

(19)



(11)

EP 3 892 948 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

13.10.2021 Bulletin 2021/41

(51) Int Cl.:

F28D 1/04 (2006.01)(21) Application number: **20461528.0**(22) Date of filing: **10.04.2020**

(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(71) Applicant: **Valeo Autosystemy SP. Z.O.O.****32-050 Skawina (PL)**

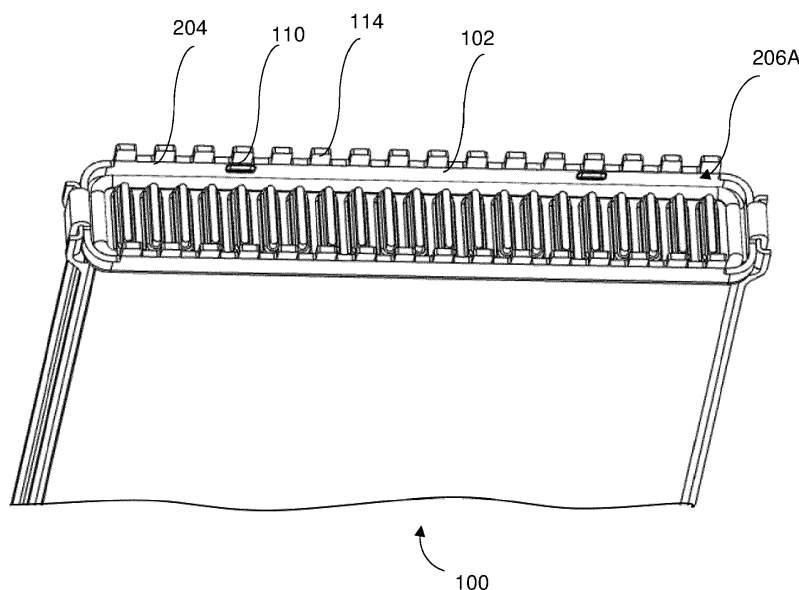
(72) Inventors:

- **WALUSIAK, Pawel**
32 050 SKAWINA (PL)

• **MORYC, Mateusz****32 050 SKAWINA (PL)**• **PAC, Rafal****32 050 SKAWINA (PL)**(74) Representative: **Valeo Systèmes Thermiques****Service Propriété Intellectuelle****ZA l'Agiot, 8 rue Louis Lormand****CS 80517****La Verrière****78322 Le Mesnil-Saint-Denis Cedex (FR)**(54) **HEAT EXCHANGER**

(57) A header-tank assembly for a heat exchanger is provided. The header-tank assembly includes a header, a tank, a protrusion and a groove. The tank is provided with a conduit connected from a first side of the tank, so that a centre of gravity of the tank is shifted towards the first side of the tank. Further, the tank includes a foot portion adapted to be coupled to the header. The protrusion

is formed on of any one of an outer wall of the foot portion of the tank and an inner wall of the header. The groove, complimentary to the protrusion, is formed at least one of the outer sidewall of the foot portion of the tank and the inner wall of the header. The protrusion and the groove are so formed on a side opposite to the first side of the tank.

**FIG. 4**

Description

[0001] The present invention generally relates to a heat exchanger, more particularly, to a header-tank assembly of a heat exchanger provided with a groove-protrusion setup to retain the tank within the header while assembling the tank with the header of the heat exchanger.

[0002] Generally, heat exchanger are provided with a pair of tanks to enable introduction or reception of fluid to or from the heat exchanger. The heat exchanger may include a core provided with a pair of headers at both side of the core. The pair of headers is adapted to be coupled with the pair of tanks, thereby enabling the fluid circulation to the core of the heat exchanger. Further, a gasket is introduced to provide proper sealing between the pair of tanks and the pair of headers. The pair of headers is brazed with the core and it is provided with any connecting means to couple it with the pair of tanks. The connecting means may be tabs formed on the periphery of the pair of headers and adapted to be crimped on the tanks to enable connection between the pair of tanks and the pair of headers. To connect the pair of tanks with the pair of headers, a series of steps are to be performed. Initially, the gasket is provided on the pair of headers, followed by placing the pair of tanks on the respective headers of the core. Upon placing the pair of tanks on the respective headers, the assembly is moved to a machine in which the tabs formed on the headers are crimped/bent on the foot portion of the respective tanks. In order to enable optimal crimping between the pair of tanks and respective headers, the pair of tanks have to lie flat on the gasket provided on the respective headers without any inclination of the tank.

[0003] In case the pair of tanks has its centre of gravity distant from a symmetric plane of the pair of tanks, the pair of tanks may pop from the respective header while assembling the tank on the respective header. Further, the pair of tanks may not lie flat on the gasket provided on the respective header, which may lead to improper connection between the pair of tanks and respective headers. Further, any inclination of the tank with respect to the respective header prevents the tabs formed on the header from being crimped on the tanks, and it may lead to damaging the gasket e.g., by pinching. In case the pair of tanks having centre of gravity distant from symmetry plane of the tanks, the pair of tanks may experience topping out of tank on one side from the respective header and results in falling out of the tank from the respective header.

[0004] Accordingly, there remains a need for an assembly that retains the tanks in the respective header while assembling. Further, there remains another need for the assembly that avoid topping out of the tanks from one side of the respective header while crimping the tank onto the header.

[0005] In the present description, some elements or parameters may be indexed, such as a first element and a second element. In this case, unless stated otherwise,

this indexation is only meant to differentiate and name elements which are similar but not identical. No idea of priority should be inferred from such indexation, as these terms may be switched without betraying the invention. Additionally, this indexation does not imply any order in mounting or use of the elements of the invention.

