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(54) **HEAT EXCHANGER ASSEMBLY**

(57) A heat exchanger assembly (10) includes a manifold (20) having a first side plate (30), a second side plate (32) disposed opposite the first side plate (30), a first face plate (36), a second face plate (38) disposed opposite the first face plate (36), a base plate (34), and a plurality of cooling elements (40). The first face plate (36) and the second face plate (38) each extend between the first side plate (30), the second side plate (32), and the base plate (34). The base plate (34) extends between proximal ends of the first side plate (30), the second side plate (32), the first face plate (36), and the second face plate (38). The plurality of cooling elements (40) extends between the first face plate (36) and the second face plate (38).

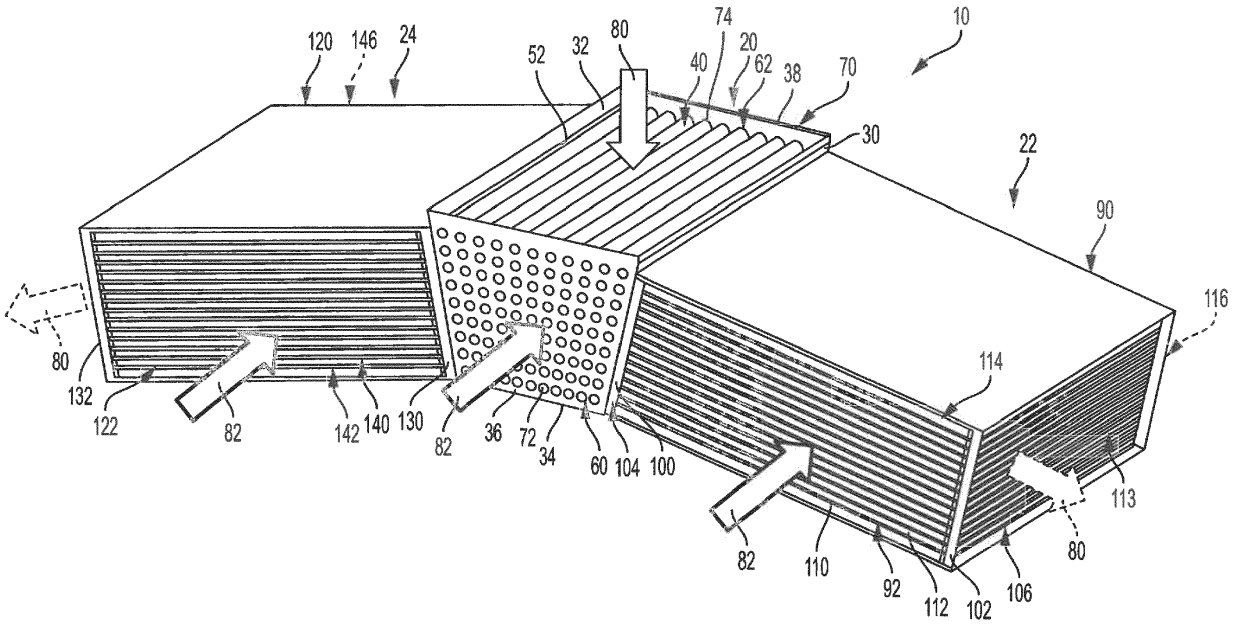


FIG. 1

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Description

BACKGROUND

[0001] Exemplary embodiments pertain to the art of heat exchangers.

[0002] A heat exchanger may include multiple fluid pathways including a cold fluid pathway and a hot fluid pathway. The heat exchanger may be used to heat or cool at least one of the fluid pathways. The heat exchangers also include manifolds and headers that gather fluid flow from multiple layers within the heat exchanger but do not improve the overall heat exchanging performance.

