of the first fluid flow in the inflow region out of the heat exchanger core and/or past the latter can be reduced or prevented.

[0040] Furthermore, at least one part section selected from the following group, the rear-side part section, the upper-side part section, the lower-side part section, the right-side part section, the left-side part section or the shell-like main body, can be configured so as to bear tightly, in particular sealingly against the upper side and/or lower side on the opening side.

[0041] The respective part section can advantageously be configured so as to bear tightly against the upper side or against the lower side by way of a tight, in particular sealing

configuration on the opening side of this type, in such a way that an opening-side outflow of the first fluid flow in the inflow region out of the heat exchanger core and/or past the latter can be reduced or prevented.

[0042] Furthermore, at least one part section, selected from the following group: the upper-side part section, the lower-side part section, the right-side part section, the left-side part section or the shell-like main body, can have a configuration which is tight, in particular bears sealingly against the upper side and/or lower side.

[0043] The respective part section can advantageously bear tightly against the upper side or against the lower side in such a way that an outflow or flow of the first fluid flow past the heat exchanger core can be prevented or reduced over the entire respective side.

[0044] Furthermore, at least one part section selected from the following group: the right-side part section, the left-side part section or the shell-like main body, can have a configuration which is tight, in particular bears sealingly against the right-hand side and/or left-hand side.

[0045] The respective part section can advantageously bear tightly against the right-hand side or against the left-hand side in such a way that an outflow or a flow of the first fluid flow past the heat exchanger core can be prevented or reduced over the entire respective side.

[0046] Furthermore, the inlet opening can be configured on the upper-side part section, on the lower-side part section, on the right-side part section, on the left-side part section, or on the rear-side part section.

[0047] The configuration of the inlet opening on one of the part sections can advantageously ensure that the fluid flow is introduced or conducted into the heat exchanger core via the inlet opening of the shell-like main body in such a way that bypass flows of the first fluid flow which do not lead through the heat exchanger core can be reduced or prevented.

[0048] Here, a configuration of the inlet opening is advantageously to be provided, in particular, in the rear-side part region, since, in this case, an introduction or conduction of the first fluid flow into the heat exchanger core can be performed at the outermost point

with regard to the flow direction of the heat exchanger core. It is also conceivable, however, that the inlet opening is provided in the lower-side or upper-side part section and in the right-side or left-side part section, depending on where the inlet opening for the first fluid flow is arranged in the housing, with the result that the outflow opening of the first fluid flow into the housing and the inlet opening of the shell-like main body can be brought into congruence. A structural design of this type also prevents or at least reduces bypass flows of the first fluid flow.

[0049] Furthermore, the shell-like main body can be configured so as to be spaced apart from the heat exchanger core in the region of the inlet opening in the installed position.

[0050] The first fluid flow can advantageously flow into the shell-like main body in an unimpeded manner in this spaced-apart region, and can be distributed sufficiently homogeneously from there over the individual fluid ducts which are arranged between the tube plates.

[0051] Furthermore, a bulge can be configured around the inlet opening.

[0052] A distribution space or supply space can advantageously be provided by way of the configuration of a bulge of this type in the region of the inlet opening, in which distribution space or supply space the first fluid can collect, and from which distribution space or supply space the first fluid can be distributed to the individual fluid ducts between the tube plates. In addition, a bulge of this type can advantageously also serve to ensure that the first fluid flow which enters into the housing is conducted as completely as possible into the shell-like main body by virtue of the fact that the bulge is brought into operative connection with an outflow opening which lies within the housing.

[0053] Furthermore, the inlet opening can have an attaching stub. A feed line of the first fluid flow from the housing into the shell-like main body can advantageously be configured by way of an attaching stub of this type, since the attaching stub can be brought into operative connection within the housing with the outflow opening of the first fluid flow in the housing. The formation of bypass flows by the first fluid flow which enters into the housing can be prevented to as great an extent as possible by way of this, since virtually the entire first fluid flow is trapped via the attaching stub and is introduced into the shell-like main body.

[0054] Furthermore, in the installed position, at least one part section, selected from the following group: the rear-side part section, the right-side part section, the left-side part section, can be configured so as to be spaced apart at least in sections in the circumferential direction, and to be spaced apart completely from the heat exchanger in the region between a lowermost tube plate and an uppermost tube plate in the stack direction.

[0055] Spacing apart in this way of the respective part section from the heat exchanger core can advantageously ensure that the first fluid flow can be introduced into every fluid duct which is configured between the tube plates. Here, the regions which are spaced apart configure distribution ducts, into which the first fluid flow enters and from which the first fluid flow can enter into the respective fluid ducts which are configured between the tube plates.

[0056] Furthermore, in the installed position, at least one part section, selected from the following group: the rear-side part section, the right-side part section, and the left-side part section, can have at least one inner rib which runs in the stack direction and can be of interrupted or continuous configuration.

[0057] Precisely defined spacing apart of the respective part section from the heat exchanger core can advantageously be achieved by way of inner ribs of this type, with the result that distribution ducts are configured between the ribs, via which distribution ducts the first fluid flow can be distributed into the fluid ducts which are configured between the tube plates. In addition, stiffening of the shell-like main body can be achieved by way of inner ribs of this type.

[0058] Furthermore, at least two part sections, selected from the following group: the rear-side part section, the right-side part section, the left-side part section, the upper-side part section, and the lower-side part section, can be connected to one another by means of a positively locking connection which has at least one connecting element pair, in particular by means of a latched connection or a clipped connection.

[0059] A relatively simple and additionally releasable connection between the respective part sections can advantageously be configured on account of the positively locking connection, with the result that the mounting of the part sections on the heat exchanger

core can be performed in a simplified manner by way of the connecting pair elements being pressed into one another. It is likewise conceivable that, in the case of maintenance, the positively locking connection can be released again by way of simple release of the connecting element pair, and maintenance or replacement of the guiding/directing apparatus can be carried out.

[0060] Furthermore, it is conceivable that at least one part section, selected from the following group: the rear-side part section, the right-side part section, the left-side part section, the upper-side part section, and the lower-side part section, is connected to the heat exchanger core by means of a positively locking connection which has at least one connecting element pair, in particular by means of a latched connection or clipped connection.

[0061] The part sections can advantageously be attached not only among one another but rather also to the heat exchanger core on account of a positively locking connection of this type. It is conceivable here that the heat exchanger core has holes, cutouts or the like, into which connecting elements, for example, of the latched connection or clipped connection can be pressed, and the respective part section can thus be attached to the heat exchanger core.

[0062] Furthermore, at least two part sections, selected from the following group: the rear-side part section, the right-side part section, the left-side part section, the upper-side part section, and the lower-side part section, can be connected to one another in an integrally joined manner and, in particular, can be configured in one piece.

[0063] Preassembly of the part sections can advantageously be avoided on account of the integrally joined or single-piece configuration of the respective part sections, with the result that the mounting complexity during the mounting of the shell-like main body on the heat exchanger core can be carried out in as simplified manner as possible and efficiently in terms of costs and time.

[0064] Furthermore, at least one part section, selected from the following group: the rear-side part section, the right-side part section, the left-side part section, or the shell-like main body, can have at least one lug-shaped flow directing element on the opening side, which flow directing element is arranged on the right-hand side or on the left-hand side

between two plates in the installed position.

[0065] By way of lug-shaped flow directing elements of this type at the opening-side end of the shell-like main body, directing or guiding of the first fluid flow can advantageously be achieved beyond said opening-side end. Part fluid flows which do not flow in the fluid ducts which are configured between the tube plates or exit from said fluid ducts can be prevented or at least considerably reduced by way of the lug-shaped flow directing elements. Here, the lug-shaped flow directing elements are configured in such a way that a microscopic flow direction is configured which leads to the first fluid flow remaining substantially within fluid ducts which are configured between the respective tube plates, and doing so beyond the shell-like main body, since the first fluid flow is discharged more deeply into the heat exchanger core in the flow transverse direction by way of the lug-shaped flow directing elements. As a result, an outflow of the first fluid flow from the heat exchanger core is prevented or at least reduced even beyond the shell-like main body.

[0066] Here, a lug-shaped flow directing element is understood to mean a part of the respective part section which extends from the right-hand side or left-hand side into a fluid duct which is configured between two tube plates.

[0067] Furthermore, the lug-shaped flow directing element can be arranged at an angle α of from 30° to 90° with respect to the flow direction.

[0068] The desired flow guidance or direction of the first fluid flow can advantageously be achieved by way of a configuration of this type of the angle between the lug-shaped flow directing element and the flow direction, with the result that the first fluid flow remains substantially in the fluid ducts which are configured between the tube plates.

[0069] It is also conceivable that the lug-shaped flow directing element is arranged at an acute angle α of from 40° to 90° , in particular of from 50° to 90° , optionally of from 50° to 80° and, for example, of from 55° to 75° with respect to the flow direction.

