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(54) Integral heat exchanger distributor

(57) A heat exchanger comprises a first inlet port (14), a first outlet port (32) longitudinally spaced apart from the first inlet port (14), a plurality of substantially parallel parting plates (144) stacked along a no-flow axis (129), a plurality of first flow spaces (146) and a plurality of metering plates (154). The plurality of first flow spaces (146) are defined between adjacent ones of at least some of the parting plates (144) and provide communication between the first inlet port (14) and the first outlet port (32). The plurality of metering plates (154) are disposed across an upstream end of at least one of the first flow spaces (146). Each of the plurality of metering plates (154) includes at least one metering aperture (156) providing fluid communication between the first inlet port (14) and the at least one first flow space (146).

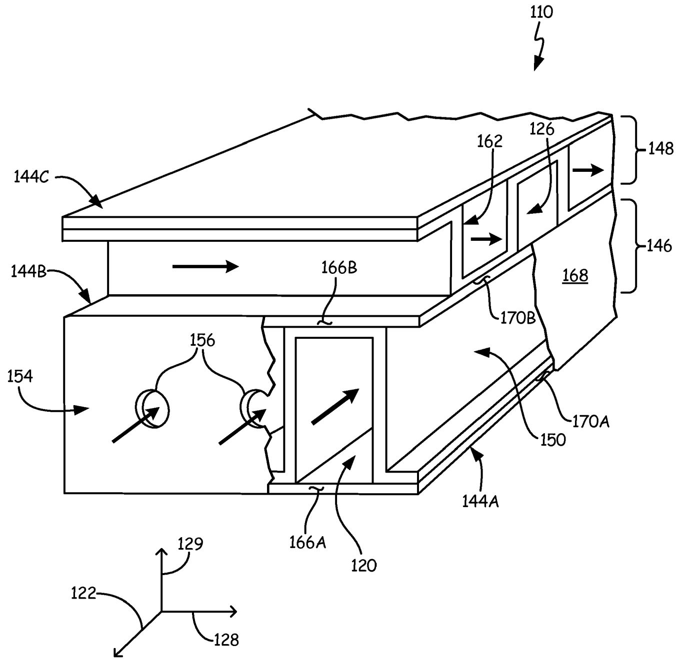

FIG. 3

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Description

BACKGROUND

[0001] The described subject matter relates generally to heat exchangers, and more specifically to heat exchangers for use with in various refrigerant systems.

[0002] The current method of distributing a liquid/vapor mixture to the inlet face of an evaporator-type heat exchanger is through a distributor tube. An attempt is made to position holes of the distributor tube at optimum locations and to line them up with each fin passage of a plate fin heat exchanger. Due to tolerance accumulation and manufacturing variation, however, these holes feeding the liquid/vapor mixture do not readily line up with their respective passages. Thus there is often uneven distribution of the liquid/vapor mixture which reduces efficiency of thermal transfer.

SUMMARY

[0003] In one aspect, a heat exchanger comprises a first inlet port, a first outlet port longitudinally spaced apart from the first inlet port, a plurality of substantially parallel parting plates stacked along a no-flow axis, a plurality of first flow spaces, and a plurality of metering plates. The plurality of first flow spaces are defined between adjacent ones of at least some of the parting plates and provide communication between the first inlet port and the first outlet port. The plurality of metering plates are disposed across an upstream end of at least one of the first flow spaces. Each of the plurality of metering plates includes at least one metering aperture providing fluid communication between the first inlet port and the at least one first flow space.

[0004] In another aspect, a heat exchanger subassembly comprises a first parting plate, a second parting plate spaced apart from, and substantially parallel to, the first parting plate, a third parting plate spaced apart from, and substantially parallel to, the first and second parting plates. A first flow space is disposed between the first and second parting plates, and a second flow space is disposed between the second and third parting plates. A first closure bar is disposed along a first edge of the first flow space between the first and second parting plates. The first closure bar has a plurality of metering apertures in communication with the first flow space.

[0005] In another aspect, a heat exchanger subassembly comprises first, second, and third spaced apart and parallel parting plates. A first plurality of fins are disposed in a first flow space between the first and second parting plates. A second plurality of fins are arranged transversely to the first plurality of fins, and are disposed in a second flow space between the second and third parting plates. A first closure bar is disposed along a first edge of the first flow space between the first and second parting plates, the first closure bar having a plurality of metering apertures in communication with the first flow space between adjacent ones of the first plurality of fins.

[0006] In another aspect, an evaporator comprises a plurality of refrigerant passages in heat exchange relationship with a plurality of air passages. A refrigerant inlet header is disposed adjacent to an upstream end of at least one of the plurality of refrigerant passages. A first closure bar is disposed between the refrigerant inlet header and the upstream end of the at least one refrigerant passage. A metering aperture is formed through the first closure bar and is aligned with the at least one refrigerant passage. The metering aperture provides fluid communication between the refrigerant inlet header and the at least one refrigerant passage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 shows an example evaporator-type heat exchanger.

FIG. 2 is a sectional view of the heat exchanger taken through line 2-2 of FIG. 1.

FIG. 3 depicts a heat exchanger subassembly suitable for use in the example evaporator-type heat exchanger of FIG. 1.

FIG. 4 shows an alternative embodiment of a counterflow heat exchanger.

FIG. 5 depicts an alternative heat exchanger subassembly suitable for use in the example counterflow heat exchanger of FIG. 4.

DETAILED DESCRIPTION

[0008] FIG. 1 depicts crossflow heat exchanger 10 with various portions cut away to illustrate the general location of certain internal features. FIG. 1 also shows first fluid 12, inlet port 14, housing 16, inlet chamber 18, refrigerant passages 20, first/longitudinal axis 22, second incoming fluid 24, air passages 26, second/transverse axis 28, third/no-flow axis 29, outlet chamber 30, and first outlet port 32.

[0009] Heat exchanger 10 is described with reference to an example evaporator-type heat exchanger for an aircraft. The evaporator can be configured as part of a vapor-cycle air management system (not shown). However, it will be appreciated that the configuration of crossflow heat exchanger 10 shown here is provided for illustrative purposes, and the described subject matter can be readily adapted to other uses. For example, though shown as a crossflow evaporator-type heat exchanger, the described subject matter can be adapted to many other heat exchanger configurations in which flow rates of each fluid can be suitably managed. A second non-limiting example embodiment of a counterflow heat exchanger is shown in FIG. 4.

