

(19)



(11)

EP 3 789 720 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

10.03.2021 Bulletin 2021/10

(51) Int Cl.:

F28F 9/02 (2006.01)

(21) Application number: **19461578.7**

(22) Date of filing: **09.09.2019**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

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(54) **A HEAT EXCHANGER**

(57) The invention comprises a heat exchanger for a motor vehicle comprising a row of tubes. The tubes are fluidly connected with at least one manifold. The manifold comprises a header and a tank, between which a sealing means is located. The sealing means comprising two shorter sides, two longer sides, and at least one transverse portion connecting the opposite longer sides and

being located essentially between the main axes of a pair of the tubes, wherein the transverse portion is located between a pair of neighboring tubes comprising a first supporting tube and a second supporting tube, wherein there is at least one non-supporting tube situated between the pair of neighboring tubes and any of the short sides of the sealing means.

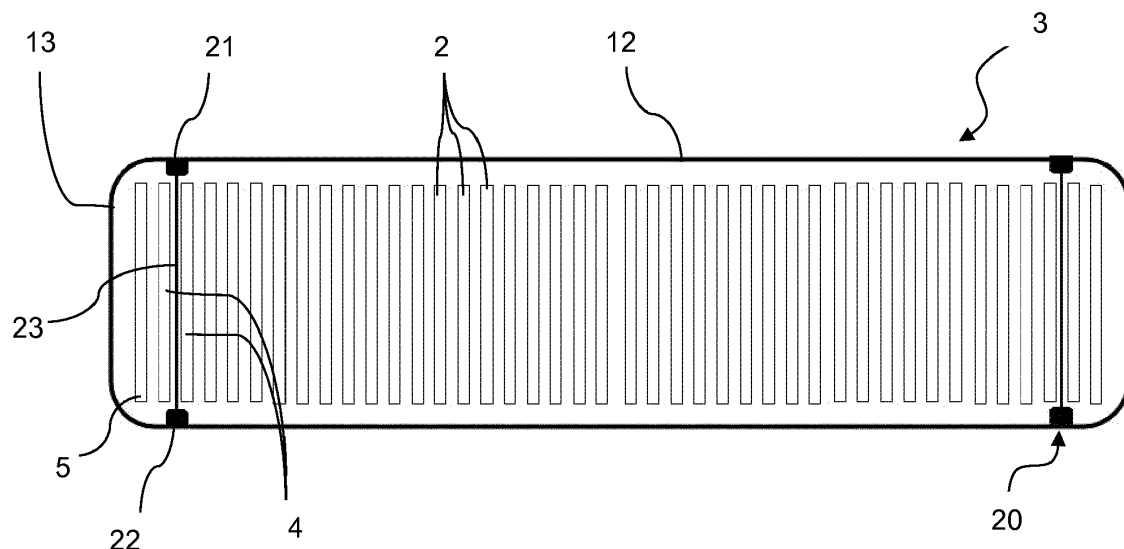


Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a heat exchanger for motor vehicle, in particular to a heat exchanger for coolant fluid.

BACKGROUND OF THE INVENTION

[0002] Heat exchangers may be used, for example, in motor vehicles. In its simplest form they comprise a core which is usually formed by tubes, fins, and a collector. The sub-components of the heat exchanger are usually mechanically connected one to another by means of crimping connection or flange connection with a rubber seal trapped between the sub-components. Typical core consists of a metal material such as, for example, an aluminum material and the collecting or distributing box are usually made of synthetic material.

[0003] Despite more and more advanced technology, the radiators are still vulnerable for leakage during its operational lifetime. The gaskets are used in the majority of the applications to seal the heat exchanger. Gaskets are relatively cheap, easy to apply and manufacture, but on the other hand they are quite difficult to embed on the sealing region, so it doesn't slip off the header be pinched by the tank during assembly.