[0070] Here, in the case of an elongate flow directing element, the direction of extent (as viewed from the shell-like main body) of the flow directing element can be used as a direction for the determination of the acute angle with respect to the flow direction.

[0071] Furthermore, the lug-shaped flow directing element can have a rectangular or a wedge-shaped, in particular acutely tapering, shape in the viewing direction of the stack direction.

[0072] The desired flow guidance or direction of the first fluid flow in the fluid ducts which are configured between the tube plates can advantageously be achieved or reinforced further by way of a shape of this type.

[0073] Furthermore, the rear-side part section, the right-side part section, the left-side part section or the shell-like main body can have at least one sprung web which, in the installed position, is arranged on the upper side and/or on the lower side and is oriented toward the heat exchanger core.

[0074] The shell-like main body can advantageously be held in position in the installed position by way of a sprung web of this type, and can be fastened or held on the heat exchanger core with a certain stress.

[0075] In a further aspect of the invention, a heat exchanger core having a guiding/directing apparatus as described above is proposed. The advantages which are listed in the above text can advantageously be achieved as a result.

[0076] In a further aspect, a heat exchanger having a heat exchanger core which is inserted into a housing of the heat exchanger is proposed, which heat exchanger is equipped with a guiding/directing apparatus as described above, the inlet opening of the guiding/directing apparatus being arranged directly in front of the inner inflow opening of the housing for the first fluid flow.

[0077] The advantages which are listed in the above text can advantageously be achieved as a result, and a substantially complete transfer of the first fluid flow which enters into the housing via the inlet opening into the guiding/directing apparatus can be performed on account of operatively connected positioning of the inlet opening of the guiding/directing apparatus and the inner outflow opening of the housing.

[0078] Here, an inner outflow opening is understood to mean the opening within the housing, via which opening the first fluid flow flows into the housing. Furthermore, a bulge which surrounds the inlet opening can be placed tightly, in particular sealingly,

onto the inner outflow opening.

[0079] A bulge of the guiding/directing apparatus, which bulge is placed tightly, in particular sealingly onto the inner outflow opening in this way, can advantageously bring about a complete transfer of the first fluid flow into the guiding/directing apparatus, with the result that bypass flows which flow past the guiding/directing apparatus can be reduced or prevented.

[0080] Furthermore, an attaching stub which configures the inlet opening can be placed tightly, in particular sealingly onto the inner outflow opening or, in particular, can be introduced sealingly into the inner outflow opening.

[0081] Part flows of the first fluid flow which flow past the guiding/directing apparatus and to this extent build up bypass flows which flow past the heat exchanger core can advantageously likewise be reduced or prevented on account of the tightly, in particular sealingly seated or tightly, in particular sealingly introduced arrangement of the attaching stub on or in the inner outflow opening.

BRIEF DESCRIPTION OF THE DRAWINGS

[0082] FIG. 1 is a perspective view of a heat exchanger core for use with some embodiments of the invention which is constructed from a plurality of tube plates which are stacked in the stack direction, the heat exchanger core in the viewing direction of the stack direction and the tube plates being of round or oval configuration.

[0083] FIG. 2 is a perspective view of a heat exchanger core for use with some embodiments of the invention which is constructed from a plurality of tube plates which are stacked in the stack direction, the heat exchanger core in the viewing direction of the stack direction and the tube plates being of elongate or substantially rectangular configuration.

[0084] FIG. 3 is a partial perspective view of the heat exchanger core of FIG. 2 with a guiding/directing apparatus which is arranged in the inflow region.

[0085] FIG. 4a is a partial perspective view of the heat exchanger core of FIG. 2 with a guiding/directing apparatus which has a bulge in the region of an inlet opening of the guiding/directing apparatus.

[0086] FIG. 4b shows an associated flow pattern of a cross section through the heat exchanger core of FIG. 4a in the inflow region.

[0087] FIG. 5a is a partial perspective view of the heat exchanger core of FIG. 2 with a guiding/directing apparatus which has an attaching stub in the region of an inlet opening of the guiding/directing apparatus.

[0088] FIG. 5b shows an associated flow pattern of a cross-section through the heat exchanger core of FIG. 5a in the inflow region.

[0089] FIG. 6 is a partial perspective view of a guiding/directing apparatus in the installed position with the heat exchanger core of FIG. 2 with sprung webs on the upper side.

[0090] FIG. 7 is a partial perspective view of an inlet opening which is configured in a guiding/directing apparatus.

[0091] FIG. 8 is a detail view of a guiding/directing apparatus which is configured in two pieces with a connecting element pair which is configured as a clip connection and connects the two parts of the guiding/directing apparatus to one another via a positively locking connection.

[0092] FIG. 9 is a partial perspective view of a two-piece configuration of a guiding/directing apparatus with sprung webs which are configured on the upper side.

[0093] FIG. 10 is a detail view of a guiding/directing apparatus which is configured in two pieces with a connecting element pair which is configured as a latched connection and connects the two parts of the guiding/directing apparatus to one another via a positively locking connection.

[0094] FIG. 11 is a detail view of a two-piece guiding/directing apparatus with a connecting element, configured as a lug, of a connecting element pair which is configured as a latched connection.

[0095] FIG. 12 is a detail view of a two-piece guiding/directing apparatus with a connecting element pair which configures the positively locking connection and is configured as a clipped connection or plugged connection.

[0096] FIG. 13a is a partial perspective view of a multiple-piece guiding/directing apparatus, at least one part of the guiding/directing apparatus being arranged on the upper side and being connected to the further part by means of a positively locking connection which is configured as a latched connection.

[0097] FIG. 13b is a detail view of the latched connection of FIG. 13a.

[0098] FIG. 13c is a partial section view through the latched connection of FIG. 13a.

[0099] FIGs. 14a-c depict an embodiment of a guiding/directing apparatus with a lug-shaped flow element which is rectangular and/or runs perpendicularly with respect to the flow direction.

[0100] FIGs. 14d-e depict the flow of a fluid through the heat exchanger core according to the embodiment of FIGs. 14a-c.

[0101] FIGs. 15a-c depict an embodiment of a guiding/directing apparatus with a lug-shaped flow element which tapers acutely and/or runs obliquely with respect to the flow direction.

[0102] FIGs. 15d-e depict the flow of a fluid through the heat exchanger core according to the embodiment of FIGs. 15a-c.

[0103] FIGs. 16a-d are partial perspective views of a heat exchanger core with bypass prevention elements according to an alternative embodiment, to prevent a bypass flow on the lower side of the heat exchanger core with respect to the housing by means of a sealing lip.

DETAILED DESCRIPTION

[0104] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the accompanying drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” or “having” and variations

thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms “mounted,” “connected,” “supported,” and “coupled” and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, “connected” and “coupled” are not restricted to physical or mechanical connections or couplings.

[0105] FIGs. 1 and 2 show two different embodiments of heat exchanger cores 100, in which, in addition to other embodiments, a guiding/directing apparatus 110 (as described in the preceding text and in the following text) can be used. The guiding/directing apparatus 110 is not shown here in FIGs. 1 and 2.

[0106] The heat exchanger core 100 according to FIG. 1 has a plurality of tube plates 120 which are stacked in the stack direction 130. Here, the embodiment which is shown in FIG. 1 has round or oval tube plates 120, with the result that the heat exchanger core is of doughnut-shaped configuration. On its upper side 140, the heat exchanger core 100 has an inlet 150 and an outlet 160 for at least one second fluid flow which flows through the tube plates 120 at least in sections. First fluid ducts 170 which are flowed through by a first fluid flow are configured between the tube plates 120. Accordingly, the said first fluid flow flows around the tube plates 120. Since at least the inlet 150 for the second fluid flow is positioned on the upper side 140, the side which lies opposite the upper side 140 on the heat exchanger core 100 is the lower side 180.

[0107] If the heat exchanger core 100 is of elongate configuration, as shown in FIG. 2, a longitudinal direction 190 which extends along a longitudinal axis of the heat exchanger core 100 can be defined in addition to the stack direction 130. A heat exchanger core of elongate configuration of this type is likewise constructed from a plurality of tube plates 120 which are stacked in the stack direction 130. The second fluid flow in turn flows within the tube plates 120, which second fluid flow is fed by way of an inlet 150 and can exit from the heat exchanger core 100 again via the outlet 160. In accordance with one possible definition, that side of the heat exchanger core 100, on which at least the inlet 150 for the second fluid flow is configured, is once again the upper side 140, whereas the side which lies opposite the upper side 140 is accordingly the lower side 180. Since the inlet 150 and the outlet 160 are positioned in the longitudinal direction 190 in each case at

the end of the heat exchanger core 100, the macroscopic flow direction of the second fluid flow (called the second flow direction in a simplified manner in the following text) runs parallel to the longitudinal direction 190. It is then conceivable that the first fluid flow runs through the heat exchanger core 100 along a (macroscopic) first flow direction 210, it being possible for the first flow direction 210 (as shown in FIG. 2) to run in the counterflow principle with respect to the second flow direction 200. It is also conceivable, however, that the first flow direction 210 runs in the parallel flow principle, in the crossflow principle or in the counter-crossflow principle with respect to the second flow direction 200. It is advantageous, however, if the first flow direction 210 runs in the counterflow principle with respect to the second flow direction 200, as shown in FIG. 2.