[0010] First incoming fluid 12 is received into inlet port 14 formed in housing 16. First incoming fluid 12 can be, for example, a refrigerant having previously been passed through an expansion valve (not shown). Inlet chamber 18 is disposed adjacent to an upstream side of one or more refrigerant passages 20 extending along first or longitudinal axis 22. In the crossflow heat exchange relationship of FIG. 1, second incoming fluid 24 (e.g., air) flows transversely through a plurality of air passages 26 in heat exchange relationship with the one or more refrigerant passages 20. Air passages 26 can be substantially perpendicular to refrigerant passages 20 and can extend along second or transverse axis 28.

[0011] In certain embodiments, parting plates can be stacked along third or no-flow axis 29 to define first and second flow spaces (best shown in FIGS. 2 and 3). First flow spaces can provide communication between inlet port 14 and outlet port 32 via refrigerant passages 20, while second flow spaces can provide communication along air passages 26. In certain of these embodiments, multiple layers of refrigerant passages 20 and air passages 26 are stacked in alternating first and second flow spaces along third/no-flow axis 29.

[0012] In a heat exchange relationship for an evaporator, the mixed liquid/vapor phase of first incoming fluid 12 is heated and vaporized as it passes through inlet chamber 18, refrigerant passages 20, and outlet chamber 30. First outgoing fluid 36, which in this example is vaporized refrigerant, is then discharged from outlet port 32 spaced longitudinally apart from inlet chamber 14. As first incoming fluid 12 passes through refrigerant passages 20, the heat of vaporization chills adjacent/alternating air passages 26 so that second outgoing fluid 34 has a lower temperature than second incoming fluid 24.

[0013] To optimize heat transfer and fluid flow rates, the flow of first incoming fluid 12 (e.g., liquid/vapor phase refrigerant) can be metered before entering refrigerant passages 20 in the first flow space(s). Thus a plurality of metering plates can be disposed across an upstream end of at least one of these first flow spaces. As will be seen in subsequent figures, each of the plurality of metering plates can include at least one metering aperture providing fluid communication between the first inlet port and the at least one first flow space. In certain embodiments, the metering plate(s) can take the form of one or more closure bars or other equivalent structure metallurgically bonded to the internal features of the heat exchanger.

[0014] FIG. 2 shows a portion of example crossflow heat exchanger 10 taken across line 2-2 of FIG. 1. FIG. 2 also includes inlet chamber 18, refrigerant passages 20, first/longitudinal axis 22, air passages 26, second/transverse axis 28, third/no-flow axis 29, parting plates 44, first flow spaces 46, second flow spaces 48, first fins 50, upstream refrigerant passage ends 52, first closure bar 54, metering apertures 56, metering plates 60, and second fins 62.

[0015] A plurality of parting plates 44 are stacked along third/no-flow axis 29 of heat exchanger such that pairs of adjacent parting plates 44 define alternating first flow spaces 46 and second flow spaces 48, therebetween. Portions of first closure bars 56 are cut away to show first flow spaces 46 between parting plates 44, as well as a first plurality of fins 50 disposed in each first flow space 46. First fins 50 form first fluid passages extending along first/longitudinal axis 22. In the evaporator example, the first fluid passages correspond to refrigerant passages 20.

[0016] Inlet chamber 18 is disposed adjacent to respective upstream ends 52 of each refrigerant passage 20. In the view of FIG. 2, inlet chamber 18 extends outward from the page. A plurality of first closure bars 54 are disposed along a first edge of first flow space 46 between inlet chamber 18 and upstream refrigerant passage ends 52. One or more metering apertures 56 can be formed (e.g., by machining) through each first closure bar 54, effectively creating a plurality of metering plates 60 disposed in or over an upstream portion of upstream refrigerant passage ends 52. Metering plates 60, either individually or in the form of first closure bar(s) 54, provide fluid communication between inlet chamber 18 and each refrigerant passage 20. First closure bars 54, and/or individual metering plates 60 can be brazed or otherwise metallurgically bonded to adjacent parting plates 44 defining each first flow space 46. First closure bars 54 and/or individual metering plates 60 can be assembled directly to a heat exchanger plate-and-fin subassembly such as the subassembly shown in FIG. 3. Metering apertures 56 can thus be more closely aligned with each fluid passage (e.g., refrigerant passages 20). It also allows inlet chamber 18 to be an open inlet chamber or header common to multiple refrigerant passages 20.

[0017] This and other related heat exchanger configurations eliminate the need for a separate distributor tube. In certain embodiments, this reduces the required number of individual fluid headers for each refrigerant passage, potentially reducing weight and manufacturing complexity. Manufacturing variation, tolerance stackup, and assembly errors all increase the occurrence of the misalignment of feedholes formed in the distributor tube relative to individual headers for each refrigerant passage.

[0018] Metering apertures 56 can be individually configured to control the pressure and resulting flow rate of first incoming fluid 12 (shown in FIG. 1) through each refrigerant passage 20. In certain embodiments, one or more metering apertures 56 are cylindrical or frustoconical. A cross-section of each metering aperture 56 can also be tailored to local or global flow and pressure parameters.

[0019] The cross-sectional area of each metering aperture 56 can also vary according to its location. In certain embodiments, the size, shape, and/or cross-sectional area of each aperture can be configured so as to provide a substantially equivalent pressure drop through each of the refrigerant passages 20 between inlet chamber 18 and outlet chamber 30 (shown in FIG. 1). In certain embodiments, the size, shape and/or cross-sectional area of each metering aperture 56 can be made to vary according to its position along at least one of second/transverse axis 28 and third/no-flow axis 29.

[0020] To further enhance heat transfer relationships, a plurality of second fluid passages can extend through one or more of the second flow spaces 48. In the evaporator example, the second fluid passages correspond to air passages 26, extending along second/transverse axis 28 substantially perpendicular to first/longitudinal axis 22 and refrigerant passages 20. A second plurality of fins 62 can be disposed in each second flow space 48 to form first fluid passages extending along first/longitudinal axis 22. In the crossflow heat exchange relationship, the second plurality of fins 62 can be disposed transversely to the first plurality of fins 50.