[0004] Document DE 4243495 A1 discloses the gasket for the heat exchanger comprising a circular members stretched and hooked in the corners of the header. This solution provides stretching of the gasket in two directions, however the circular members force major changes in the construction of the header, so it could be assembled with it. Moreover, the corner area of the header is very vulnerable to leakage, so weakening the walls of the header for the sake of stretching the gasket may bring a negative effect on the water-tightness of the heat exchanger.

[0005] Concerning the upper mentioned facts, it would be desired to provide a gasket supporting member for the heat exchanger that will prevent twisting and/or pinching of the gasket in its corner area, without a need of modification of the other elements of the heat exchanger.

SUMMARY OF THE INVENTION

[0006] The object of the invention is, among others, a heat exchanger for a motor vehicle comprising a row of tubes fluidly connected with a header and a tank, between which a sealing means is located. The sealing means comprises two shorter sides, two longer sides, and at least one transverse portion connecting the opposite longer sides and being located essentially between the main axes of a pair of the tubes, wherein the transverse portion is located between a pair of neighboring tubes comprising a first supporting tube and a second supporting tube, wherein there is at least one non-sup-

porting tube situated between the pair of neighboring tubes and any of the short sides of the sealing means.

[0007] Preferably, the sealing means comprises the two shorter sides and two longer sides forming an essentially rectangular shape.

[0008] Preferably, there are three non-supporting tubes situated between the pair of neighboring tubes and any of the short sides of the sealing means.

[0009] Preferably, the heat exchanger comprises the first supporting tube and the second supporting tube, wherein there are eight non-supporting tubes situated between the pair of neighboring tubes and any of the short sides of the sealing means.

[0010] Preferably, the sealing means comprises at least two transverse portions, the transverse portions being located symmetrically in reference to the shorter sides.

[0011] Preferably, the transverse portion comprises a first support, a second support, the supports being attached to the opposite longer sides, the transverse portion further comprises at least one span extending between the first support and the second support.

[0012] Preferably, the supports further comprise grooves parallel to the longer sides.

[0013] Preferably, the supports comprise a cylindrical portions at an end adjacent to the span.

[0014] Preferably, the header comprises a slot for receiving the tube, the slot remaining in a tight connection with the outer perimeter of the tube, the slot further comprising a collar protruding to the inner side of the manifold.

[0015] Preferably, the span of the transverse portion is not in a contact with the collar.

[0016] Preferably, the span of the transverse portion is in a contact with the collar.

[0017] Preferably, the span of the transverse portion is in a contact with the outer wall of at least one tube.

[0018] Preferably, the two longer sides, two shorter sides and the transverse portion are made of an elastic material.

[0019] Preferably, the transverse portion is made of material having different properties than the two shorter sides and the two longer sides.

[0020] Preferably, the header comprises notches, the notches being deployed along the outer perimeter of the header, the notches being configured to receive the two longer sides and the two shorter sides of the sealing means.

[0021] The invention can be applied in a vast majority of the heat exchangers, in particular radiators with I-flow and U-flow fluid distribution. In contrast to prior art, the present invention facilitates the assembly of the heat exchanger, by reducing the time needed to properly deploy the gasket on the header, and prevents the leakage thereof during operating conditions by minimizing the risk of the gasket being pinched, rolled or deformed during assembly process of heat exchanger

BRIEF DESCRIPTION OF DRAWINGS

[0022] Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic view of gasket and tubes deployment according to the first embodiment on the invention.

Fig. 2 shows a schematic view of gasket and tubes deployment according to the second embodiment on the invention.

Fig. 3 shows a schematic view of gasket and tubes deployment according to the third embodiment on the invention.

Fig. 4 shows a schematic view of gasket and tubes deployment according to the fourth embodiment on the invention.

Fig. 5 shows a schematic view of gasket and tubes deployment according to the fifth embodiment on the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0023] The subject of an invention comprises a heat exchanger for a motor vehicle. The heat exchangers are configured to transfer to the environment heat accumulated in the system during the combustion process in the most efficient way possible.