[0108] In the following text, guiding/directing apparatuses 110 will be described which can be installed with an elongate heat exchanger core 100, as shown in FIG. 2. It is also conceivable, however, that every possible form of a heat exchanger core, such as the doughnut form in FIG. 1, can be provided with a similar guiding/directing apparatus 110. Said guiding/directing apparatuses 110 are then to be designed structurally in such a way that the first fluid flow flows through the heat exchanger core 100 substantially in the first fluid ducts 170 which are arranged between the tube plates 120.

[0109] As shown in FIG. 3, the guiding/directing apparatus 110 is arranged in an inflow region 220 of the first fluid flow in the heat exchanger core 100. Here, the guiding/directing apparatus 110 has a shell-like main body 230 which has an opening 240, into which the heat exchanger core 100 is inserted. Furthermore, the shell-like main body 230 has a rear-side part section 250 which is arranged on that side of the shell-like main body 230 which lies opposite the opening 240. The shell-like main body 230 is preferably arranged in the region of the outlet 160, since, in this case, the heat exchanger core can be flowed through in the counterflow principle with regard to the first flow direction 210 and the second flow direction 220. Furthermore, the shell-like main body can have a left-side part section 260, and a right-side part section 270 which is arranged in a concealed manner and so as to lie opposite the left-side part section 260. The shell-like main body 230 can likewise be equipped with a lower-side part section 280, and an upper-side part section 290 which is arranged in a concealed manner.

[0110] An inlet opening 300 for the first fluid flow is configured in the lower-side part

section 280, via which inlet opening 300 the first fluid flow can be introduced into the heat exchanger core 100 by means of the guiding/directing apparatus 110, with the result that the first fluid flow flows mainly through the heat exchanger core 100. In the embodiment which is shown in FIG. 3, the inlet opening 300 is configured as merely an opening in the lower-side part section 280 of substantially planar configuration.

[0111] In order to improve the inflow behavior of the first fluid flow via the inlet opening 300 into the heat exchanger core 100, a bulge 310 (as shown in FIG. 4a) can be provided around the inlet opening 300 or in the region of the inlet opening 300, or the inlet opening 300 can have an attaching stub 320, as shown in FIG. 5a. Both the bulge 310 and the attaching stub 320 can be arranged directly in front of an inner inlet opening of a housing (not shown) for the first fluid flow. It is likewise conceivable that the bulge 310 lies possibly sealingly on the inner inlet opening of the housing, or that the attaching stub 320 is inserted at least in sections into the inner inlet opening.

[0112] By way of a bulge 310 of this type or by way of an attaching stub 320 of this type, the inflow behavior of the first fluid flow into the guiding/directing apparatus can be improved in such a way that the distribution of the first fluid flow to the first fluid ducts 170 which are configured between the tube plates can take place in an improved manner.

[0113] A distribution of this type of the first fluid flow to the first fluid ducts 170 which are arranged between the tube plates 120 can be determined by means of flow patterns 330, 340, as shown in FIGs. 4b and 5b. Here, FIG. 4b shows the flow pattern 330 of the embodiment according to FIG. 4a with a bulge 310, and FIG. 5b shows the flow pattern 340 of the embodiment according to FIG. 5a with an attaching stub 320.

[0114] According to FIG. 4b, a first fluid flow 350 is distributed satisfactorily to the first fluid ducts 170 which are configured between the tube plates 120, which can be concluded from the very pronounced region 360 of high fluid speed. Here, the first fluid flow 350 is distributed to the first fluid ducts 170 of the heat exchanger core 100 via a gap 370 between the guiding/directing apparatus 110 and the heat exchanger core 100 on account of the spacing of the guiding/directing apparatus 110 from the heat exchanger core 100 in said region. It can be detected on the basis of the flow pattern 330, however, that the region 360 of high fluid speed can be improved further, since at least part of the first fluid flow 350 and even part of the region 360 of high fluid speed flows past the

guiding/directing apparatus 110 outside the latter.

[0115] The flow pattern 340 according to FIG. 5b which illustrates the flow in the region of the guiding/directing apparatus 110 in the case of an attaching stub 320 has a more pronounced region 360 of high fluid speed. In addition, the region 360 of high fluid speed is of more symmetrical configuration on the left-hand side and on the right-hand side, and extends further in the direction of the upper side 140 of the heat exchanger core 110.

[0116] Accordingly, it can be concluded from this that the distribution of the first fluid flow 350 to the first fluid ducts 170 can be improved in the case of the use of an attaching stub 320 in comparison with a bulge 310. In addition, it can be recognized in comparison with FIGs. 4b and 5b that a not inconsiderable proportion of the first fluid flow 350 flows off outside the heat exchanger core 100 as a bypass flow 380 only in the case of a bulge 310. In contrast to this, virtually the entire first fluid flow 350 is introduced into the heat exchanger core 100 via the attaching stub 320, as shown in FIG. 5b.

[0117] The embodiment which is shown in FIGs. 6, 7, 8, 9, 10 and 11 has a two-piece construction of the guiding/directing apparatus 110. As shown in FIG. 6, the guiding/directing apparatus 110 can have the right-side part section 270 and the left-side part section 260, said part sections 260, 270 being configured separately from one another. Said two part sections 260, 270 extend on the heat exchanger core 100 from a lower-side edge 390 of the lower side 180 to an upper-side edge 400 of the upper side 140. In addition, the two part sections 260, 270 are configured spaced apart from the heat exchanger core 110 at least between the lower-side edge 390 and the upper-side edge 400, and so as to bear at least tightly, in particular sealingly, against the heat exchanger core 100 on the opening side. On the upper side, the guiding/directing apparatus 110 has a sprung web 410 which is oriented toward the heat exchanger core 100 both on the right-hand side and on the left-hand side, with the result that the left-side part section 260 and the right-side part section 270 accordingly in each case have a sprung web 410 of this type. The guiding/directing apparatus 110 can be fixed or at least positioned on the heat exchanger core 100 by means of the sprung webs 410.

[0118] As shown in FIG. 7, the inlet opening 300 is likewise configured on the lower side 180 of the heat exchanger core 100 or of the guiding/directing apparatus 110 in said embodiment, a bulge 310 being configured around the inlet opening 300. It is also

conceivable, however, that an attaching stub 320 (as shown in FIG. 5a, for example) is configured in addition or as an alternative, instead of the bulge 310. Since the guiding/directing apparatus 110 is of two-piece and substantially symmetrical configuration, the inlet opening 300 is also configured by way of the two part sections 260, 270 of the guiding/directing apparatus 110.

[0119] On the rear-side part section 250 (as shown in FIG. 8), the two part sections 260, 270 of the guiding/directing apparatus 110 are connected to one another by way of a connecting element pair 420, 430, by means of a positively locking connection which is configured as a clipped connection 440. Here, on the left-side part section 260 of the guiding/directing apparatus 110, the clipped connection 440 has one or more pins 420 which build up the positively locking connection in the form of a clipped connection 440 after being clipped to the pins 420 which are configured on the right-side part section 270. Accordingly, the rear-side part section 250 is divided by way of the clipped connection 440.

[0120] It is likewise conceivable that the two part sections 260, 270 of the guiding/directing apparatus 110 are connected to one another by means of a latched connection 450, it being possible for lugs 460 to be configured on the left-side part section 260 of the guiding/directing apparatus 110 (as shown in FIGs. 9, 10 and 11), which lugs can be latched with openings 470 which are configured on the right-side part, in order to configure the latched connection 450.

[0121] As shown in FIG. 9, even if the rear-side part section 250 is of two-piece configuration in the embodiment which is shown, it likewise extends in the stack direction 130 from the lower-side edge 390 to the upper-side edge 400 and in the circumferential direction 480 from the left to the right. In addition, the rear-side part section 250 is configured so as to be spaced apart from the heat exchanger core 100 at least in sections, at least between the lower-side edge 390 and the upper-side edge 400, and is configured so as to bear sealingly at least on the upper side against the upper side 140 of the heat exchanger core 100 or so as to bear at least tightly against the upper side 140 of the heat exchanger core 100.

[0122] The left-side part section 260 extends in the circumferential direction 480 (as shown in FIG. 9, for example), from the rear-side part section 250 toward the opening

240, and the right-side part section 270 extends from the rear-side part section 250 in the circumferential direction 480, likewise toward the opening 240.