[0021] FIG. 3 shows plate-and-fin subassembly 110 for a heat exchanger such as an evaporator. FIG. 3 also includes first fluid passages 120, first/longitudinal axis 122, second fluid passages 126, second/transverse axis 128, third/no-flow axis 129, parting plates 144A, 144B, 144C, first flow space 146, second flow space 148, first fins 150, first closure bar 154, metering apertures 156, metering plates 160, second fins 162, first edges 166A, 166B, second closure bar 168, and second edges 170A, 170B.

[0022] First parting plate 144A, second parting plate 144B, and third parting plate 144C are generally parallel to one another and spaced apart along third/no-flow axis 129. First plurality of fins 150 are disposed in first flow space 146 between first and second parting plates 144A, 144B, defining a plurality of first fluid passages 120 extending along first/longitudinal axis 122. Second plurality of fins 162 can be disposed in second flow space 148 between second and third parting plates 144B, 144C. In the crossflow configuration, fins 162 can be arranged transversely to fins 150 to define a plurality of second fluid passages 126 extending along second/transverse axis 128.

[0023] Similar to FIG. 2, first closure bar 154 is disposed along first edges 166A, 166B of first flow space 146 between first and second parting plates 144A, 144B. First closure bar 154 can include a plurality of metering apertures 156 in communication with first flow space 146 between adjacent ones of fins 150. This forms effective metering plates 160 disposed at one end of each first fluid passage 120. In certain embodiments, first closure bar 154 and/or individual metering plates 160 are metallurgically bonded to first and second parting plates 144A, 144B.

[0024] In certain embodiments, second closure bar 168 can be arranged transversely to first closure bar 154 along second edges 170A, 170B of first flow space 146. Second closure bar 168 can be free of any metering apertures to prevent leakage or intermingling of fluids passing separately through first and second flow spaces 146, 148. A longitudinal axis of second closure bar 168 can thus be arranged parallel to the first plurality of fins 150.

[0025] FIG. 4 shows an alternative embodiment which includes counterflow heat exchanger 210. Various portions of counterflow heat exchanger 210 are cut away in FIG. 4 to illustrate the general location of certain internal features. Similar to FIG. 1, which shows an example crossflow heat exchanger 10, counterflow heat exchanger 210 can also be configured as an evaporator-type heat exchanger. However, counterflow heat exchanger 210 is provided for illustrative purposes, and the described subject matter can be readily adapted to other uses.

[0026] First incoming fluid 212, for example, a liquid/vapor phase refrigerant mixture, can be received into first inlet port 214A formed in housing 216. Inlet chamber 218A is disposed adjacent to an upstream side of one or more first fluid passages 220, with each passage extending along first/longitudinal axis 222. First fluid 212 then enters outlet chamber 230, where it is discharged (as first outgoing fluid 236) from first outlet port 232A longitudinally spaced apart from first inlet port 214A.

[0027] Second incoming fluid 224, for example, air, enters via second inlet port 214B, then flows through housing 216 before exiting from second outlet chamber 230B. Second inlet port 214B is also longitudinally spaced apart from second outlet port 232B. In a counterflow design, second inlet port 214B can be disposed at the same longitudinal end of heat exchanger 210 as first outlet port 232A, while first inlet port 214A can be disposed at the same longitudinal end of heat exchanger 210 as second outlet port 232B. It will be appreciated that heat exchanger 210 can be further adapted to a coflow relationship in which fluid inlets 214A, 214B are disposed at the same longitudinal end, and are longitudinally spaced apart from outlet ports 232A, 232B.

[0028] Second fluid 224 flows through heat exchanger 210 via a plurality of longitudinal second fluid passages 226 in heat transfer relationship with the one or more first fluid passages 220. Multiple layers of first fluid passages 220 and second fluid passages 226 can be stacked in an alternating manner between adjacent parting plates along third/no-flow axis 229. In certain embodiments, passages 226 can be arranged in a serpentine manner through each layer so that second fluid 224 flows back and forth along first axis 222 before exiting via second outlet port 232B. This is best seen in FIG. 5.

[0029] FIG. 5 shows plate-and-fin subassembly 310 for a heat exchanger such as counterflow heat exchanger 210 shown in FIG. 4. First parting plate 344A, second parting plate 344B, and third parting plate 344C are generally parallel to one another and spaced apart along third/no-flow axis 329. First plurality of fins 350 are disposed in first flow space 346 between first and second parting plates 344A, 344B, defining a plurality of first passages 320 extending along first/longitudinal flow axis 322. Second plurality of fins 362 can be disposed in second flow space 348 between second and third parting plates 344B, 344C, defining a plurality of second passages 326 also extending along first/longitudinal flow axis 322. Second fins 362 can thus be arranged parallel to first fins 350.

[0030] Similar to FIGS. 2 and 3, first closure bar 354 is disposed along first edges 366A, 366B of first flow space 346 between first and second parting plates 344A, 344B. First closure bar 354 can include a plurality of metering apertures 356 in communication with first flow space 346 between adjacent ones of first fins 350. This forms effective metering plates 360 disposed at one end of each first fluid passage 320. In certain embodiments, first closure bar 354 and/or individual metering plates 360 are metallurgically bonded to first and second parting plates 344A, 344B. In certain embodiments, second closure bar 368 can be arranged transversely to first closure bar 354 along second edges 370A, 370B of first flow space 346. Second closure bar 368 can be free of metering apertures to prevent leakage or intermingling of fluids passing through first and second flow spaces 346, 348.

[0031] In certain embodiments of a counterflow heat exchanger, fluid can flow in the same direction along second passages 326. However, to allow for serpentine flow in second flow space 348, some fins 362 can optionally be recessed from first edges 366B, 366C to allow the fluid in second flow space 348 to change direction. It will be appreciated that, in these embodiments, additional closure bars or plates (not shown for clarity) can be disposed along first edges 366B, 366C to enclose the serpentine passages and retain the second fluid within second flow space 348.

Discussion of Possible Embodiments

[0032] The following are non-exclusive descriptions of possible embodiments of the present disclosure.

[0033] A heat exchanger comprises a first inlet port, a first outlet port longitudinally spaced apart from the first inlet port, a plurality of substantially parallel parting plates stacked along a no-flow axis, a plurality of first flow spaces, and a plurality of metering plates. The plurality of first flow spaces are defined between adjacent ones of at least some of the parting plates and provide communication between the first inlet port and the first outlet port. The plurality of metering plates are disposed across an upstream end of at least one of the first flow spaces. Each of the plurality of metering plates includes at least one metering aperture providing fluid communication between the first inlet port and the at least one first flow space.