[0024] In the majority of applications, the heat exchange fluid enters the heat exchanger (not shown) through at least one inlet, circulates through the core of the heat exchanger (not shown), and exits through at least one outlet (not shown). The heat exchanger usually comprises a plurality of tubes 2 tightly assembled with the header (not shown) on each open end of the tube. Each header comprises slots for providing a tight assembly with the tubes, and the other side of the header is covered with the tank. The connection between the header and the tank is vulnerable for leakage, due to e.g. different thermal expansion of two different materials which of the header and the tank are made. The sealing means needs to be provided to facilitate the water-tightness of the heat exchanger.

[0025] Fig. 1 presents the sealing means 3 deployed around the plurality of tubes 2. The sealing means 3 is in a contact with the header and the tank, so that it reflects the main shape of the header. The number of tubes 2 in the Figs 1-5 may vary depending on desired size of the heat exchanger, so the 42 tubes 2 presented Figs 1-5 should be regarded as exemplary. The tubes are of essentially rectangular shape. The tubes 2 are fluidly connected with at least one header. The header comprises slots, which are of essentially the same shape as the

outer perimeter of the tubes. The header may be assembled with the tank in the process of e.g. crimping, so that the two sub-components cannot be disassembled using force.

[0026] The sealing means 3 comprise two shorter sides 13 aligned parallelly to each other, and two longer sides 12 also aligned parallelly to each other, whereas the longer sides 12 are aligned perpendicularly to the main direction of the shorter sides 13. As consequence, the sealing means 3 may form essentially rectangular shape with smooth edges. The sealing means of a known shape are vulnerable for deformations, such as twisting, tearing, etc.

[0027] To facilitate the even distribution of the sealing means 3, at least one transverse portion 20 connecting the opposite longer sides 12 and being located essentially between the main axes of a pair of the tubes 2 is introduced between the header and the tank.

[0028] The transverse portion 20 is located between a pair of neighboring tubes 4. The neighboring tubes 4 are essentially the same tubes as the tubes 2 deployed in the distance from the transverse portion 20. The neighboring tubes 4 deployed in the vicinity of the transverse portion 20 comprise a first supporting tube 4a and a second supporting tube 4b. The transverse portion 20 is located between the first supporting tube 4a and the second supporting tube 4b. The first supporting tube 4a is located on the left-hand side of the transverse portion 20, and the second supporting tube 4b is located on the right-hand side of the transverse portion 20. In order to provide a proper functionality of the subject of an invention, there is at least one non-supporting tube 5 situated between the pair of neighboring tubes 4 and any of the short sides 13 of the sealing means 3. The non-supporting tubes 5 are essentially the same tubes as the tubes 2 deployed in the distance from the transverse portion 20. This allows the transverse portion 20 to be distanced from the shorter side 13, so that the transverse portion 20 absorbs the stress coming from stretching more efficiently. The transverse portion 20 may be deployed with a different gap from the adjacent shorter side 13 depending on the desired effect, flow regime, occurrence of the dead zones, etc. Fig. 1 presents an embodiment, wherein there are two transverse portions 20 distanced from the adjacent short sides 13 by one non supporting portion 5.

[0029] The transverse portion 20 is built of several elements, inter alia a first support 21, a second support 22 and a span 23. The supports 21, 22 are attached to the opposite longer sides 12. The attachment is usually carried out by maintaining a continuity of material between the longer sides 12 and the supports 21, 22. The supports 21, 22 are further connected to at least one span 23 extending between the first support 21 and the second support 22. The attachment is also carried out by maintaining a continuity of material between the supports 21, 22 and the span 23.

[0030] The span 23 is stretched between the supports 21, 22 forming a straight portion. Alternatively, the span

is stretched between the supports 21, 22 forming an arched portion.

[0031] In an embodiment presented in the Fig.2, the transverse portion 20 is distanced from the shorter side 13 by three non-supporting tubes 5 deployed perpendicularly to the longer side 12. Increasing the distance between the shorter side 13 of the sealing means 3 and its transverse portion enables an alternative sealing means fitment in the header, for example in the heat exchangers of bigger dimensions.