[0123] The embodiment which is shown in FIG. 12 is likewise of two-piece configuration in the circumferential direction 480, a positively locking connection which is configured as a clipped/plugged connection 490 being produced by way of clipping or plugging of a clamp 500 which runs continuously in the stack direction 130 in a longitudinal manner with a pin 510 which likewise runs continuously in the stack direction 130 in a longitudinal manner. Accordingly, the positively locking connection can be achieved by virtue of the fact that the clamp 500 is pressed onto the longitudinally running pin 510 or onto the bead which runs in the stack direction 130, or by the longitudinally running pin 510 being pushed into the clamp 500 on the upper side or on the lower side.

[0124] The embodiment which is shown in FIGs. 13a, b, c is likewise of two-piece configuration, but not in the circumferential direction 480, but rather in the stack direction 130. Accordingly, the guiding/directing apparatus 110 has (as shown in FIG. 13a) a main body 520 which encloses the heat exchanger core 100 on the rear side, on the right side, on the left side and on the lower side at least in sections in the inflow region 220. A cover 530 is provided on the upper side, it being possible for the cover 530 to be connected to the main body 520 in a positively locking manner by means of a plurality of connecting element pairs 540. Here, at least one connecting element pair 540 can be configured as a latched connection, the cover 530 having holes 550 in this case (as shown in FIGs. 13b, c), into which holes 550 latching bars 560 can be introduced, the positively locking connection being configured on account of the latched action of the latching bars 560 in the holes 550. Here, the inlet opening 300 which is configured on the lower side 180 can be surrounded by a bulge 310 or can have an attaching stub 320, as shown in FIG. 5a, for example.

[0125] The embodiment of a guiding/directing apparatus 110 (as shown in FIGs. 14a, b, c, d, e) is likewise of two-piece configuration in a manner which runs in the circumferential direction 480. On the inner side, as shown in FIG. 14a, for example, the guiding/directing apparatus 110 can have at least one inner rib 570, by way of which the guiding/directing apparatus 110 is supported on the heat exchanger core 100, with the result that uniform spacing of the guiding/directing apparatus 110 from the heat

exchanger core 100 is made possible. Here, an inner rib 570 of this type can be of continuous configuration or can be of continuous configuration at least in sections in the stack direction 130.

[0126] In addition or as an alternative, the guiding/directing apparatus 110 is equipped on the opening side, on the left-hand side and/or on the right-hand side with lug-shaped flow directing elements 580 which extend at least partially into the heat exchanger core 100. Here, the lug-shaped flow directing element 580 can be oriented at a right angle with respect to the longitudinal direction 190 of the heat exchanger core 100, and can be of substantially rectangular configuration. Flow patterns 585 as shown in FIGs. 14d, e result in the case of lug-shaped flow directing elements 580 which are configured in this way. A conclusion can be made from flow patterns 585 of this type, inter alia on the basis of the regions 590 of high flow speed, that the first fluid flow 350 runs substantially within the first fluid ducts 170, and that bypass flows are produced only to a slight extent, if at all. Here, FIG. 14d shows a flow pattern 585 which is produced substantially when a feed of the first fluid flow 350 into the heat exchanger core 100 or into the first fluid ducts 170 is performed via the left-side part section 260 and the right-side part section 270, and optionally on a subordinate scale via the rear-side part section 250, whereas FIG. 14e shows a flow pattern 585, in which the first fluid flow 350 is introduced into the heat exchanger core 100 or into the first fluid ducts 170 substantially via a rear-side part section 250.

[0127] The embodiment of a guiding/directing apparatus 110 (as shown in FIGs. 15a, b, c, d, e) is likewise of two-piece configuration so as to run in the circumferential direction 480. On the inner side, the guiding/directing apparatus 110 can have at least one inner rib 570 (not shown), by way of which the guiding/directing apparatus 110 is supported on the heat exchanger core 100, with the result that uniform spacing of the guiding/directing apparatus 110 from the heat exchanger core 100 is made possible. Here, an inner rib 570 of this type can be of continuous configuration or can be of continuous configuration at least in sections in the stack direction 130.

[0128] In addition or as an alternative, the guiding/directing apparatus 110 is equipped on the opening side, on the left-hand side and/or on the right-hand side with lug-shaped flow directing elements 580 which extend at least partially into the heat exchanger core 100.

Here, the lug-shaped flow directing element 580 can be oriented obliquely with respect to the longitudinal direction 190 of the heat exchanger core 100, and can be of substantially acutely or conically tapering configuration. Flow patterns 585 as shown in FIGs. 15d, e result in the case of lug-shaped flow directing elements 580 which are configured in this way. A conclusion can be made from flow patterns 585 of this type, inter alia on the basis of the regions 590 of high flow speed, that the first fluid flow 350 runs substantially within the first fluid ducts 170, and that bypass flows are produced only to a slight extent, if at all. Here, FIG. 15d shows a flow pattern 585 which is produced substantially when a feed of the first fluid flow 350 into the heat exchanger core 100 or into the first fluid ducts 170 is performed via the left-side part section 260 and the right-side part section 270, and optionally on a subordinate scale via the rear-side part section 250, whereas FIG. 15e shows a flow pattern 585, in which the first fluid flow 350 is introduced into the heat exchanger core 100 or into the first fluid ducts 170 substantially via a rear-side part section 250.

[0129] In addition or as an alternative, as shown in FIGs. 16a, b, c, d, a seal element 600 can also be provided which prevents or at least reduces a bypass flow at least along the lower side 180 of the heat exchanger core 100. A seal element 600 of this type can be fastened to the heat exchanger core 100 by means of a belt 605 which runs around the heat exchanger core 100, and said seal element 600 can have a sealing lip 610, by way of which a possible bypass region 620 which runs on the lower side 180 can be sealed at least to such an extent that a bypass flow of the first fluid flow 350 can be suppressed as far as possible. Here, as shown in FIG. 16a, the sealing lip 610 can have one blade 630 or a plurality of blades 630, as shown in FIGs. 16c, d.

[0130] In addition or as an alternative, a left-side and/or right-side sealing lip 640 can also be provided in each case (as shown in FIGs. 16c, d), by way of which a bypass flow can be prevented or reduced as far as possible on the left-hand side or on the right-hand side of the heat exchanger core 100.

[0131] Various alternatives to the certain features and elements of the present invention are described with reference to specific embodiments of the present invention. With the exception of features, elements, and manners of operation that are mutually exclusive of or are inconsistent with each embodiment described above, it should be noted that the

alternative features, elements, and manners of operation described with reference to one particular embodiment are applicable to the other embodiments.

[0132] The embodiments described above and illustrated in the figures are presented by way of example only and are not intended as a limitation upon the concepts and principles of the present invention. As such, it will be appreciated by one having ordinary skill in the art that various changes in the elements and their configuration and arrangement are possible without departing from the spirit and scope of the present invention.

What is claimed is:

1. A guiding/directing apparatus for a first fluid flow that flows through a heat exchanger core constructed from a plurality of tube plates that conduct a second fluid flow and are stacked in the stack direction, comprising:
 - a shell-like main body arranged in an inflow region of the first fluid flow into the heat exchanger core when the guiding/directing apparatus is in an installed position on the heat exchange core;
 - an opening through which the heat exchanger core extends in a flow direction of the first fluid flow through the heat exchanger core, said flow direction being aligned with a longitudinal direction of the heat exchanger core; and
 - an inlet through which the first fluid flow enters into the guiding/directing apparatus, the first fluid flow being directed from the inlet to the opening so that the first fluid flow exits the guiding/directing apparatus through the opening by way of flow passages arranged between the tube plates.
2. The guiding/directing apparatus of claim 1, wherein the shell-like main body comprises:
 - a rear-side part section arranged opposite the opening and extending from a lower side of the heat exchanger core to an upper side of the heat exchanger core in the stack direction;
 - a left-side part section extending between a first edge of the opening and the rear-side part section; and
 - a right-side part section extending between a second edge of the opening and the rear-side part section.
3. The guiding/directing apparatus of claim 2, wherein the shell-like main body further comprises a lower-side part section arranged adjacent to an outermost one of the plurality of plates, wherein the inlet is arranged within the lower-side part section.
4. The guiding/directing apparatus of claim 3, wherein a majority of the lower-side part

section has a planar configuration and wherein the inlet comprises an opening through the planar configuration.