[0006] In view of the foregoing, an embodiment of the invention herein provides a header-tank assembly. The header-tank assembly includes a header, a tank, at least one protrusion and at least one groove. The tank is provided with a conduit connected from a first side of the tank, so that a centre of gravity of the tank is shifted towards the first side of the tank. Further, the tank includes a foot portion adapted to be coupled to the header. The protrusion is formed on of any one of an outer wall of the foot portion of the tank and an inner wall of the header. The groove, complimentary to the protrusion, is formed on of any one of the tank and the header. Further, the groove is formed on any one of the outer sidewall of the foot portion of the tank and the inner wall of the header. The protrusion and the groove are so formed at least on a side opposite to the first side of the tank.

[0007] In one embodiment, the protrusion is formed on the outer wall of the foot portion of the tank on a side opposite to the first side of the tank, and the groove is formed on inner wall of the header, complementary to the protrusion.

[0008] In another embodiment, the protrusion is formed on the inner wall of the header, and the groove is formed on the outer wall of the foot portion of the tank on a side opposite to the first side of the tank.

[0009] In one example, the protrusion is formed throughout any one of the outer wall of the foot portion of the tank, and the inner wall of the header.

[0010] In another example, the groove is formed throughout any one of the outer wall of the foot portion of the tank, and the inner wall of the header.

[0011] Further, the protrusion comprises a slope adapted to slide into the groove when the tank is positioned on the header.

[0012] Further, a gasket disposed on a gasket recess formed on the header is adapted to provide sealing between the header and the tank when the tank is positioned on the header.

[0013] Further, the heat exchanger includes a heat exchanger core fluidically connected to the header. The conduit is fluidically connected to the header to enable fluid flow to the heat exchanger core.

[0014] Other characteristics, details and advantages of the invention can be inferred from the description of the invention hereunder. A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying figures, wherein:

FIGS. 1 and 2 illustrate schematic views of a heat

exchanger, in accordance with an embodiment of the present invention;

FIG. 3 is a top view of a header provided with a gasket of the heat exchanger of Fig. 1;

FIGS. 4 and 5 illustrate perspective views the header of Fig. 3 showing grooves formed thereon;

FIGS. 6 and 7 illustrate perspective views of a tank of the heat exchanger of FIG. 1; and

FIG. 8 illustrates an exploded view of the tank on the header of the heat exchanger of Fig. 1.

[0015] It must be noted that the figures disclose the invention in a detailed enough way to be implemented, the figures helping to better define the invention if need be. The invention should however not be limited to the embodiment disclosed in the description.

[0016] The present invention relates to a heat exchanger provided with a pair of tanks coupled with a core of the heat exchanger. The heat exchanger may include a pair of headers corresponding to the pair of tanks. The pair of tanks is adapted to be coupled with the respective headers of the heat exchanger. The pair of headers and the pair of tanks are collectively referred to as a header-tank assembly. For the sake of brevity and clarity, the heat exchanger explained in the present document is described with one header and one tank. Although the present document is explained with a header and a tank amongst the pair of header and tank assemblies, the same features can be applied to other header and tank amongst the pair of header and tank assemblies. The heat exchanger is provided with a groove-protrusion configuration to retain the tank on the header, while assembling the tank on the header. The groove is complementary to the protrusion formed in the heat exchanger, and adapted to be coupled with each other, thereby providing a retention force between the tank and the header while assembling the tank on the header of the heat exchanger. Further, detailed location and geometry of the groove-protrusion configuration are explained with forthcoming description with figures.

[0017] FIGS. 1 and 2 illustrate schematic views of a heat exchanger 100, in accordance with an embodiment of the present invention. The heat exchanger 100 includes a heat exchanger core 10 having a pair of headers 102 to receive heat exchange elements (not shown in figures). The pair of headers 102 may be brazed with the heat exchanger core 10 and fluidically connected to the heat exchange elements. The heat exchanger 100 further includes a pair of tanks 104 adapted to be coupled with the pair of headers 102 provided with the heat exchanger core 10. The pair of tanks 104 enables fluid communication with the heat exchanger core 10. In one example, one tank 104 may provide the fluid to the heat exchanger core 10, and other may receive the fluid from

the heat exchanger core 10. For the sake of brevity and clarity, one header and one tank are shown in the figures and accordingly explained in the description. Further, the header 102 and the tank 104 are collectively referred to as a header-tank assembly 100A. The tank 104 has a foot portion 106 adapted to be in-contact with the header 102. Further, tabs 114 defined on the header 102 are adapted to be crimped on the foot portion 106 of the tank 104 to enable a rigid connected between the tank 104 and the header 102.

[0018] Further, the tank 104 may include a conduit 112 to introduce or receive the fluid to or from the heat exchanger core 10. Further, the header 102 is provided with a gasket (not shown in Figs. 1 and 2) to enable fluid-tight connection between the header 102 and the tank 104. In one embodiment, the header 102 is provided with the tabs 114 formed on the periphery/edges of the header 102. The tabs 114 are adapted to bend on the foot portion 106 of the tank 104, once the tank 104 is placed on the header 102. In one embodiment, the tank 104 may have its centre of gravity outside of the symmetric plane of the tank 104 with respect to centre of the header 102, since the tank 104 is asymmetrical in shape and have unbalanced mass in one side of the tank 104. In one example, the symmetric plane of the tank 104 is defined on a point on which both sides of the tank 104 have equal mass. In such cases, the tank 104 may pop-out from the header 102 at one side, while crimping the tank 104 on the header 102. In one embodiment, the conduit 112 is formed on a first side 104A of the tank 104, so the centre of gravity is moved out of the symmetric plane of the tank, thereby the tank 104 may not lie flat on the header 102 and there may be an inclination between the tank 104 and the header 102. Such inclination may lead to toppling of the tank 104 while assembling the tank 104 on the header 102 and to damaging of the gasket as pinching, provided in the header 102. As the conduit 112 is connected from the first side 104A of the tank 104, the centre of gravity of tank is shifted towards the first side 104A of the tank 104. To overcome such issues, protrusions and grooves (not shown in Figs. 1 and 2) are provided on the header 102 and the tank 104 respectively. Further, placement of the protrusions 108 and the grooves 110 are explained in forthcoming figures.