[0032] Fig 3. presents the transverse portion 20 being distanced from the shorter side 13 by eight non-supporting tubes 5 deployed perpendicularly the longer side 12. Fig. 3 discloses also one of preferable embodiments of an invention, wherein the distance between the transverse portion and the shorter side is equal or substantially equal to the length of the shorter side 13, which is essentially equal to the distance between the longer sides 12. An essentially rectangular shape formed by the transverse portion 20, the longer sides 12 and the shorter side 13 facilitates the uniform distribution of mechanical stress around the sealing means 3.

[0033] The distance between the transverse portion 20 and the shorter side 13 of the sealing means 3 depends mainly on the dimensions of the heat exchanger and the pressure in the cooling loop.

[0034] Fig. 4 presents another embodiment of an invention, wherein the sealing means 3 comprise not only one transverse portion 20, but at least two transverse portions 20 located on the same half of the sealing means 3. Multiple transverse portions 20 on the same half of the sealing means 3 are proven to absorb stress from the longer sides 12 more efficiently.

The transverse portions 20 seek to be deployed symmetrically along the two longer sides 12, however, for some specific applications, it is executable to provide unsymmetrical deployment of the transverse portions 20 along the longer sides 12. However, such deployment of the transverse portions 20 may increase the overall cost of the heat exchanger.

[0035] The main embodiment of an invention comprises the single span 23 attached to one pair of supports 21, 22. The other variations are also executable, especially when some areas are vulnerable to the deformation of the sealing means 3.

[0036] Fig. 4 presents an example, wherein the single transverse portion 20 comprises more than one span 23. The additional span 23 may play a role of securing member for the transverse portion 20 in case of the first span 23 gets damaged. It could prevent a single transverse portion from malfunction.

[0037] Fig. 5 presents another example, wherein the single transverse portion 20 comprises more than one span 23.

For example, adding a baffle to the manifold may impact the sealing means 3 in the area adjacent to this baffle. To relax the sealing means 3 in the area of the baffle it would be desired to add the transverse portions 20 be-

tween the tubes 2 adjacent to the baffle and the baffle itself. The solution could be a double span 23 extending between the same pair of supports 21, 22, wherein each span 23 is on the other side of the baffle.

[0038] Both the sealing means 3 and the transverse portion 20 are made of an elastic material, yet the properties of the two may be either the same, or they may be different, e.g. the transverse portion 20 is made of the stiffer material than the longer sides 12 and the shorter sides 13 of the sealing means 3.

[0039] The supports 21, 22 ought to be robust and flexible at the same time to keep the proper tension of the span 23 and to fit to the shape of the header. To provide such properties, the supports 21, 22 are of variable shape to provide rigidity at the attachment points, and flexibility between the attachment points.

For example, the flexibility of the supports 21, 22 is provided by the grooves parallel to the longer sides 12.

For example, the supports 21, 22 comprise a cylindrical portions at an ends adjacent to the span 23 to provide rigidity of the supports 21 22.

[0040] The header of the heat exchanger comprises a slot for receiving the tube 2. The slot is of the shape similar to the one delimited by the outer perimeter of the single tube 2. In order to provide a tight connection between the slot and the outer perimeter of the tube 2, the slot further comprises a collar 6 protruding to the inner side of the manifold.

[0041] In one of the embodiments of the invention, the span 23 of the transverse portion 20 is not in a contact neither with any of the collars 6, nor any of the tube 2. The span 23 extends in the vicinity of the two adjacent collars 2 in a direction parallel to at least one neighboring walls of the tube 2.