5. The guiding/directing apparatus of claim 3, wherein the lower-side part section includes a bulge in the region of the inlet.
6. The guiding/directing apparatus of claim 3, wherein the lower-side part section includes a stub extending away from the heat exchanger core in the stacking direction, the inlet being provided by the stub.
7. The guiding/directing apparatus of claim 3, wherein the shell-like main body further comprises an upper-side part section arranged opposite the lower-side part section, the upper-side part section configured to bear tightly against a corresponding upper side of the heat exchanger core in order to create a seal for the first fluid.
8. The guiding/directing apparatus of claim 7, wherein the upper-side part section includes one or more sprung webs to bear against the upper side of the heat exchanger core.
9. The guiding/directing apparatus of claim 1, wherein the shell-like main body extends over a portion of the heat exchanger core in a circumferential direction, said portion being between 5% and 50% of the total circumference of the heat exchanger core.
10. The guiding/directing apparatus of claim 9, wherein the shell-like main body is spaced away from the heat exchanger core over at least some of said portion of the heat exchanger core, thereby defining a gap between the shell-like main body and the heat exchanger core through which the first fluid can flow.
11. The guiding/directing apparatus of claim 10, further comprising one or more inner ribs extending inwardly towards the heat exchanger core to at least partially define the

gap.

12. The guiding/directing apparatus of claim 10, wherein the inlet is provided at a first end of the guiding/directing apparatus in the stack direction and wherein the gap decreases in size between the first end and an opposing second end of the guiding/directing apparatus in the stack direction.

13. The guiding/directing apparatus of claim 9, wherein the shell-like main body comprises two separate pieces that are joined together, each of which extend over half of said portion of the heat exchanger core in the circumferential direction.

14. The guiding/directing apparatus of claim 13, wherein the two separate pieces are joined together by a positively locking connection.

15. The guiding/directing apparatus of claim 14, wherein the positively locking connection is selected from the group consisting of a clipped connection and a latched connection.

16. The guiding/directing apparatus of claim 1 wherein the opening includes opposing first and second edges extending in the stack direction, further comprising a plurality of lug-shaped flow directing elements extending at least partially into the heat exchanger core from the first and second edges.

17. The guiding/directing apparatus of claim 16, wherein the plurality of lug-shaped flow directing elements are oriented at a right angle with respect to the longitudinal direction of the heat exchanger core.

18. The guiding/directing apparatus of claim 16, wherein the plurality of lug-shaped flow directing elements are oriented obliquely with respect to the longitudinal direction of the heat exchanger core.

19. The guiding/directing apparatus of claim 18, wherein the plurality of lug-shaped flow

directing elements have a tapering configuration.

20. The guiding/directing apparatus of claim 1, wherein the guiding/directing apparatus is made from plastic.

Fig. 1

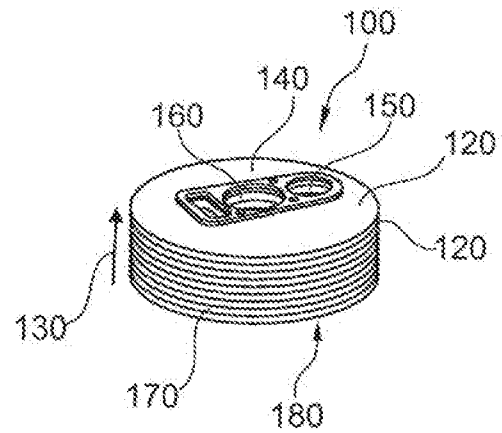


Fig. 2

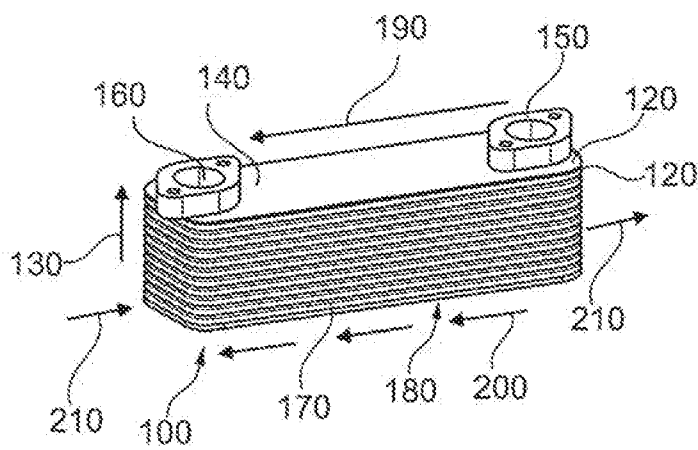


Fig. 3

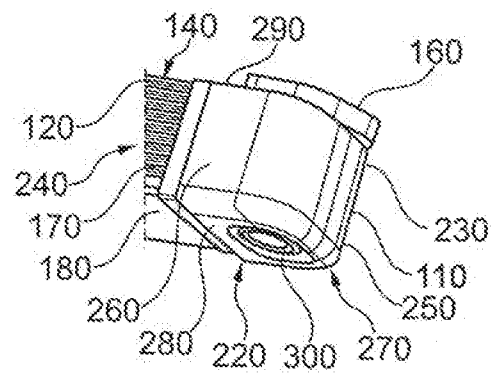


Fig. 4a

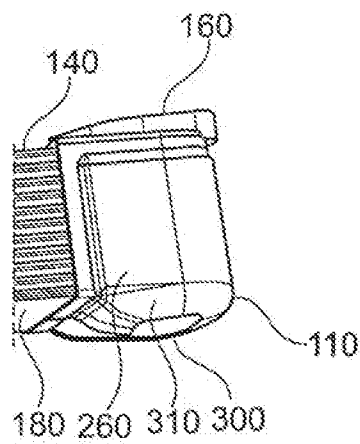


Fig. 4b

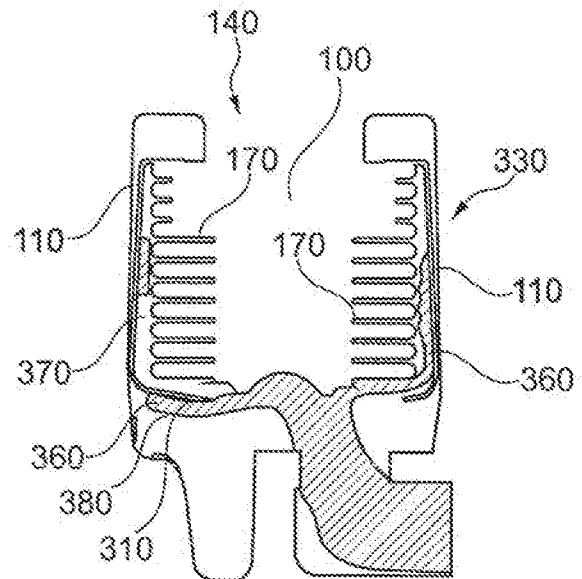


Fig. 5a

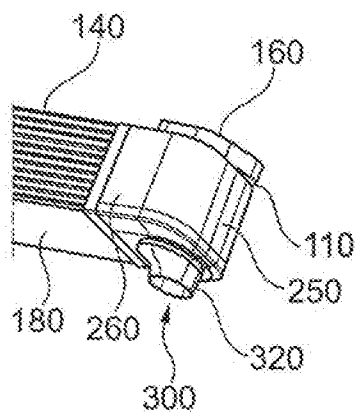
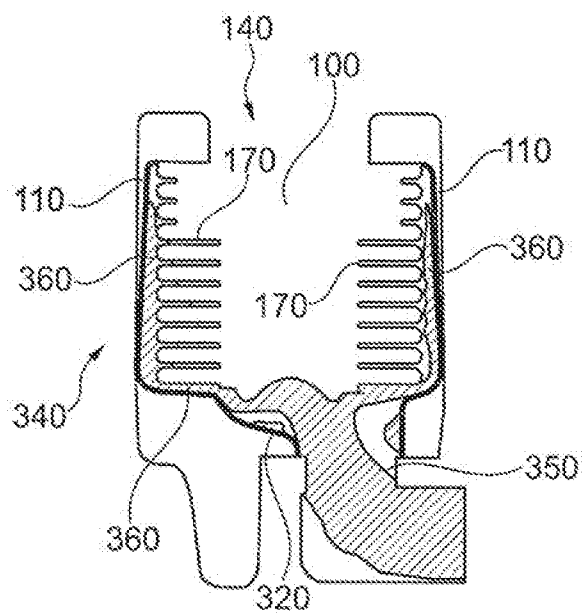