[0019] FIGS. 3-5 illustrate different views of the heat exchanger core 10 depicting the header 102, in accordance with an embodiment of the present invention. In this example, Fig. 3 is a top view of the header 102 provided with the gasket 202. Further, a recess is formed on the header 102 to receive the gasket 202. The gasket 202 is provided in the header 102 to provide sealing between the tank 104 and the header 102, when the tank 104 is coupled to the header 102. The gasket 202 can be of rubber or any flexible material, which can withstand high temperature. Further, Figs. 4 and 5, illustrate perspective views of the header 102 having the grooves 110. Further, the grooves 110 may be formed on an inner wall 204 of lateral sides of the header 102 as shown in Figs. 4 and

5. In one example, Fig. 4 illustrates the grooves 110 formed on the inner wall 204 of a first lateral side 206A of the header 102, and Fig. 5 shows the grooves 110 formed on the inner wall 204 of a second lateral side 206B of header 102. The grooves 110 are adapted to receive corresponding protrusions formed on the tank 104, to retain the tank 104 on the header 102 while crimping the tabs 114 on the foot portion 106 of the tank 104. In a preferred embodiment, at least one groove 110 is optimal to retain the tank 104 on the header 104 while crimping the tabs 114 on the foot portion 106 of the tank 104. In such case, the groove 110 is formed on a side of the header 102, which is opposite side of the first side of the tank 104. For example, if the tank 104 has the conduit 112 in the first side 104A of the tank 104, the centre of gravity is on the first side 104A of the tank 104. In such case, the groove 110 can be formed on, an opposite side to the first side 104A of the tank 104, on the header 102. Further, placement of the groove 110 clearly explained in the forthcoming figures.

[0020] In one embodiment, the grooves 110 can be formed throughout the inner circumference of the inner wall 204 of the header 102. In another embodiment, the grooves 110 can be formed at regular intervals on the inner wall 204 of the both the first and second lateral sides 206A and 206B of the header 102. In another embodiment, the grooves 110 can be formed on the inner wall 204 of the either of the first lateral side 206A or the second lateral side 206B of the header 102. Further, the tank 104 is adapted to be received between both the first lateral side 206A and the second lateral side 206B of the header 102. In one example, an outer wall of the tank 104 is in contact with the inner wall 204 of the header 102 when the tank 104 is placed on the header 102.

[0021] FIGS. 6 and 7 illustrate perspective views of the tank 104 of the heat exchanger 100 of FIG. 1. The tank 104 includes the foot portion 106 provided on the periphery of the tank 104, and the outer wall 302 is adjacent to the foot portion 106. Further, the protrusions 108 are provided on the outer wall 302 of the tank 104. In one embodiment, the protrusions 108 are provided on the outer wall 302 of lateral sides of the tank 104. In one embodiment, the protrusions 108 may be formed on the outer wall 302 of a first lateral side of tank 304A or a second lateral side of tank 304B. In another embodiment, the protrusions 108 may be formed on the outer wall 302 of both the first and second lateral sides of tank 304A and 304B. In preferred embodiment, the protrusions 108 are formed a lateral side which is opposite to the centre of gravity of the tank 104 or the first side 104A of the tank 104. In this example, the conduit 112 is formed in a direction same as the first lateral side of tank 304A, so the centre of gravity may be oriented towards the first lateral side of tank 304A. Hence, there is possibility of topping of the tank 104 from the header 102 at the second lateral side of tank 304B, so the protrusions 108 are formed on the second lateral side of tank 304B as shown in Fig. 6. The protrusions 108 formed on the outer wall 302 of the

second lateral side of tank 304B are complementary to the groove 110 formed in the inner wall 204 of the second lateral side 206B of the header 102. Thereby, connection between the tank 104 and the header 102 is formed which retains the tank 104 on the header 102 while assembling the tank 104 on the header 102. As shown in Figs. 6 and 7, the protrusions 108 are formed on the outer wall 302 of the second lateral side of tank 304B, and the outer wall 302 of the first lateral side of tank 304A is protrusion-free side. In one example, the tank 104 requires at least one protrusion 108 to connect or to retain the tank 104 on the header 102. Further, the protrusions 108 include a slope adapted to slide into the grooves 110 formed on the header 102, when the tank 104 is positioned on the header 102. The heat exchanger 100 can be a water cooled condenser.

[0022] FIG. 8 illustrates an exploded view of the tank 104 on the header 102 of the heat exchanger 100 of Fig. 1. In the shown exploded view of the tank 104 and the header 102, the protrusions 108 are formed on the tank 104 and the grooves 110 are formed on the header 102. The protrusions 108 are complimentary to the grooves 110 to receive the protrusions 108 in the grooves 110, when the tank 104 is placed on the header 102 of the heat exchange core 10. Although the protrusions 108 are formed on the tank 104 and the grooves 110 are formed on the header 102, it is possible to configure the protrusions 108 on the header 102 and the grooves 110 on the tank 104. In such configuration, the protrusions 108 are formed on the header 102 and the grooves 110 are formed on the tank 104. In this embodiment, the protrusions 108 are formed on the inner wall 204 of the first and second lateral sides 206A and 206B of the header 102. Further, the grooves 110 are formed on the outer wall 302 of the foot portion 106 of the tank 104. The protrusions 108 slide into the grooves 110, when the tank 104 is placed on the header 102. Then, the tabs 114 are bend over the foot portion 106 of the tank 104 to enable a rigid connection between the tank 104 and the header 102. As the protrusions 108 and the grooves 110 enables the tank 104 to retain on the header 102, there is no toppling of tank while assembling the tank 104 on the header 102, even though the tank 104 has its centre of gravity outside the symmetric plane of the tank 104. Thereby, the assembling time of the tank 104 on the header 102 also reduced.