[0034] The heat exchanger of the preceding paragraph can optionally include, additionally and/or alternatively, any one or more of the following features, configurations and/or additional components:

A further embodiment of the foregoing heat exchanger, wherein the plurality of metering plates comprise a first closure bar arranged along a first edge of the at least one first flow space proximate to the first inlet port.

A further embodiment of any of the foregoing heat exchangers, wherein the first closure bar is metallurgically bonded to adjacent ones of the parting plates defining the one of the first flow spaces.

A further embodiment of any of the foregoing heat exchangers, further comprising a second closure bar arranged transversely to the first closure bar along a second edge of the first flow space, the second closure bar free of any metering apertures.

A further embodiment of any of the foregoing heat exchangers, wherein a cross-sectional area of each metering aperture varies along at least one of: the no-flow axis, and a transverse axis.

A further embodiment of any of the foregoing heat exchangers, wherein a cross-sectional area of each metering aperture is configured so as to provide a substantially equivalent pressure drop through each of the plurality of first flow spaces between the first inlet port and the first outlet port.

A further embodiment of any of the foregoing heat exchangers, further comprising a plurality of first fluid passages extending along a longitudinal axis of the at least one first flow space.

A further embodiment of any of the foregoing heat exchangers, wherein the plurality of first fluid passages comprises a first plurality of fins disposed in the at least one first flow space.

A further embodiment of any of the foregoing heat exchangers, wherein each of the plurality of metering apertures includes at least one metering aperture in communication with each of the first fluid passages.

A further embodiment of any of the foregoing heat exchangers, further comprising an inlet chamber disposed in fluid communication between the inlet port and the plurality of metering apertures.

A further embodiment of any of the foregoing heat exchangers, further comprising a second inlet port; a second outlet port; and a plurality of second flow spaces providing communication between the second inlet port and the second outlet port; the plurality of second flow spaces defined between adjacent ones of at least some of the parting plates.

A further embodiment of any of the foregoing heat exchangers, wherein the plurality of parting plates define alternating ones of the first plurality of flow spaces and the second plurality of second flow spaces.

A further embodiment of any of the foregoing heat exchangers, further comprising a second plurality of fins disposed in the at least one second flow space, the second plurality of fins defining a plurality of second fluid passages extending through the at least one second flow space.

A further embodiment of any of the foregoing heat exchangers, wherein the plurality of second fluid passages extend along a transverse axis.

A further embodiment of any of the foregoing heat exchangers, wherein the plurality of second fluid passages extend along a longitudinal axis.

A heat exchanger subassembly comprises a first parting plate, a second parting plate spaced apart from, and substantially parallel to, the first parting plate, a third parting plate spaced apart from, and substantially parallel to, the first and second parting plates. A first flow space is disposed between the first and second parting plates, and a second flow space is disposed between the second and third parting plates. A first closure bar is disposed along a first edge of the first flow space between the first and second parting plates. The first closure bar has a plurality of metering apertures in communication with the first flow space.

[0035] The heat exchanger subassembly of the preceding paragraph can optionally include, additionally and/or alternatively, any one or more of the following features, configurations and/or additional components:

A further embodiment of the foregoing heat exchanger subassembly, wherein the first closure bar is metallurgically bonded to the first and second parting plates.

A further embodiment of any of the foregoing heat exchanger subassemblies, further comprising a first plurality of fins disposed in the first flow space; and a second plurality of fins disposed in the second flow space.

A further embodiment of any of the foregoing heat exchanger subassemblies, wherein the second plurality of fins define a plurality of second flow passages arranged transversely to a plurality of first flow passages defined by the first plurality of fins.

A further embodiment of any of the foregoing heat exchanger subassemblies, wherein the second plurality of fins define a plurality of second flow passages arranged parallel to a plurality of first flow passages defined by the first plurality of fins.

A further embodiment of any of the foregoing heat exchanger subassemblies, wherein a cross-sectional area of each metering aperture varies along a length of the first closure bar.

A further embodiment of any of the foregoing heat exchanger subassemblies, further comprising a second closure bar arranged transversely to the first closure bar along a second edge of the first flow space, the second closure bar free of metering apertures.

An evaporator comprises a plurality of refrigerant passages in heat exchange relationship with a plurality of air passages. A refrigerant inlet header is disposed adjacent to an upstream end of at least one of the plurality of refrigerant passages. A first closure bar is disposed between the refrigerant inlet header and the upstream end of the at least one refrigerant passage. A metering aperture is formed through the first closure bar and is aligned with the at least one refrigerant passage. The metering aperture provides fluid communication between the refrigerant inlet header and the at least one refrigerant passage.

[0036] The evaporator of the preceding paragraph can optionally include, additionally and/or alternatively, any one or more of the following features, configurations and/or additional components:

A further embodiment of the foregoing evaporator, wherein the at least one refrigerant passage extends along a longitudinal axis of the evaporator.

A further embodiment of any of the foregoing evaporators, further comprising a plurality of parting plates spaced apart along a no-flow axis of the heat exchanger; wherein the plurality of refrigerant passages and the plurality of air passages are stacked in an alternating manner between adjacent ones of the parting plates.

A further embodiment of any of the foregoing evaporators, wherein a cross-sectional area of each metering aperture varies along a length of the first closure bar.

A further embodiment of any of the foregoing evaporators, wherein the heat exchange relationship includes a crossflow heat exchange relationship.

A further embodiment of any of the foregoing evaporators, wherein the heat exchange relationship includes a counterflow heat exchange relationship.

[0037] While described with reference to an exemplary embodiment(s), it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment(s) disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

Claims

1. A heat exchanger (10; 210) comprising:

a first inlet port (14; 214A);
a first outlet port (32; 232A) longitudinally spaced apart from the first inlet port (14; 214A);
a plurality of substantially parallel parting plates (144; 344) stacked along a no-flow axis (129; 239);
a plurality of first flow spaces (146; 346) providing communication between the first inlet port (14; 214A) and the first outlet port (32; 232A); the plurality of first flow spaces (146; 346) defined between adjacent ones of at least some of the parting plates (144;344); and
a plurality of metering plates (154; 354) disposed across an upstream end of at least one of the

first flow spaces (146; 346), each of the plurality of metering plates (154; 354) including at least one metering aperture (156; 356) providing fluid communication between the first inlet port (14; 214A) and the at least one first flow space (146; 346).