Fig. 5b



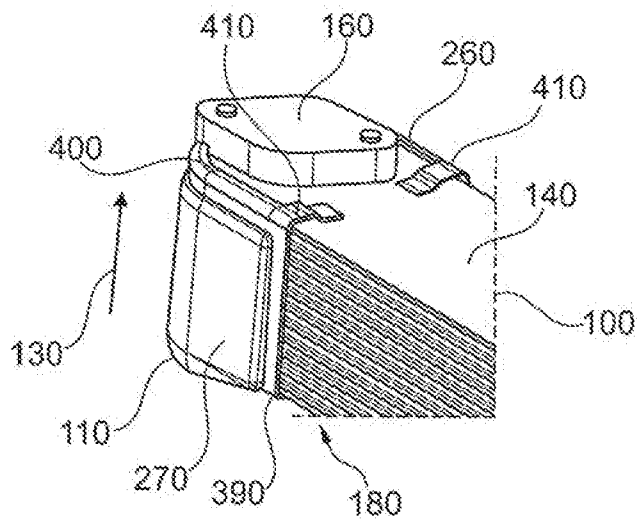


Fig. 6

Fig. 7

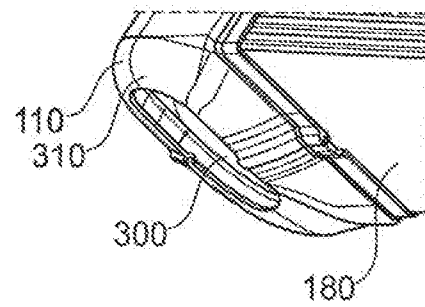
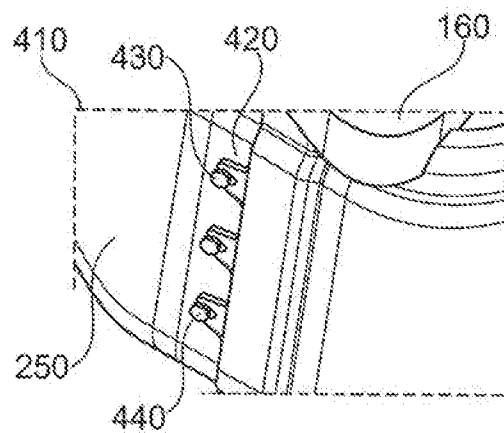
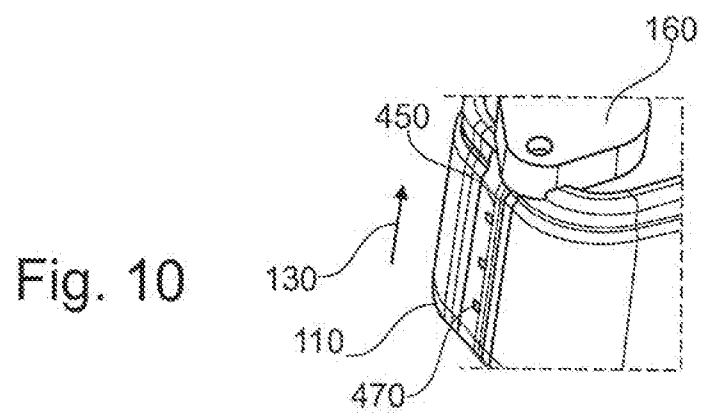
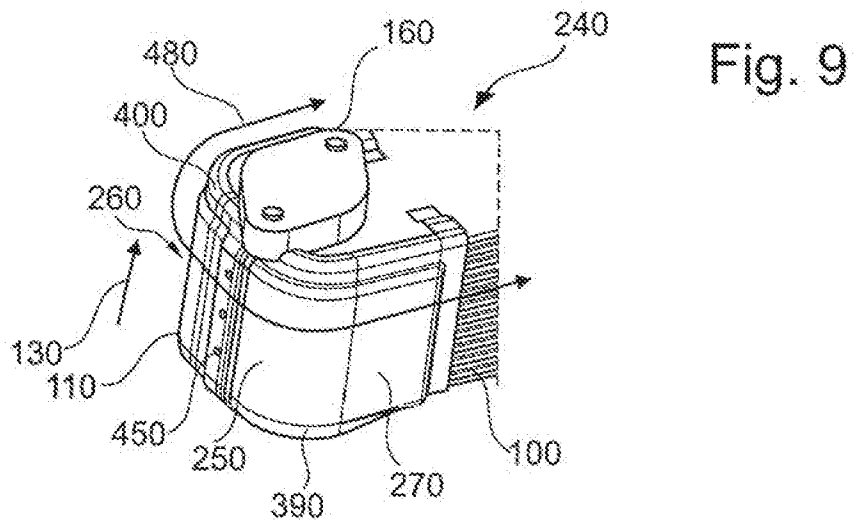