[0023] In any case, the invention cannot and should not be limited to the embodiments specifically described in this document, as other embodiments might exist. The invention shall spread to any equivalent means and any technically operating combination of means.

Claims

1. A header-tank assembly (100A), comprising:
a header (102);

- a tank (104) provided with a conduit (112) connected from a first side (104A) of the tank (104), so that centre of gravity of the tank is shifted towards the first side (104A) of the tank (104), wherein the tank (104) includes a foot portion (106) adapted to be coupled to the header (102); at least one protrusion (108) formed on any one of an outer wall of the foot portion (106) of the tank (104) and an inner wall of the header (102); and
 at least one groove (110), complimentary to the protrusion (108), formed on any one of the tank (104) and the header (102), wherein the groove (110) is formed on any one of the outer sidewall of the foot portion (106) of the tank (104) and the inner wall of the header (102), wherein the protrusion (108) and the groove (110) are so formed at least on a side opposite to the first side (104A) of the tank (104).
2. The header-tank assembly (100A) as claimed in claim 1, wherein the protrusion (108) is formed on the outer wall of the foot portion (106) of the tank (104) on a side opposite to the first side (104A) of the tank (104), and the groove (110) is formed on inner wall of the header (102), complementary to the protrusion (108).
3. The header-tank assembly (100A) as claimed in claim 1, wherein the protrusion (108) is formed on the inner wall of the header (102), and the groove (110) is formed on the outer wall of the foot portion (106) of the tank (104) on a side opposite to the first side (104A) of the tank (104).
4. The header-tank assembly (100A) as claimed of claims 1 to 3, wherein the protrusion (108) is formed throughout any one of the outer wall of the foot portion (106) of the tank (104), and the inner wall of the header (102).
5. The header-tank assembly (100A) as claimed in any of claims 1 to 3, wherein the groove (110) is formed throughout any one of the outer wall of the foot portion (106) of the tank (104), and the inner wall of the header (102).
6. The header-tank assembly (100A) as claimed in any of preceding claims, wherein the header (102) further comprising a plurality of tabs (114) formed on edges of the header (102), wherein the plurality of tabs (114) is crimped over the foot portion (106) of the tank (104) upon positioning the tank (104) in the header (102).
7. The header-tank assembly (100A) as claimed in claim 1, wherein the protrusion (108) comprises a slope adapted to slide into the groove (110) when the tank (104) is positioned on the header (102).
8. A heat exchanger (100) provided with the header-tank assembly (100A) as claimed in any of preceding claims, comprising a gasket (202) disposed on a gasket recess defined on the header (102) to provide sealing between the header (102) and the tank (104) when the tank (104) is positioned on the header (102).
9. The heat exchanger as claimed in claim 8, further comprising a heat exchanger core (10) fluidically connected to the header (102).
10. The heat exchanger as claimed in claim 9, wherein the conduit (112) is fluidically connected to the header (102) to enable fluid flow to the heat exchanger core (10).