2. The heat exchanger (10; 210) of claim 1, wherein the plurality of metering plates comprise a first closure bar (154; 354) arranged along a first edge (166; 366) of the at least one first flow space (146; 346) proximate to the first inlet port (14; 214A).

3. The heat exchanger (10; 210) of claim 2, wherein:

the first closure bar (154; 354) is metallurgically bonded to adjacent ones of the parting plates (144; 344) defining the one of the first flow spaces (146; 346); and/or
the heat exchanger (10; 210) further comprises a second closure bar (168; 368) arranged transversely to the first closure bar (154; 354) along a second edge (170; 370) of the first flow space (146; 346), the second closure bar (168; 368) being free of any metering apertures.

4. The heat exchanger (10; 210) of any preceding claim, wherein a cross-sectional area of each metering aperture (156; 356):

varies along the no-flow axis (129; 329) and/or a transverse axis (128; 328); and/or
is configured so as to provide a substantially equivalent pressure drop through each of the plurality of first flow spaces (146; 346) between the first inlet port (14; 214A) and the first outlet port (32; 232A).

5. The heat exchanger (10; 210) of any preceding claim, further comprising a plurality of first fluid passages (120; 320) extending along a longitudinal axis (122; 232) of the at least one first flow space (146; 346), and optionally wherein the plurality of first fluid passages (146; 346) comprises a first plurality of fins (150; 350) disposed in the at least one first flow space (146; 346).

6. The heat exchanger (10; 210) of claim 5, wherein each of the plurality of metering apertures (156; 356) includes at least one metering aperture (156; 356) in communication with each of the first fluid passages (120; 320).

7. The heat exchanger (10; 210) of claim 5 or 6, further comprising an inlet chamber (18; 218) disposed in fluid communication between the first inlet port (14; 214A) and the plurality of metering apertures (156; 356).

8. The heat exchanger (10; 210) of any preceding claim, further comprising:

a second inlet port (214B);
a second outlet port (232B); and
a plurality of second flow spaces (148; 348) providing communication between the second inlet port (214B) and the second outlet port (232B), the plurality of second flow spaces (148; 348) being defined between adjacent ones of at least some of the parting plates (144; 344), and optionally wherein the plurality of parting plates (144; 344) define alternating ones of the first plurality of flow spaces (146; 346) and the second plurality of second flow spaces (148; 348).

9. The heat exchanger (10; 210) of claim 8, further comprising a second plurality of fins (162; 362) disposed in the at least one second flow space (148; 348), the second plurality of fins (162; 362) defining a plurality of second fluid passages (126; 326) extending through the at least one second flow space (148; 348), and optionally wherein the plurality of second fluid passages (126; 326) extend:

along a transverse axis (128); or
along a longitudinal axis.

10. A heat exchanger subassembly (110; 310) comprising:

a first parting plate (144A; 344A);
a second parting plate (144B; 344B) spaced apart from, and substantially parallel to, the first parting plate (144A; 344A);
a third parting plate (144C; 344C) spaced apart from, and substantially parallel to, the first and second parting plates;
a first flow space (146; 346) between the first and second parting plates;
a second flow space (148; 348) between the second and third parting plates; and
a first closure bar (154; 354) disposed along a first edge (166A; 366A) of the first flow space (146; 346) between the first and second parting plates, the first closure bar (154; 354) having a plurality of metering apertures (156; 356) in communication with the first flow space (146; 346), and optionally wherein the first closure bar (154; 354) is metallurgically bonded to the first and second parting plates.

11. The heat exchanger subassembly (110; 310) of claim 10, further comprising:

a first plurality of fins (150; 350) disposed in the first flow space (146; 346); and
a second plurality of fins (162; 362) disposed in

the second flow space (148; 348), and optionally wherein the second plurality of fins (162; 362) define a plurality of second flow passages (126; 326) arranged transversely or parallel to a plurality of first flow passages (120; 320) defined by the first plurality of fins (150; 350).

12. The heat exchanger subassembly (110; 310) of claim 10 or 11, wherein a cross-sectional area of each metering aperture (156; 356) varies along a length of the first closure bar (154; 354).

13. The heat exchanger (110; 310) subassembly of any of claims 10 to 12, further comprising a second closure bar (168; 368) arranged transversely to the first closure bar (154; 354) along a second edge (170A; 370A) of the first flow space (146; 346), the second closure bar (168; 368) being free of metering apertures.

14. An evaporator (110; 310) comprising:

a plurality of refrigerant passages (120; 320) in heat exchange relationship with a plurality of air passages (126; 326);
a refrigerant inlet header (14; 214A) disposed adjacent to an upstream end of at least one of the plurality of refrigerant passages (120; 320);
a first closure bar (154; 354) disposed between the refrigerant inlet header (14; 214A) and the upstream end of the at least one refrigerant passage (120; 320); and
a metering aperture (156; 356) formed through the first closure bar (154; 354) and aligned with the at least one refrigerant passage (120; 320), the metering aperture (156; 356) providing fluid communication between the refrigerant inlet header (14; 214A) and the at least one refrigerant passage (120; 320), and optionally wherein the at least one refrigerant passage (120; 320) extends along a longitudinal axis (122; 322) of the evaporator (110; 310).

15. The evaporator (110; 310) of claim 14, further comprising a plurality of parting plates (144; 344) spaced apart along a no-flow axis (129; 329) of the evaporator (110; 310) wherein the plurality of refrigerant passages (120; 320) and the plurality of air passages (126; 326) are stacked in an alternating manner between adjacent ones of the parting plates (144; 344), and optionally wherein:

a cross-sectional area of each metering aperture (156; 356) varies along a length of the first closure bar (154; 354); and/or
the heat exchange relationship includes a:

crossflow heat exchange relationship; or
a counterflow heat exchange relationship.