[0042] In one of the embodiments of the invention, the span 23 of the transverse portion 20 is in a contact with at least one collar 6. The contact between these two elements can facilitate the stress- reduction properties of the transverse portion 20, thanks to the angular cooperation between the span 23, supports 21, 22, and the longer sides 12. Alternatively, the span 23 of the transverse portion 20 is in a contact with at least one tube 2, if the collar 6 is not provided or of the reduced size. In particular, the contact between the transverse portion 20 and the tube 2 is between their adjacent, outer walls.

[0043] In one of the embodiments of an invention, the header comprises at least one notch 7. The notches 7 are deployed along the outer perimeter of the header and they are configured to receive the two longer sides 12 and the two shorter sides 13 of the sealing means 3. This facilitates the proper deployment of the sealing means 3 on the header.

Another way to facilitate a proper deployment of the sealing means 3 with respect to the header is to provide an arched membranes at the joint point between two adjacent ends of the longer side 12 and the shorter side 13.

[0044] Other variations to the disclosed embodiments can be understood and effected by those skilled in the

art in practicing the claimed invention, from a study of drawings, the disclosure, and the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to the advantage.

Claims

1. A heat exchanger for a motor vehicle comprising a row of tubes (2); the tubes (2) being fluidly connected with at least one manifold; the manifold comprising a header, a tank, between which a sealing means (3) is located, the sealing means (3) comprising two shorter sides (13), two longer sides (12), and at least one transverse portion (20) connecting the opposite longer sides (12) and being located essentially between the main axes of a pair of the tubes (2), wherein the transverse portion (20) is located between a pair of neighboring tubes (4) comprising a first supporting tube (4a) and a second supporting tube (4b), wherein there is at least one non-supporting tube (5) situated between the pair of neighboring tubes (4) and any of the short sides (13) of the sealing means (3).
2. The heat exchanger according to claim 1, wherein the two shorter sides (13) and two longer sides (12) form an essentially rectangular shape.
3. The heat exchanger according to claim 1, comprising the first supporting tube (4a) and the second supporting tube (4b), wherein there are three non-supporting tubes (5) situated between the pair of neighboring tubes (4) and any of the short sides (13) of the sealing means (3).
4. The heat exchanger according to claim 1, comprising the first supporting tube (4a) and the second supporting tube (4b), wherein there are eight non-supporting tubes (5) situated between the pair of neighboring tubes (4) and any of the short sides (13) of the sealing means (3).
5. The heat exchanger according to claim 1, wherein the sealing means (3) comprises at least two transverse portions (20), the transverse portions (20) being located symmetrically in reference to the shorter sides 13.
6. The heat exchanger according to claim 1, wherein the transverse portion (20) comprises a first support (21), a second support (22), the supports (21,22) being attached to the opposite longer sides (12), the transverse portion (20) further comprises at least one span (23) extending between the first support (21) and the second support (22).
7. The heat exchanger according to claim 6, wherein the supports (21, 22) further comprise grooves parallel to the longer sides (12).
8. The heat exchanger according to any of preceding claims, wherein the supports (21, 22) comprise a cylindrical portions at an end adjacent to the span (23).
9. The heat exchanger according to any of preceding claims, wherein the header comprises a slot for receiving the tube (2), the slot remaining in a tight connection with the outer perimeter of the tube (2), the slot further comprising a collar protruding to the inner side of the manifold .
10. The heat exchanger according to claim 9, wherein the span (23) of the transverse portion (20) is not in a contact with the collar.
11. The heat exchanger according to claim 9, wherein the span (23) of the transverse portion (20) is in contact with the collar.
12. The heat exchanger according to claim 9, wherein the span (23) of the transverse portion (20) is in a contact with the outer wall of the supporting tubes (4a, 4b).
13. The heat exchanger according to any of preceding claims, wherein the two longer sides (12), two shorter sides (13) and the transverse portion (20) are made of an elastic material.
14. The heat exchanger according to any of preceding claims, wherein the transverse portion (20) is made of material having different properties than the two shorter sides (13) and the two longer sides (12).
15. The heat exchanger according to all preceding claims, wherein the header comprises notches, the notches being deployed along the outer perimeter of the header, the notches being configured to receive the two longer sides (12) and the two shorter sides (13) of the sealing means (3).