BRIEF DESCRIPTION

[0003] Disclosed is a heat exchanger assembly. The heat exchanger assembly includes a manifold and a first heat exchanger. The manifold has a first side plate, a second side plate, a base plate, a first face plate, a second face plate, and a plurality of cooling elements. The second side plate is disposed opposite the first side plate. The base plate extends between proximal ends of the first side plate and the second side plate. The first face plate extends between the first side plate, the second side plate, and the base plate. The second face plate is disposed opposite the first face plate and extends between the first side plate, the second side plate, and the base plate. The plurality of cooling elements extends between the first face plate and the second face plate. The first heat exchanger is operatively connected to the first side plate.

[0004] Also disclosed is a heat exchanger assembly having a manifold. The manifold has a first side plate, a second side plate disposed opposite the first side plate, a first face plate, a second face plate disposed opposite the first face plate, a base plate, and a plurality of cooling elements. The first face plate and the second face plate each extend between the first side plate, the second side plate, and the base plate. The base plate extends between proximal ends of the first side plate, the second side plate, the first face plate, and the second face plate. The plurality of cooling elements extends between the first face plate and the second face plate.

[0005] Additionally disclosed is a heat exchanger assembly. The heat exchanger assembly includes a manifold, a first heat exchanger, and a second heat exchanger. The manifold has a first side plate, a second side plate disposed opposite the first side plate, a first face plate extending between the first side plate and the second side plate, a second face plate disposed opposite the first face plate and extending between the first side plate and the second side plate, and a base plate extending between ends of the first side plate, the second side plate, the first face plate, and the second face plate. The first side plate becomes progressively closer to the second side plate in a direction that extends towards the base plate. The first heat exchanger is operatively connected to the first side plate. The second heat exchanger is operatively connected to the second side plate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

FIG. 1 is a perspective view of a heat exchanger assembly;

FIG. 2 is a partial section view of the heat exchanger assembly; and

FIG. 3 is a front view of the heat exchanger assembly.

DETAILED DESCRIPTION

[0007] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0008] Referring to FIGS. 1-3, a heat exchanger assembly 10 is shown. The heat exchanger assembly 10 includes a manifold 20, a first heat exchanger 22, and a second heat exchanger 24.

[0009] The manifold 20 is disposed between the first heat exchanger 22 and the second heat exchanger 24. In at least one embodiment, the manifold 20 may be configured as a header for at least one of the first heat exchanger 22 and the second heat exchanger 24. The manifold 20 is provided with heat exchanging features to improve the overall heat exchanger assembly performance while maximizing the available space for a given installation.

[0010] The manifold 20 includes a first side plate 30, a second side plate 32, a base plate 34, a first face plate 36, a second face plate 38, a plurality of cooling elements 40, and a mounting flange 42.

[0011] The first side plate 30 is configured as a generally planar member that defines a first opening 50. The first side plate 30 is disposed adjacent to and is operatively connected to the first heat exchanger 22.

[0012] The second side plate 32 is disposed opposite the first side plate 30. The second side plate 32 is configured as a generally planar member that defines a second opening 52. The second side plate 32 is disposed adjacent to and is operatively connected to the second heat exchanger 24.

[0013] The first side plate 30 and the second side plate 32 are angled relative to each other. The first side plate 30 becomes progressively closer to the second side plate in a direction that extends from distal ends of the first side plate 30 and the second side plate 32 towards proximal ends of the first side plate 30 and the second side plate 32.

[0014] A linear distance that is measured between the

first side plate 30 and the second side plate 32 defines a width of the manifold 20, as shown in FIG. 3. For example, a first width, w1, of the manifold 20 is defined between distal ends of the first side plate 30 and the second side plate 32. A second width, w2, of the manifold 20 is defined between proximal ends of the first side plate 30 and the second side plate 32, proximate the base plate 34.

[0015] The base plate 34 extends between proximal ends of the first side plate 30 and the second side plate 32. The base plate 34 is configured as a substantially planar member that is free of openings.

[0016] The first face plate 36 extends between a first side of each of the first side plate 30, the second side plate 32 and the base plate 34. The first face plate 36 defines a plurality of first openings 60 that are disposed substantially transverse to the first opening 50 of the first side plate 30 and the second opening 52 of the second side plate 32.