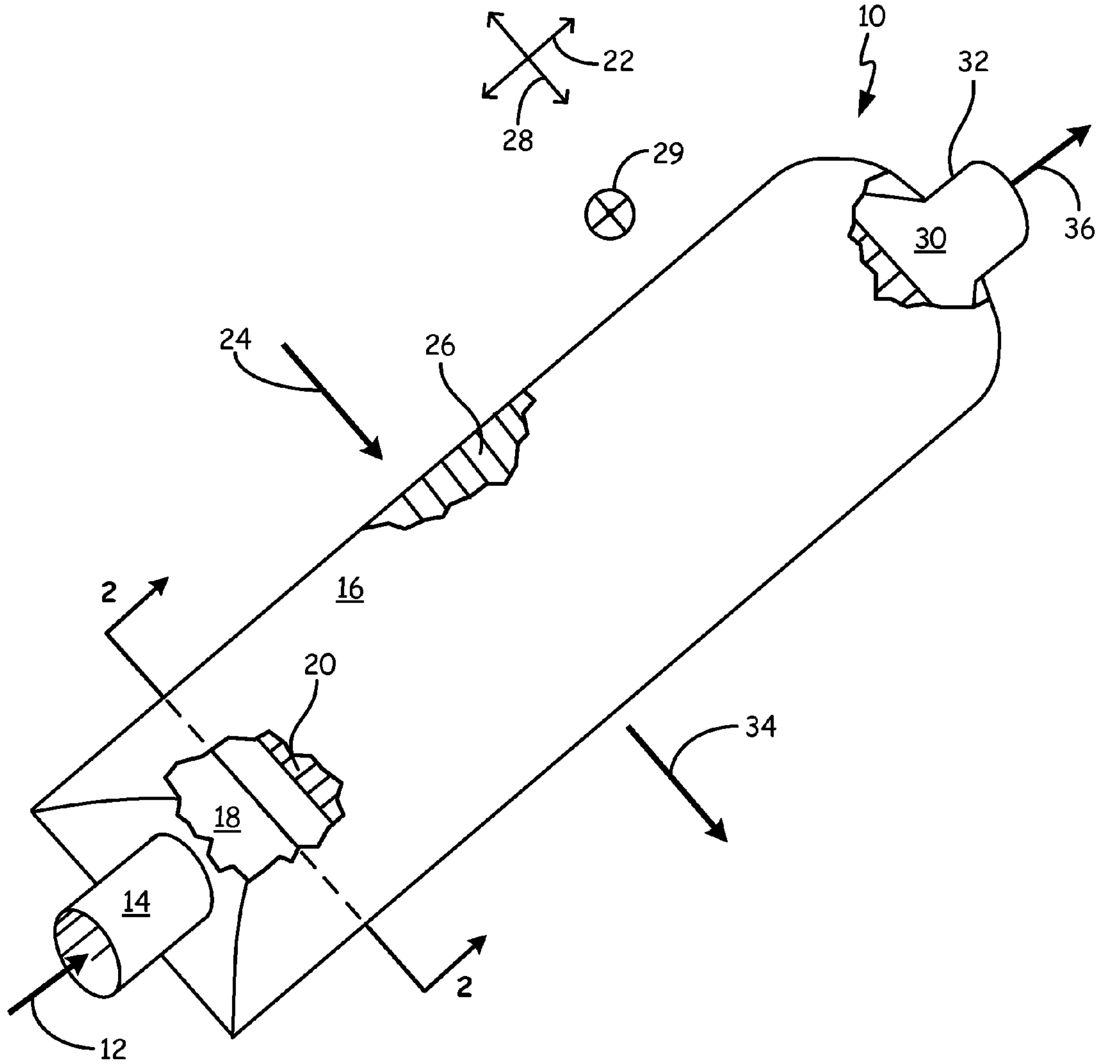

FIG. 1

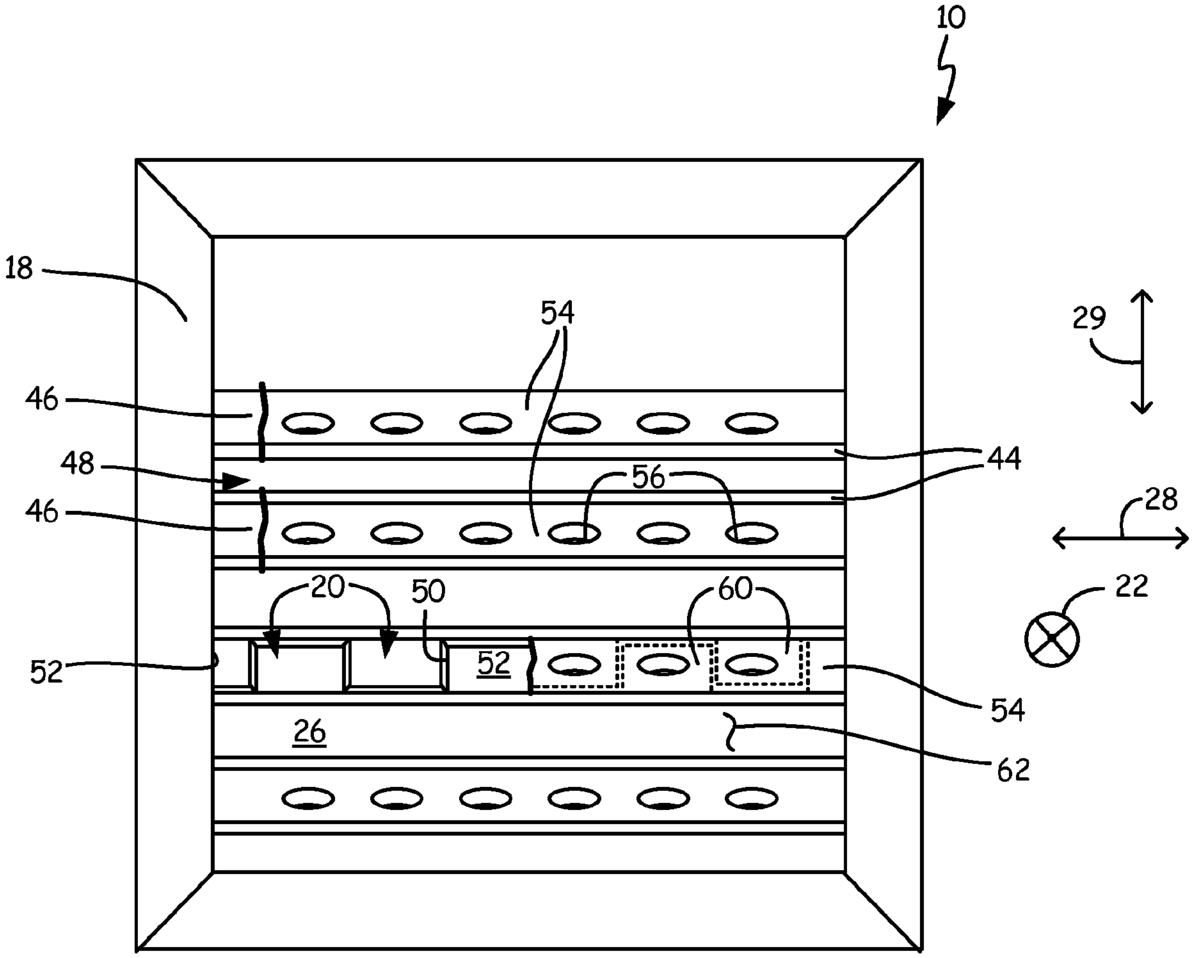

FIG. 2