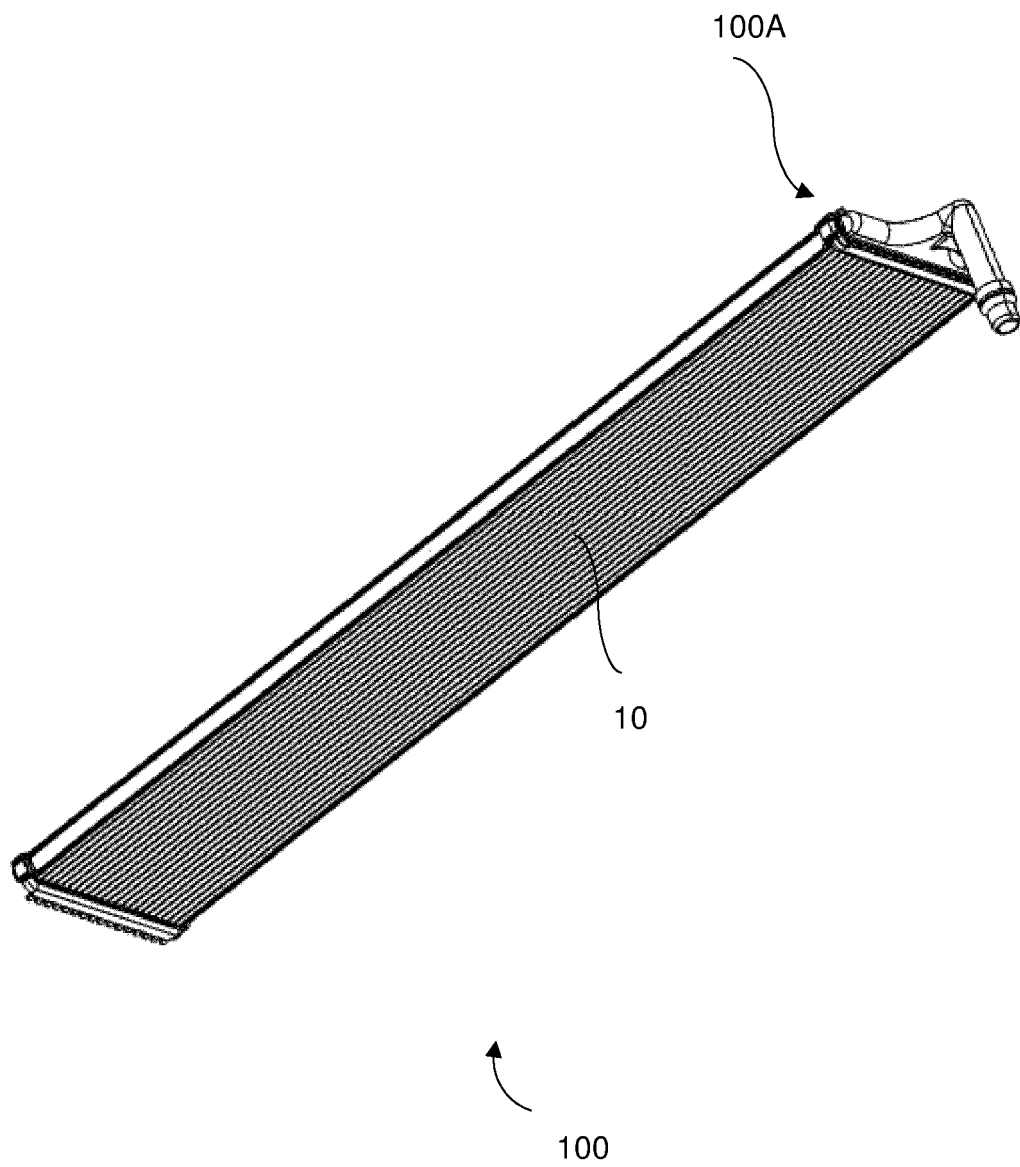


FIG. 1

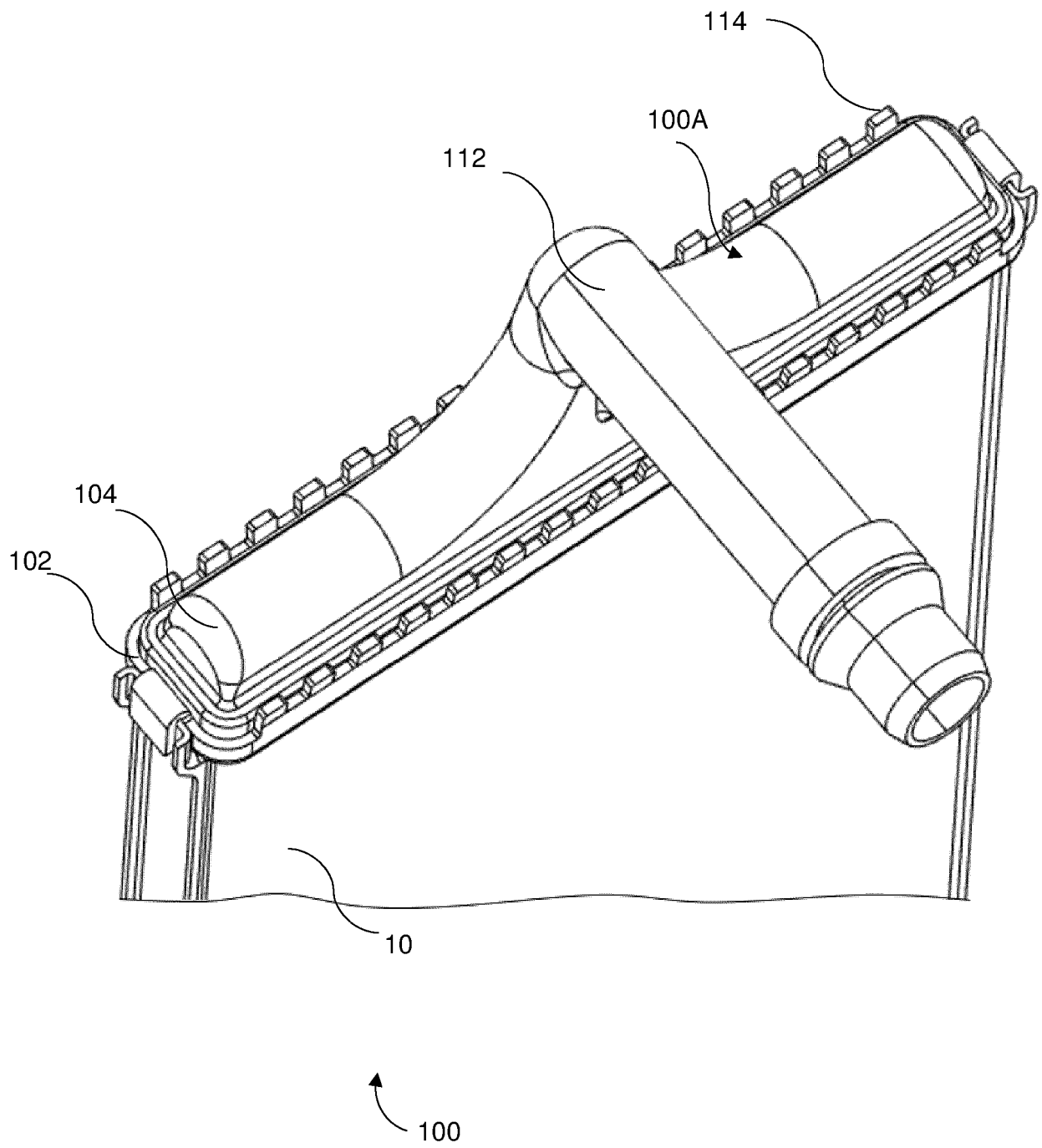