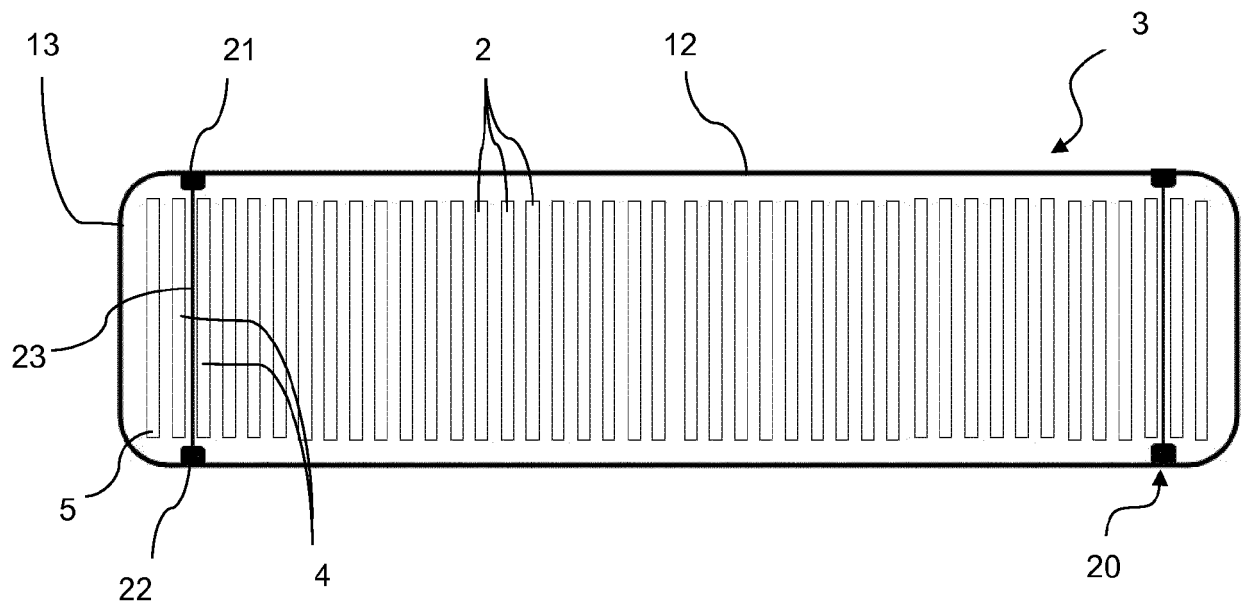


Fig. 1

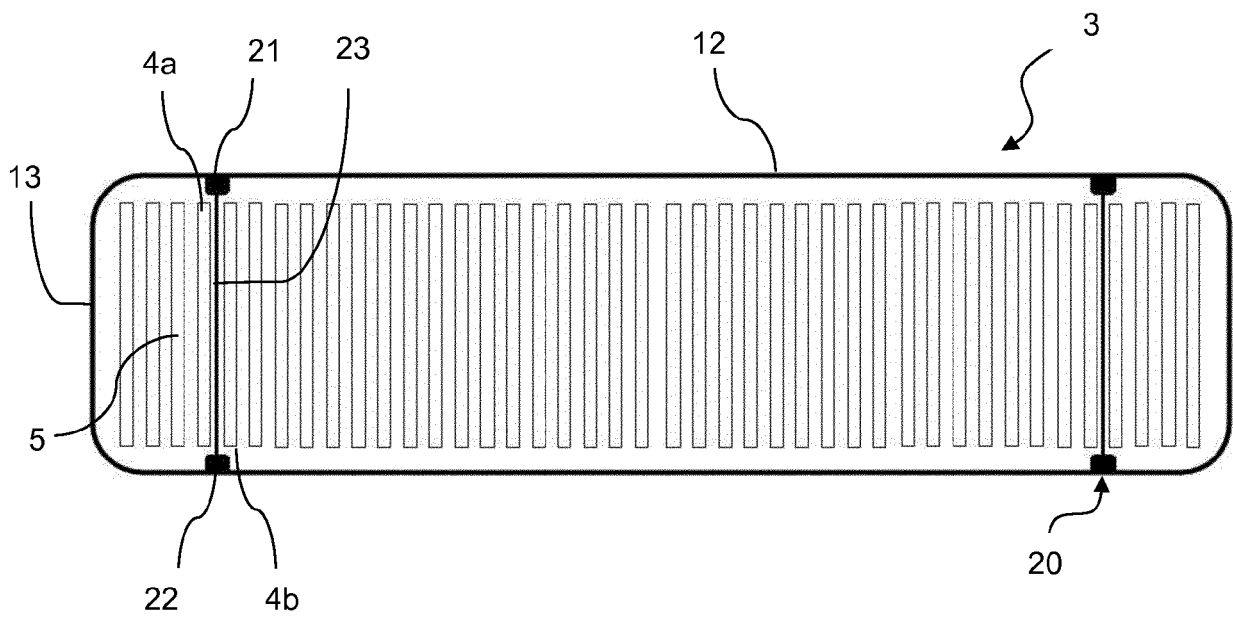


Fig. 2

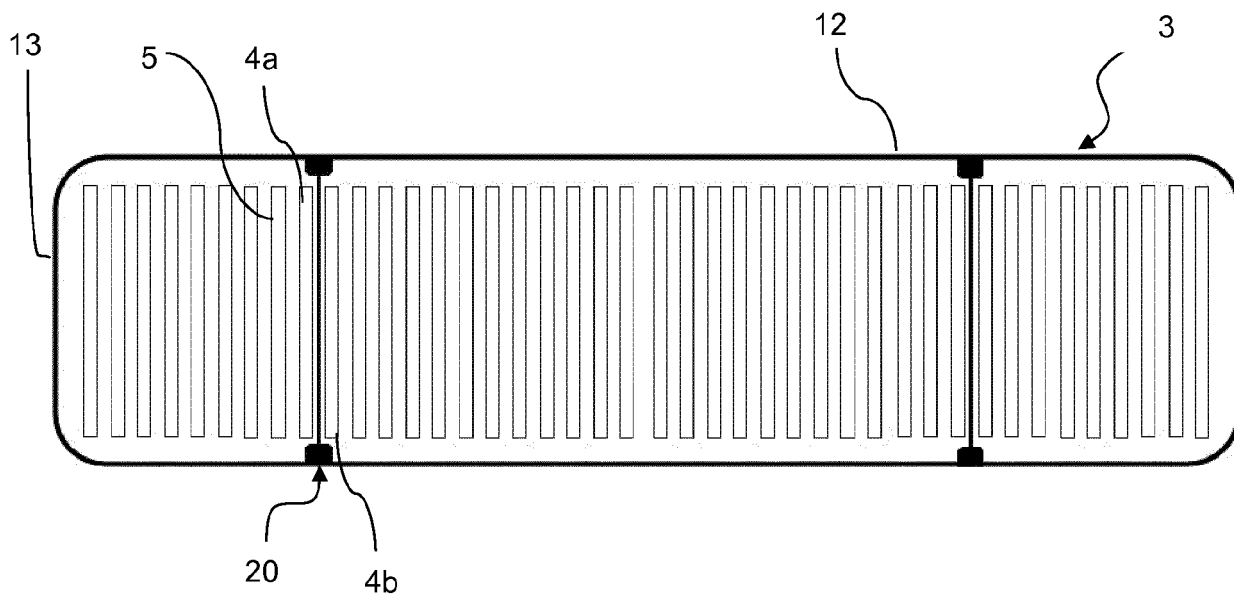


Fig. 3

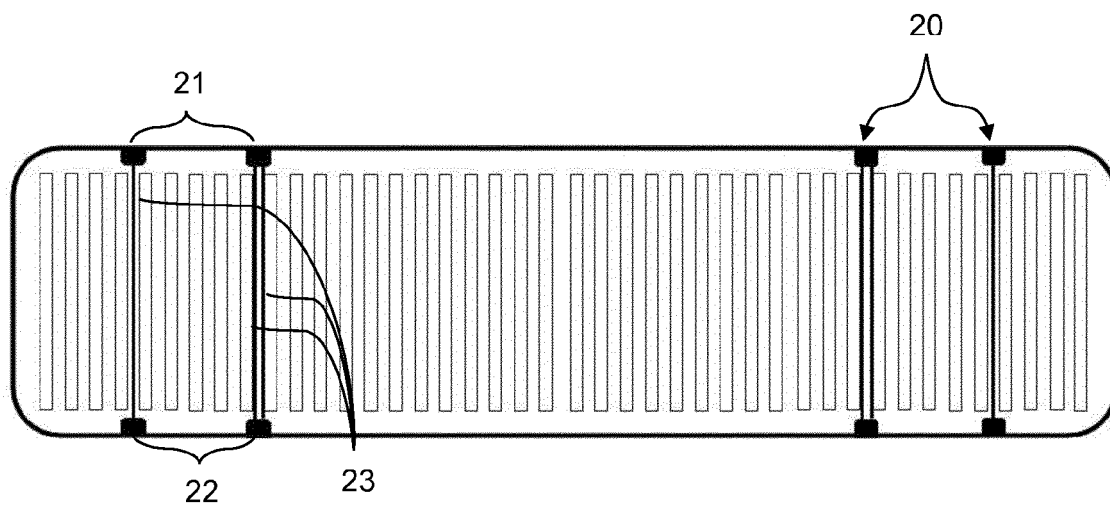