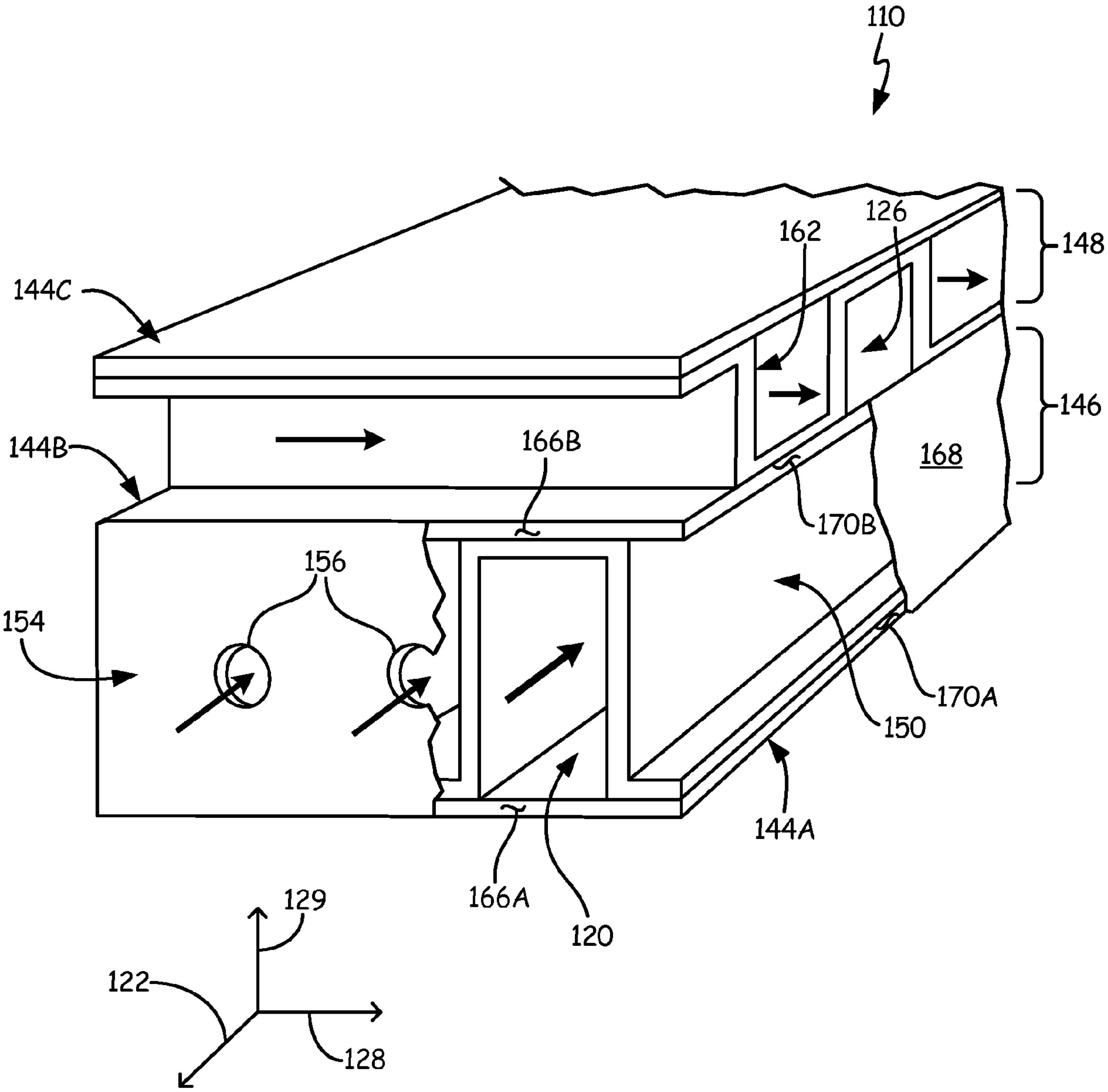
110
162
126
148
144C
146
144B
166B
168
170B
156
154
170A
150
144A
166A
120
129
122
128