FIG. 2

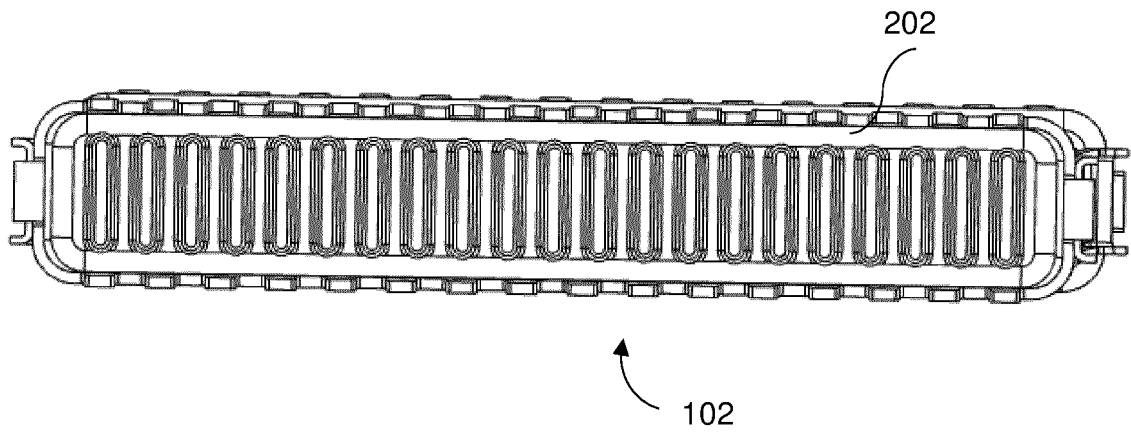


FIG. 3

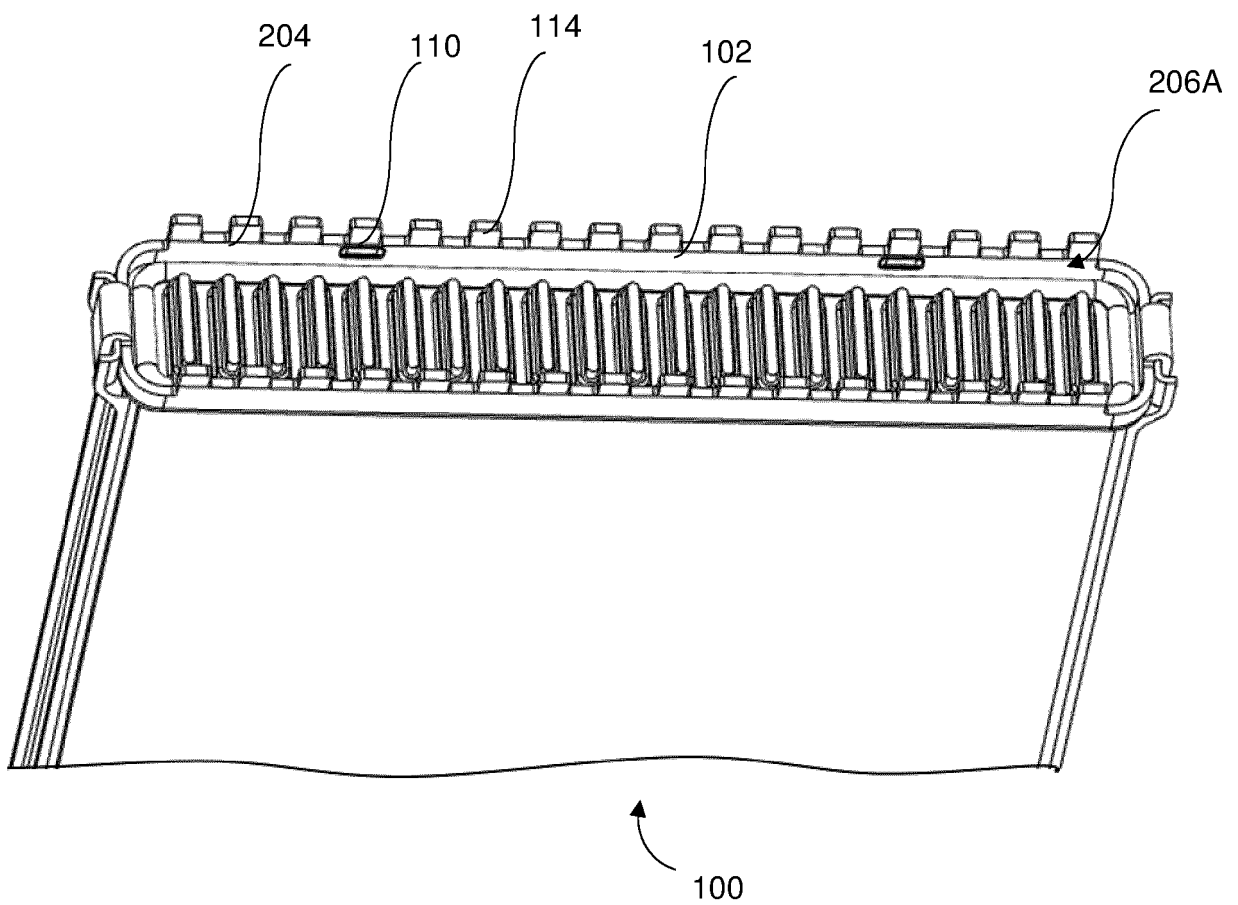