[0017] The second face plate 38 is disposed opposite the first face plate 36. The second face plate 38 extends between a second side of each of the first side plate 30, the second side plate 32, and the base plate 34. The second face plate 38 defines a plurality of second openings 62 that are disposed substantially transverse to the first opening 50 of the first side plate 30 and the second opening 52 of the second side plate 32. The plurality of second openings 62 of the second face plate 38 are proximately aligned with the plurality of first openings 60 of the first face plate 36.

[0018] The manifold 20 defines a first fluid inlet 70, a second fluid inlet 72, and second fluid outlet 74. The first fluid inlet 70 is defined by the distal ends of the first side plate 30, the second side plate 32, the first face plate 36, and the second face plate 38. The first fluid inlet 70 is arranged to receive a first fluid 80. The first fluid 80 may be a hot fluid flow that is to be cooled by at least one of the first heat exchanger 22 and the second heat exchanger 24.

[0019] The second fluid inlet 72 is defined by the plurality of first openings 60 of the first face plate 36. The second fluid inlet 72 is arranged to receive a second fluid 82. The second fluid 82 may be a cold fluid flow, which is at a lower temperature than the hot fluid flow, which enables or facilitates at least one of the first heat exchanger 22 and the second heat exchanger 24 to cool the first fluid 80.

[0020] The second fluid outlet 74 is disposed opposite the second fluid inlet 72. The second fluid outlet 74 is defined by the plurality of second openings 62 of the second face plate 38. The second fluid outlet 74 is arranged to exhaust or release the second fluid 82 that is received by the second fluid inlet 72.

[0021] The plurality of cooling elements 40 extend between the first face plate 36 and the second face plate 38. The plurality of cooling elements 40 are proximately aligned with the plurality of first openings 60 of the first face plate 36 and the plurality of second openings 62 of the second face plate 38. The plurality of cooling elements 40 are arranged to receive the second fluid 82 such that the second fluid 82 flows substantially transverse to the first fluid 80.

[0022] The plurality of cooling elements 40 may be configured as a plurality of cooling tubes that are integrated within the manifold 20, as shown in FIG. 3. The integration of the plurality of cooling tubes into the manifold 20 configures the manifold 20 has a shell tube heat exchanger that is disposed between the first heat exchanger 22 and the second heat exchanger 24.

[0023] The plurality of cooling tubes allow the second fluid 82 to crossflow and pass through the manifold 20 and the plurality of cooling tubes provide additional heat transfer surfaces for the first fluid 80 prior to entering at least one of the first heat exchanger 22 and the second heat exchanger 24. The pre-cooling of the first fluid 80 prior to entering at least one of the first heat exchanger 22 and the second heat exchanger 24 improves the heat exchanger efficiency, improves thermals of the heat exchanger assembly 10, as well as improves the cooling effectiveness by reducing the heat outflow temperature of the first fluid 80.

[0024] The mounting flange 42 extends from the manifold 20. The mounting flange 42 is disposed about the distal ends of the first side plate 30, the second side plate 32, the first face plate 36, and the second face plate 38. The mounting flange 42 is arranged to direct the first fluid 80 towards the first fluid inlet 70 as well as to couple the manifold 20 to a component.

[0025] The first heat exchanger 22 is operatively connected to the first side plate 30 of the manifold 20. The first heat exchanger 22 includes a first enclosure assembly 90 and a first core assembly 92.

[0026] The first enclosure assembly 90 is disposed about the first core assembly 92. The first enclosure assembly 90 includes a first sub-header 100 and a second sub-header 102.

[0027] The first sub-header 100 is operatively connected to the first side plate 30. The first sub-header 100 defines a first sub-header opening 104 that is proximately aligned with the first opening 50 of the first side plate 30.

[0028] The second sub-header 102 is disposed opposite the first sub-header 100. The second sub-header 102 defines a second sub-header opening 106 that is proximately aligned with the first sub-header opening 104. The first fluid 80 flows through the first fluid inlet 70 over the plurality of cooling elements 40, flows through the first opening 50, through the first sub-header opening 104, through the first core assembly 92, and exits through the second sub-header opening 106.