Fig. 8





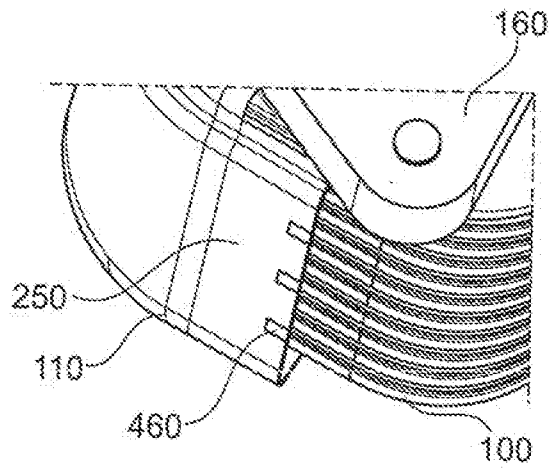


Fig. 11

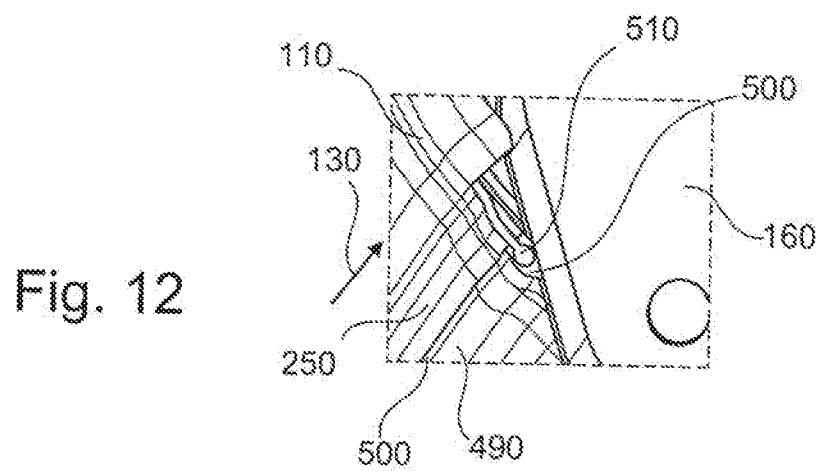


Fig. 12

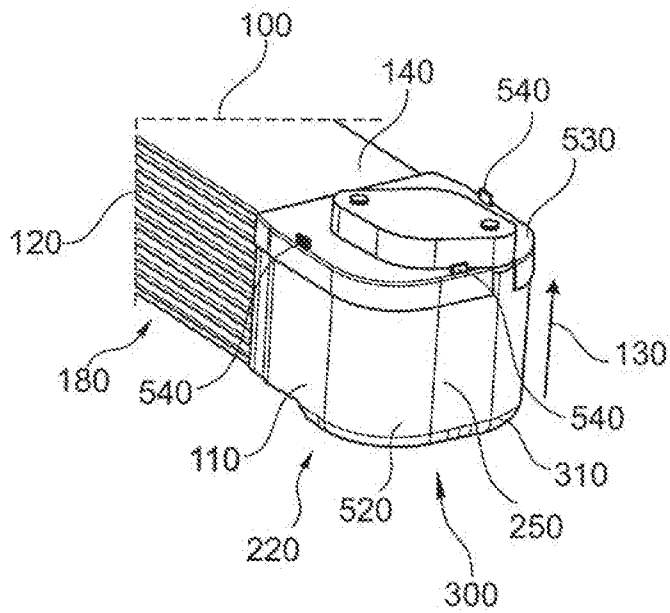


Fig. 13a

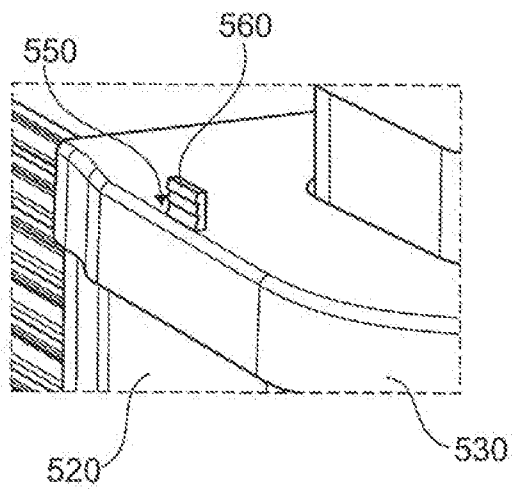


Fig. 13b

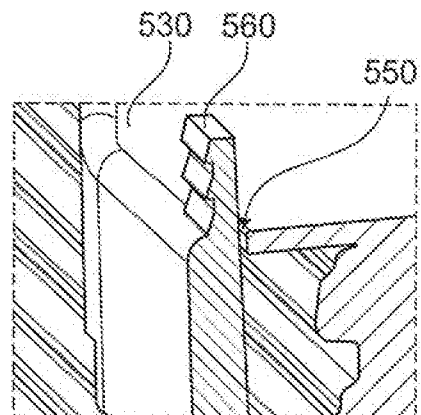


Fig. 13c

Fig. 14a

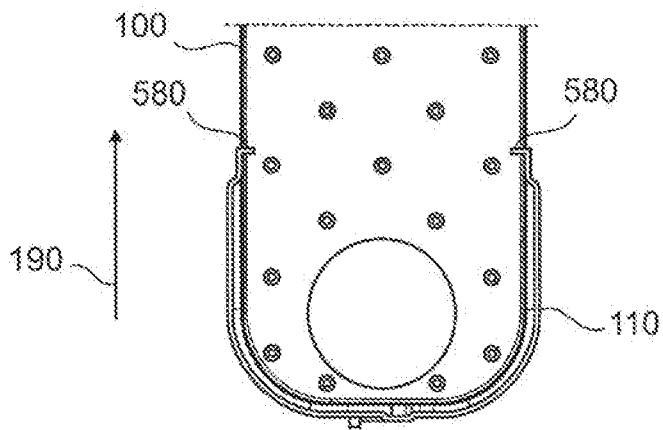
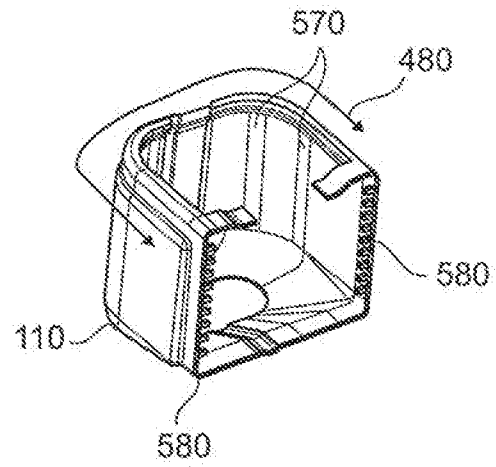


Fig. 14b

Fig. 14c

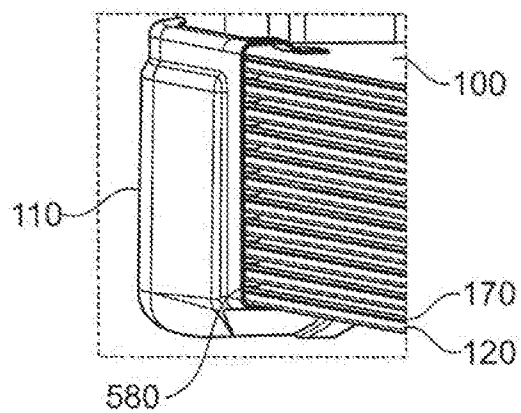


Fig. 14d

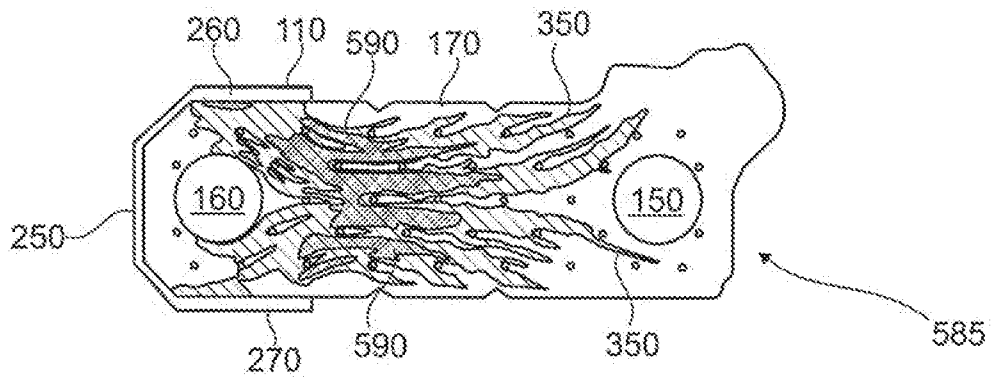
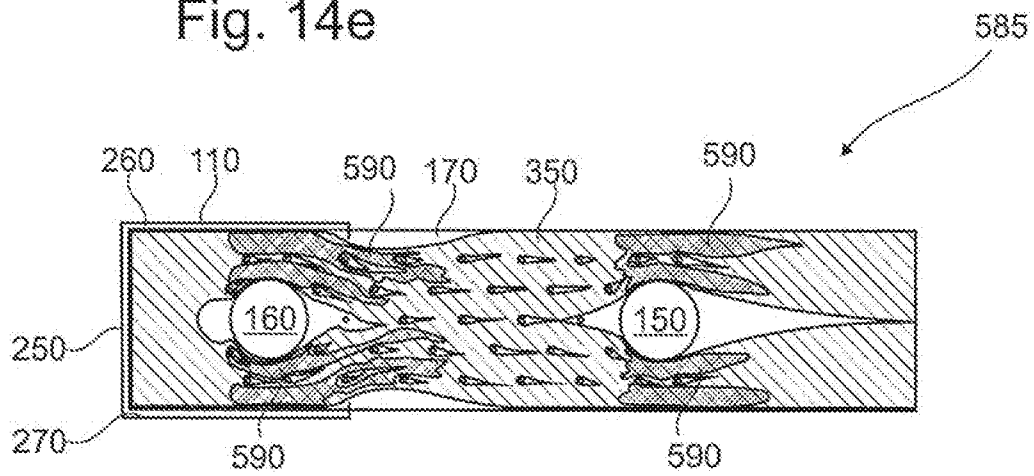


Fig. 14e



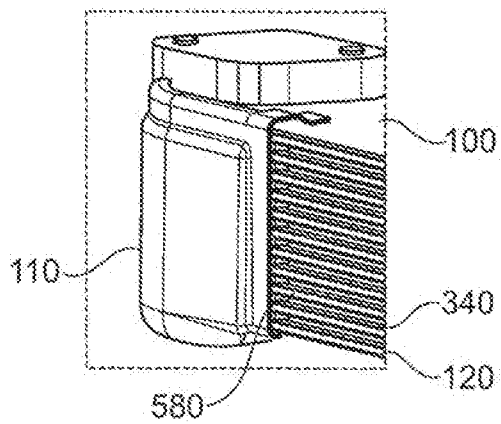
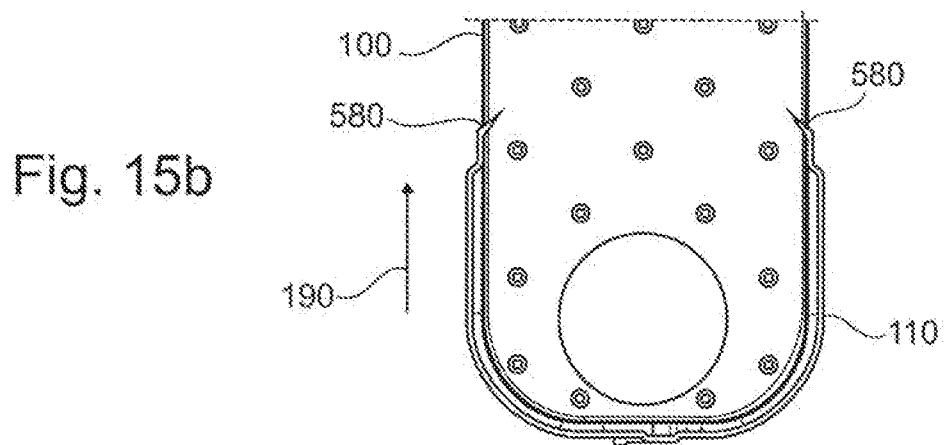
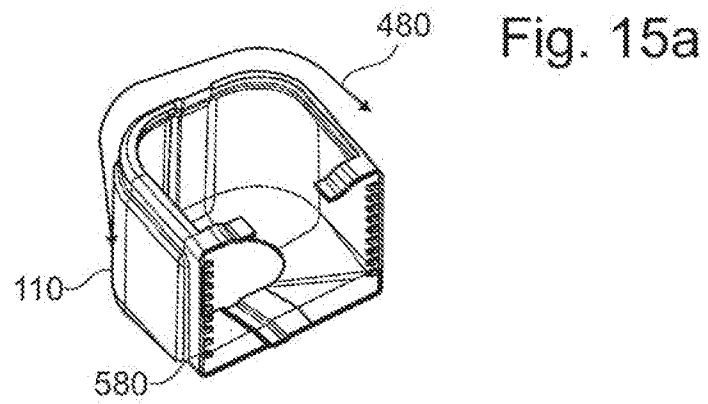