FIG. 4

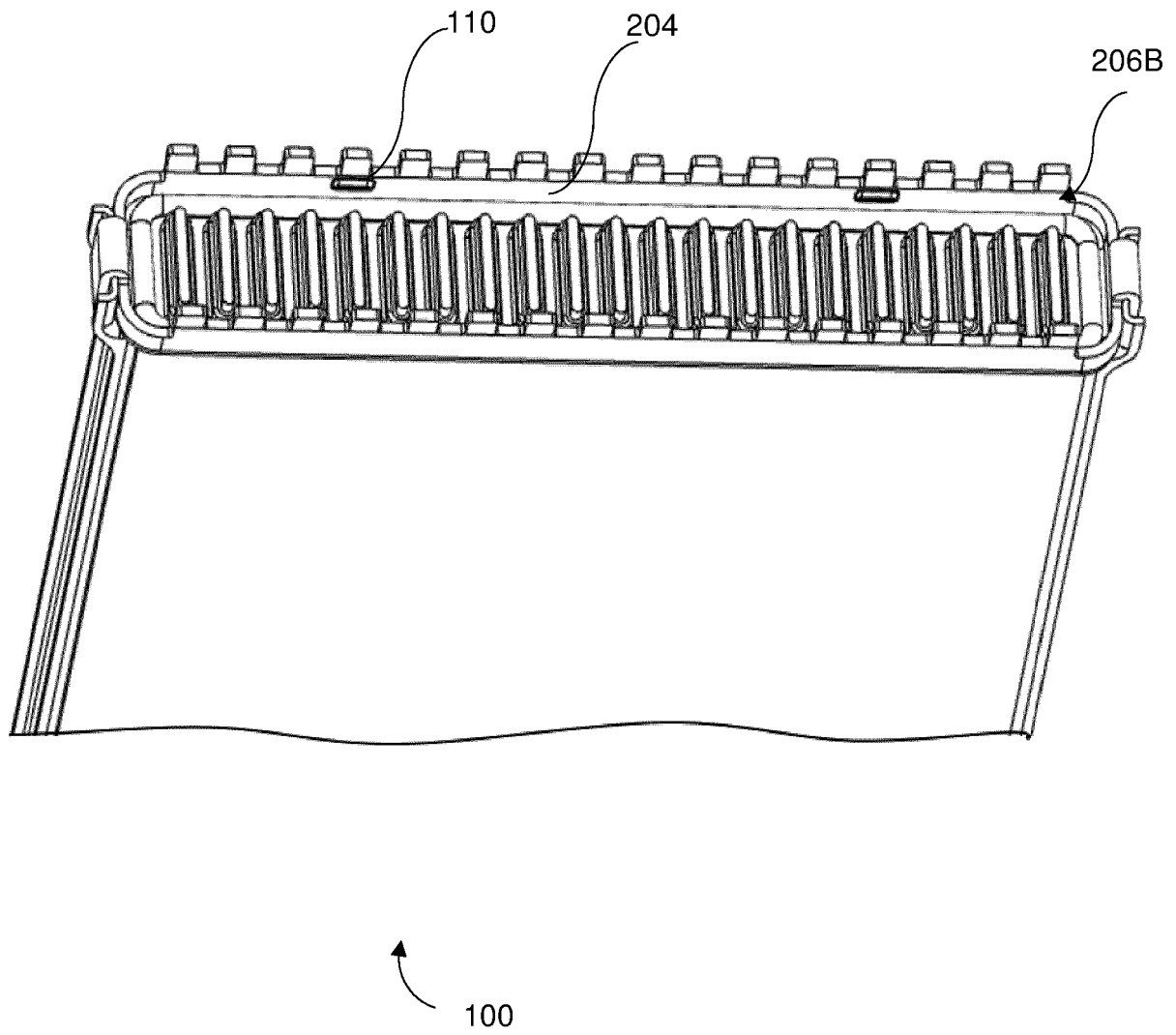


FIG. 5