[0029] The first core assembly 92 is disposed within the first enclosure assembly 90. The first core assembly 92 includes a plurality of first plates 110, a plurality of first cold side fins 112, and a plurality of first hot side fins 113.

[0030] The plurality of first plates 110 extend between the first sub-header 100 and the second sub-header 102. The plurality of first plates 110 and the plurality of first

hot side fins 113 are arranged to receive the first fluid 80 that is pre-cooled by the manifold 20 through the first sub-header opening 104 and exhausts the first fluid 80 through the second sub-header opening 106.

[0031] The plurality of first cold side fins 112 are disposed between adjacent plates of the plurality of first plates 110. The plurality of first cold side fins 112 may be joined to adjacent plates of the plurality of first plates 110. The plurality of first cold side fins 112 are arranged to receive the second fluid 82 through a first side opening 114 defined by the first enclosure assembly 90. The second fluid 82 flows through the plurality of first cold side fins 112 and helps cool the first fluid 80 that flows through the plurality of first plates 110 and the plurality of first hot side fins 113. The plurality of first cold side fins 112 are arranged to discharge or exhaust the second fluid 82 through a second side opening 116 defined by the first enclosure assembly 90.

[0032] The second heat exchanger 24 is operatively connected to the second side plate 32 of the manifold 20. The second heat exchanger 24 includes a second enclosure assembly 120 and a second core assembly 122.

[0033] The second enclosure assembly 120 is disposed about the second core assembly 122. The second enclosure assembly 120 includes a third sub-header 130 and a fourth sub-header 132.

[0034] The third sub-header 130 is operatively connected to the second side plate 32. The third sub-header 130 defines a third sub-header opening 134 that is proximately aligned with the second opening 52 of the second side plate 32.

[0035] The fourth sub-header 132 is disposed opposite the third sub-header 130. The fourth sub-header 132 defines a fourth sub-header opening 136 that is proximately aligned with the third sub-header opening 134. The first fluid 80 flows through the first fluid inlet 70 over the plurality of cooling elements, flows through the second opening 52, through the third sub-header opening 134, through the second core assembly 122, and exits through the fourth sub-header opening 136.

[0036] The second core assembly 122 is disposed within the second enclosure assembly 120. The second core assembly 122 includes a plurality of second plates 140, a plurality of second cold side fins 142, and a plurality of second hot side fins 143.

[0037] The plurality of second plates 140 extend between the third sub-header 130 and the fourth sub-header 132. The plurality of second plates 140 and the plurality of second hot side fins 143 are arranged to receive the first fluid 80 that is pre-cooled by the manifold 20 through the third sub-header opening 134 and exhausts the first fluid 80 through the fourth sub-header opening 136.

[0038] The plurality of second cold side fins 142 are disposed between adjacent plates of the plurality of second plates 140. The plurality of second cold side fins 142 may be joined to adjacent plates of the plurality of second plates 140. The plurality of second cold side fins 142 are arranged to receive the second fluid 82 through a third side opening 144 defined by the second enclosure assembly 120. The second fluid 82 flows through the plurality of second cold side fins 142 and helps cool the first fluid 80 that flows through the plurality of second plates 140 and the plurality of second hot side fins 143. The plurality of second cold side fins 142 are arranged to discharge or exhaust the second fluid 82 through a fourth side opening 146 defined by the second enclosure assembly 120.

[0039] While the first core assembly 92 and the second core assembly 122 have been described with reference to a plate and fin configuration, however, other core assembly configurations are also contemplated, such as plate and tube, tube and fin, or the like.

[0040] The first heat exchanger 22 and the second heat exchanger 24 are oriented at an angle relative to one another.

[0041] The term "about" is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, "about" can include a range of $\pm$ 8% or 5%, or 2% of a given value.

[0042] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

[0043] While the present disclosure has been described with reference to an exemplary embodiment or embodiments, 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 present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the claims.