Fig. 4

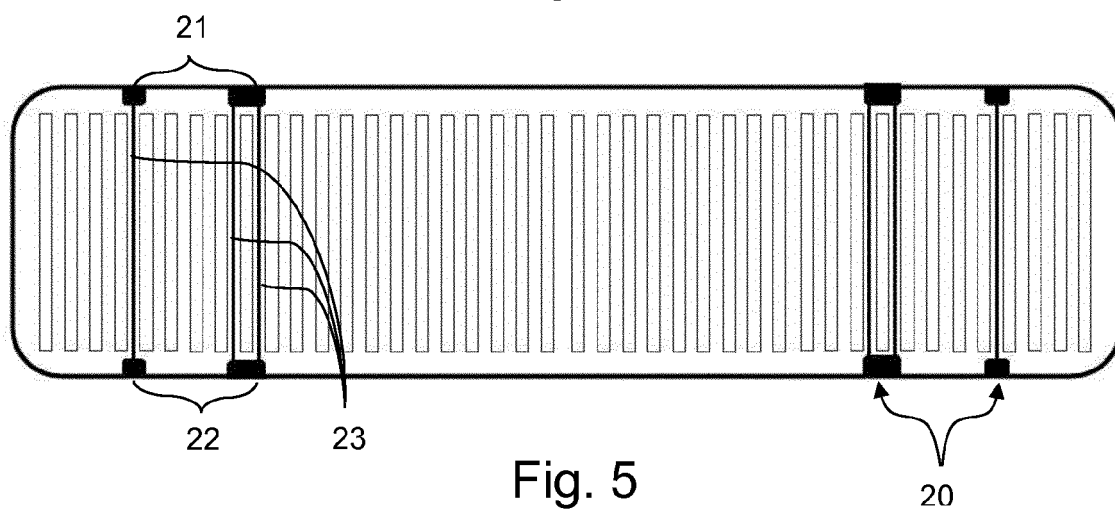


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 19 46 1578

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Place of search Munich		Date of completion of the search 5 March 2020	Examiner Jessen, Flemming
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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