FIG. 3

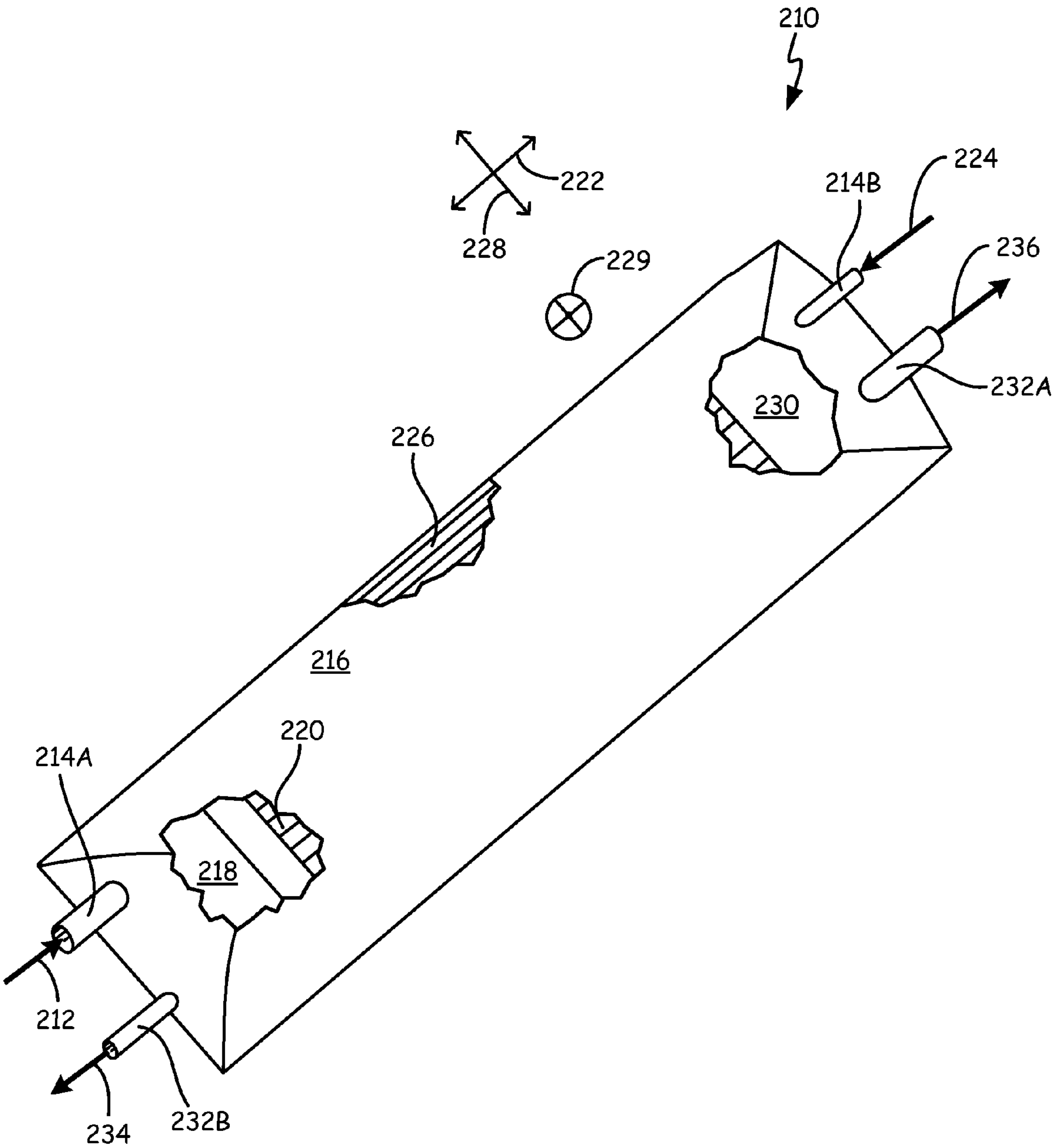
210
222
224
214B
236
228
229
232A
230
226
216
220
214A
218
212
232B
234

FIG. 4

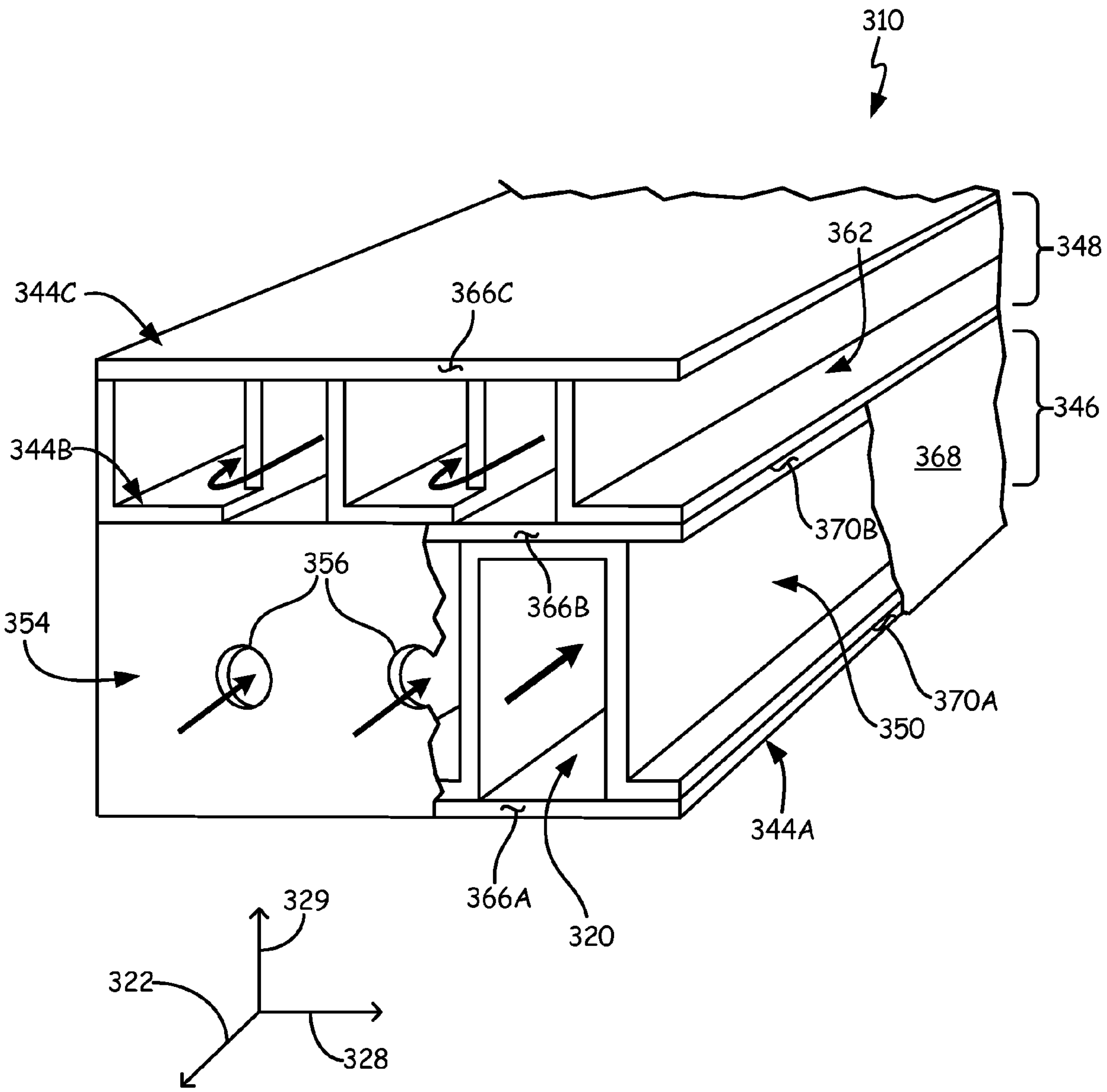
310
348
362
344C
366C
346
368
344B
370B
356
366B
354
370A
350
344A
366A
320
329
322
328

FIG. 5