Claims

1. A heat exchanger assembly (10), comprising:
   a manifold (20) having

   a first side plate (30) and a second side plate (32) disposed opposite the first side plate (30),

a first face plate (36) and a second face plate (38) disposed opposite the first face plate (36), the first face plate (36) and the second face plate (38) each extend between the first side plate (30) and the second side plate (32),
a base plate (34) extending between proximal ends of the first side plate, the second side plate, the first face plate, and the second face plate, and
a plurality of cooling elements (40) extending between the first face plate (36) and the second face plate (38).

2. The heat exchanger assembly of claim 1, further comprising a mounting flange (42) extending from the manifold (20) and disposed about distal ends of the first side plate (30), the second side plate (32), the first face plate (36), and the second face plate (38).

3. The heat exchanger assembly of claim 1 or 2, wherein the manifold (20) has a first width defined between distal ends of the first side plate (30) and the second side plate (32) and the manifold (20) has a second width defined between proximal ends of the first side plate (30) and the second side plate (32), the first width being greater than the first width.

4. The heat exchanger assembly of claim 1, 2 or 3, wherein distal ends of the first side plate (30), the second side plate (32), the first face plate (36), and the second face plate (38) define a first fluid inlet arranged to receive a first fluid and the plurality of cooling elements (40) are arranged to receive a second fluid.

5. The heat exchanger assembly of claim 1, 2, 3 or 4, wherein the first side plate (30) defines a first opening.

6. The heat exchanger assembly of any preceding claim, wherein the second side plate (32) defines a second opening.

7. The heat exchanger assembly of claim 6, further comprising a first heat exchanger (22) including:

a first sub-header (100) that is operatively connected to the first side plate, the first sub-header (100) defining a first sub-header opening (104); and
a second sub-header (102) spaced apart from the first sub-header (100), the second sub-header (102) defining a second sub-header opening (106).

8. The heat exchanger assembly of claim 7, wherein the first heat exchanger (22) further includes:

a plurality of first plates (110) extending between the first sub-header (100) and the second sub-header (102); and
a plurality of first cold side fins (112) disposed between adjacent plates of the plurality of first plates (110).

9. The heat exchanger assembly of claim 8, further comprising a second heat exchanger (24) including:

a third sub-header (130) that is operatively connected to the second side plate, the third sub-header (130) defining a third sub-header opening (134); and
a fourth sub-header (132) spaced apart from the third sub-header (130), the fourth sub-header (132) defining a fourth sub-header opening (136).

10. The heat exchanger assembly of claim 9, wherein the second heat exchanger (24) further includes:

a plurality of second plates (140) extending between the third sub-header (130) and the fourth sub-header (132); and
a plurality of second cold side fins (142) disposed between adjacent plates of the plurality of second plates (140).