Fig. 15c

Fig. 15d

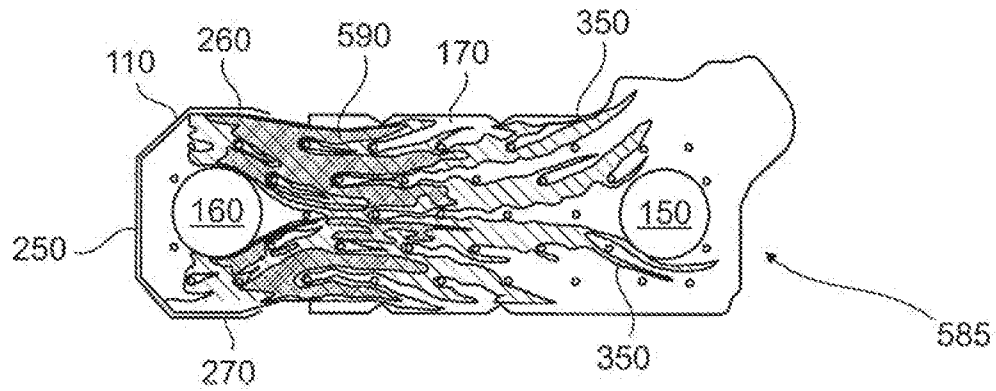
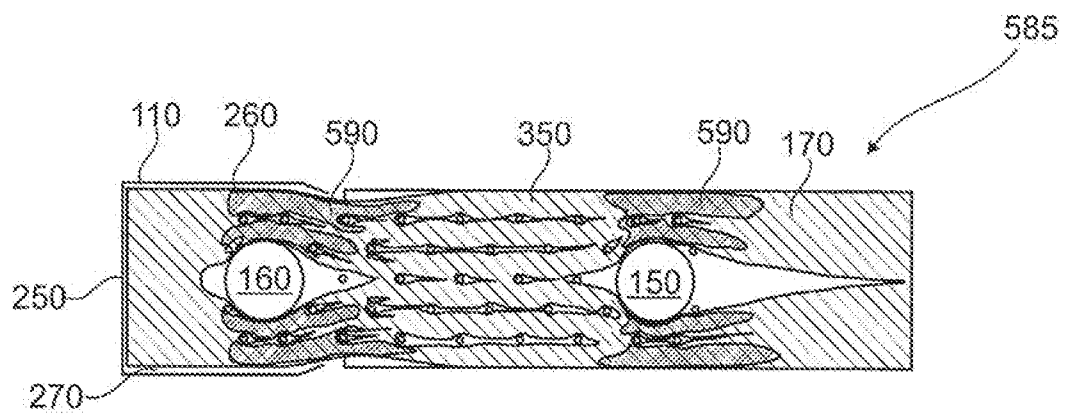


Fig. 15e



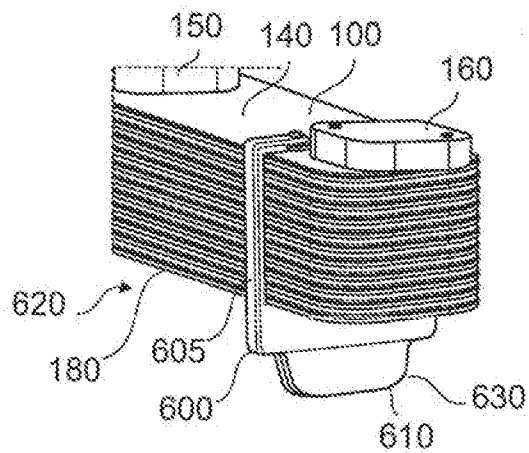


Fig. 16a

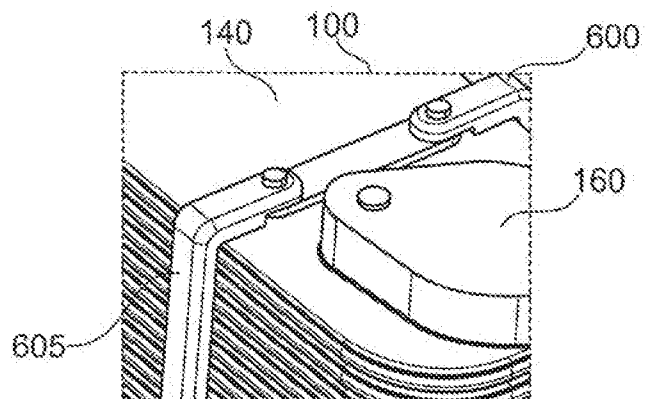
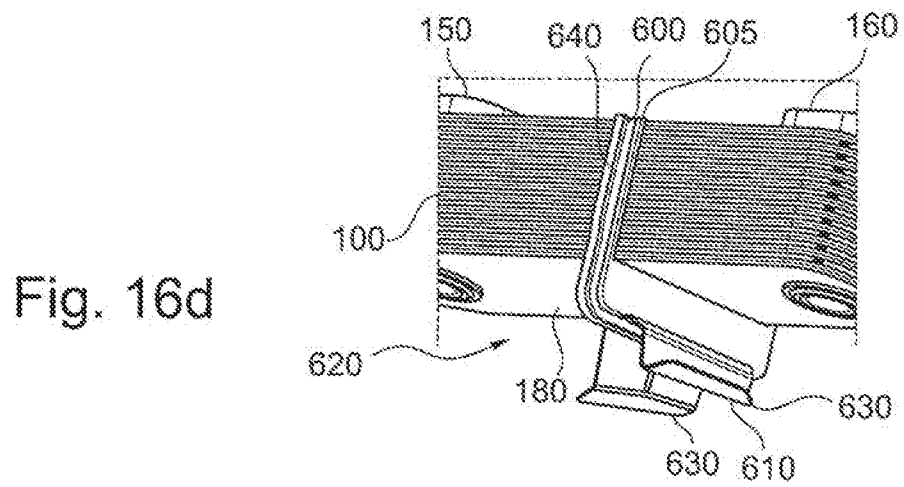
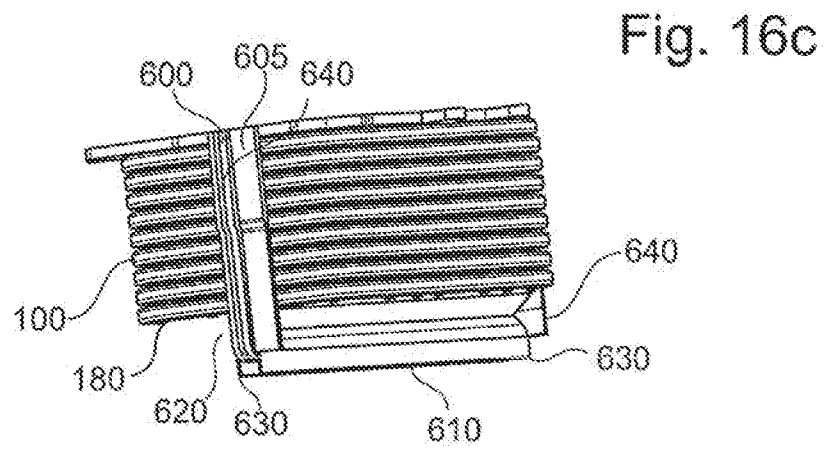


Fig. 16b



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/12883

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F28F 3/02, F28F 3/08, F28F 9/02, F28F 9/22, F28F 9/24, F28D 9/00 (2018.01)

CPC - F28D 9/00, F28F 1/00, F28F 1/04, F28F 3/08, F28F 3/12, F28F 7/00, F28F 9/00, F28F 3/14, F28D 9/0087, F28F 21/065, F28F 21/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y ----- A	US 2005/0161206 A1 (AMBROS et al.) 28 July 2005 (28.07.2005), entire document, especially Figs. 1, 2, 6, 11; para [0038], [0043]-[0046]	1-5, 7, 9-11, 16-17, 19 ----- 8, 12, 20 ----- 13-15, 18
X	US 6,293,337 B1 (STRAHLE et al.) 25 September 2001 (25.09.2001), entire document, especially Figs. 1-6; col 4, ln 4-11	1-3, 6
Y	WO 2006/010463 A1 (DEUTZ AKTIENGESELLSCHAFT) 2 February 2006 (02.02.2006), entire document, especially Figs. 2-3	8, 12
Y ----- A	US 2015/0184952 A1 (BEHR GMBH & CO. KG) 2 July 2015 (02.07.2015), entire document, especially Figs. 6-9; para [0005]	20 ----- 13-15, 18
A	JPS 6186590 A (HISAKA WORKS LTD) 02 May 1986 (02.05.1986), entire document	1-20
A	US 2010/0313587 A1 (WOLFE, IV et al.) 16 December 2010 (16.12.2010), entire document	1-20
A	WO 2008/034829 A1 (VALEO SYSTEMES THERMIQUES) 27 March 2008 (27.03.2008), entire document	1-20



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

9 March 2018

Date of mailing of the international search report

29 MAR 2018

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/12883

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, P	US 2017/0268413 A1 (DANA CANADA CORPORATION) 21 September 2017 (21.09.2017), entire document	1-20
A,P	US 2017/0335740 A1 (MODINE MANUFACTURING CORPORATION) 23 November 2017 (23.11.2017), entire document	1-20