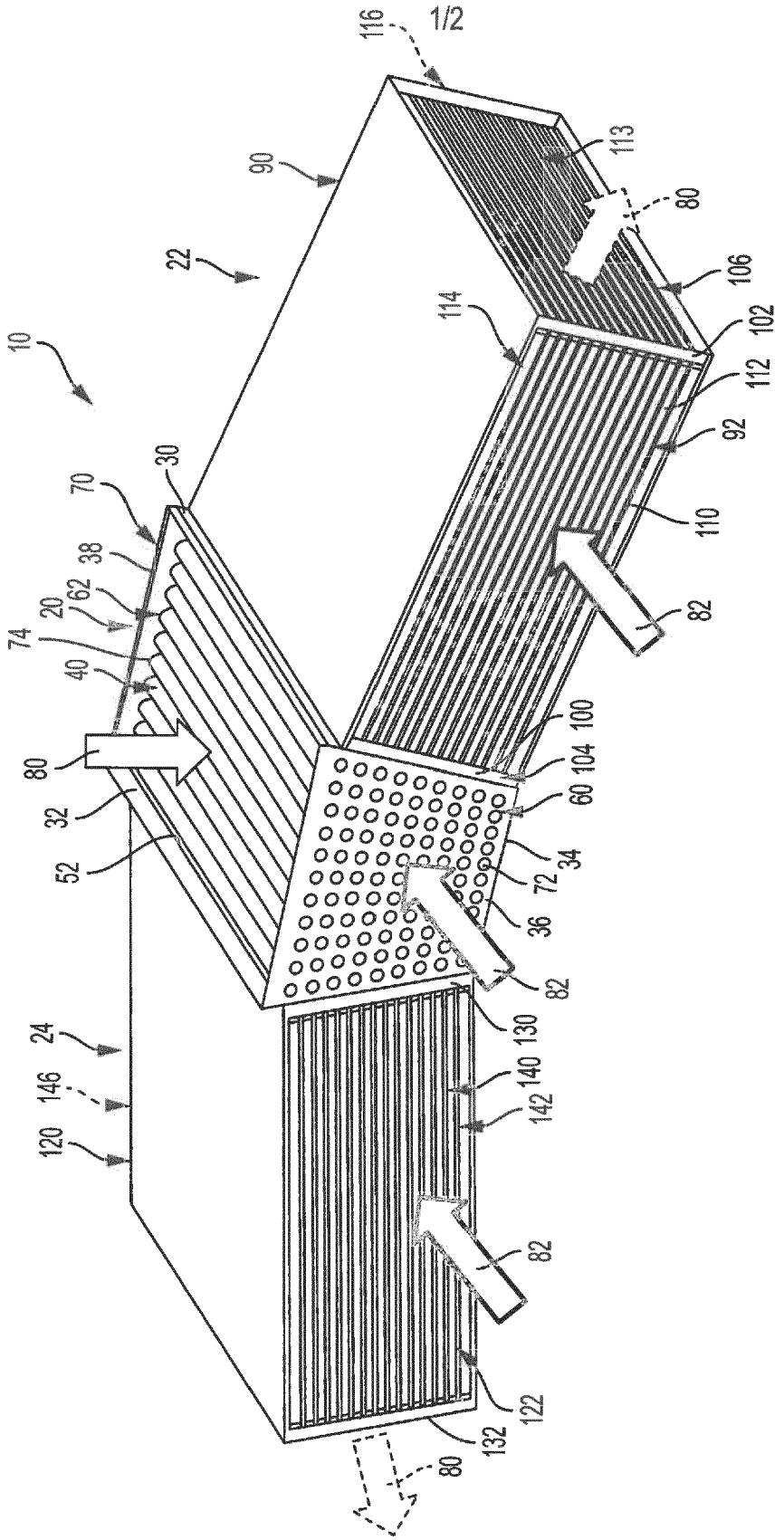

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FIG. 1

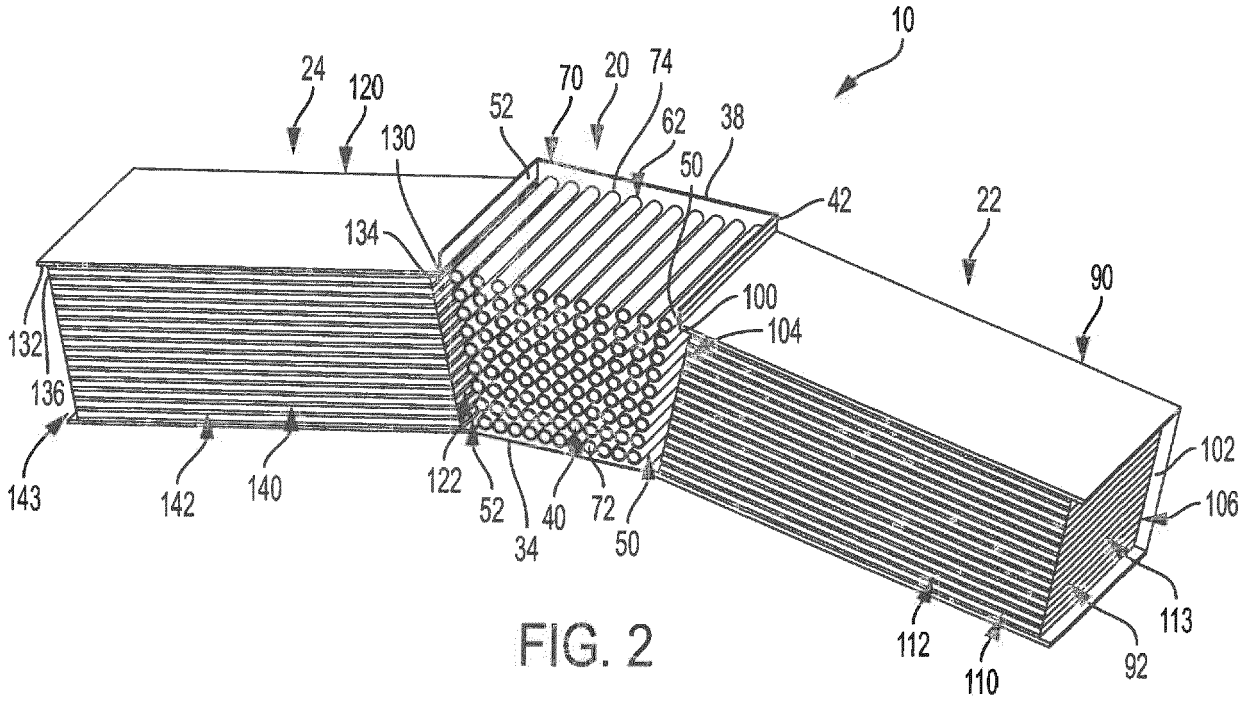

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FIG. 2

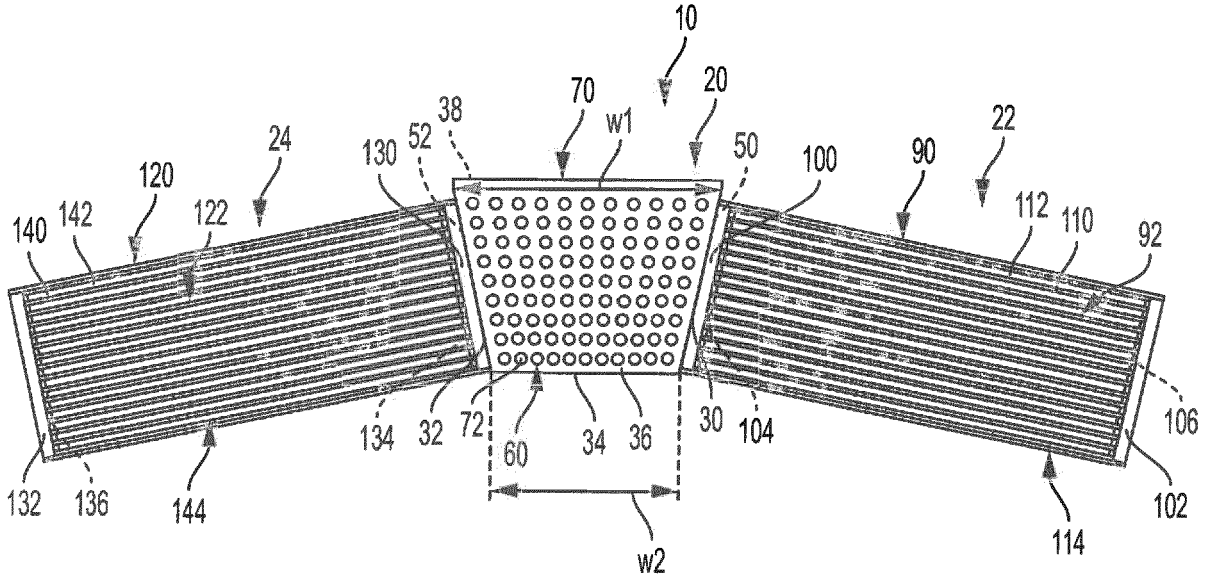

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FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 6661

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 August 2018	Bloch, Gregor

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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