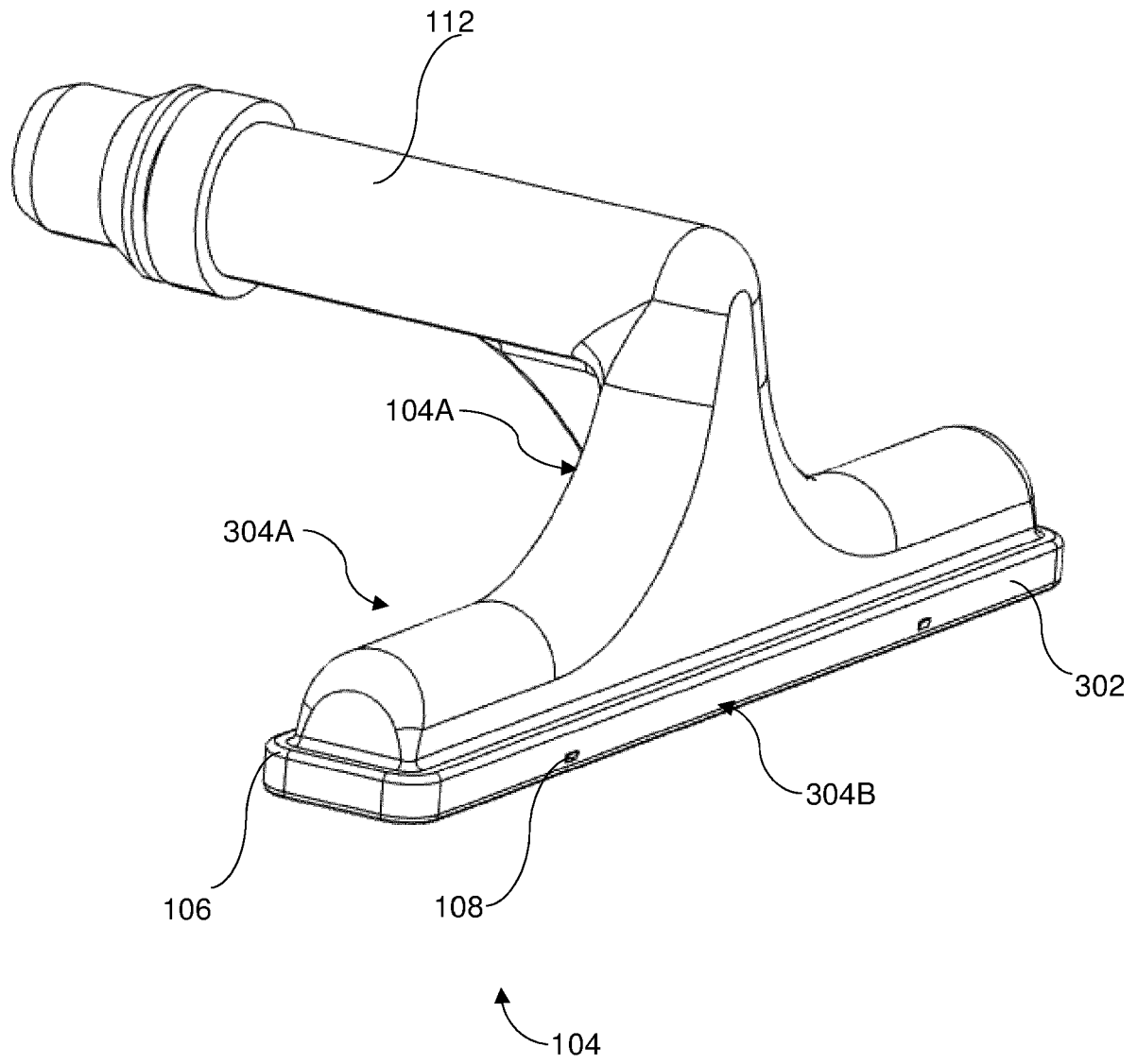


FIG. 6

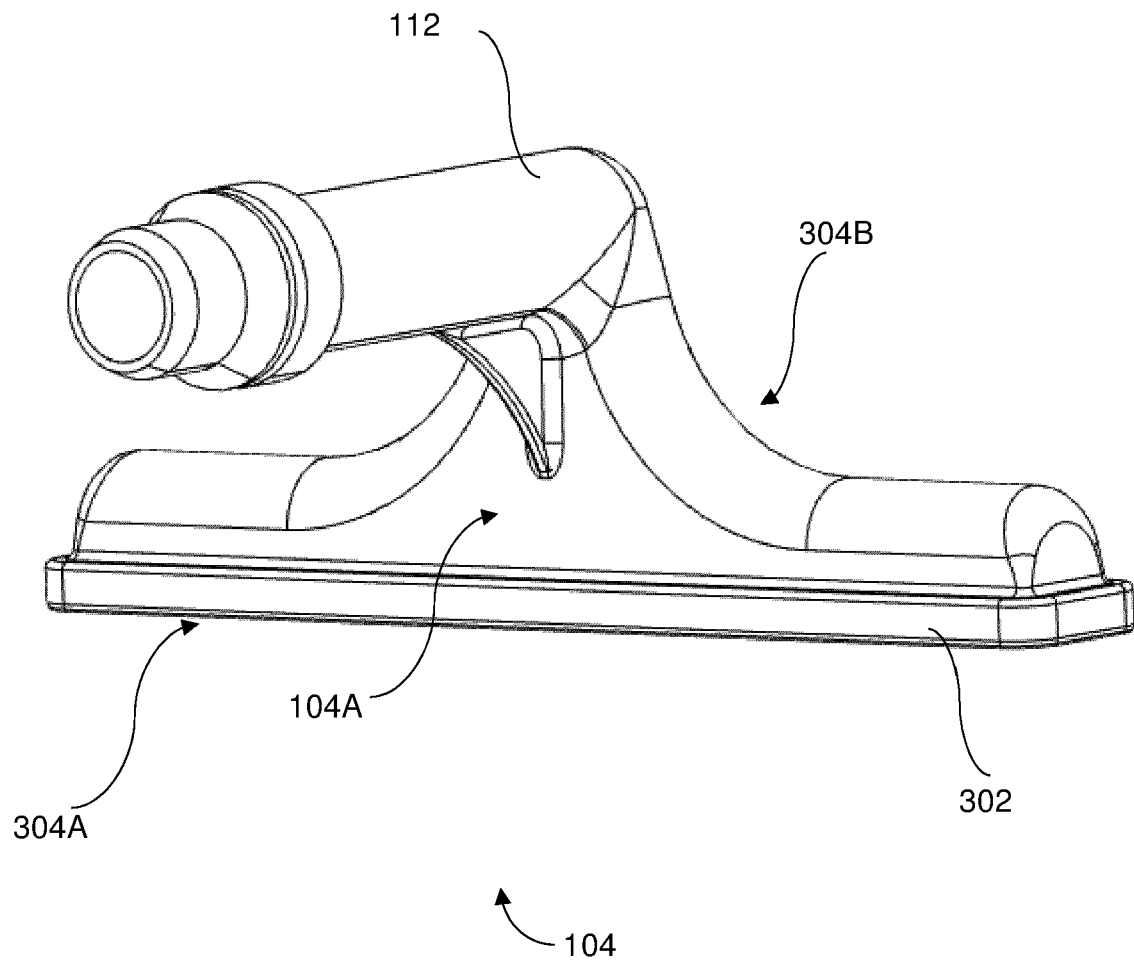


FIG. 7

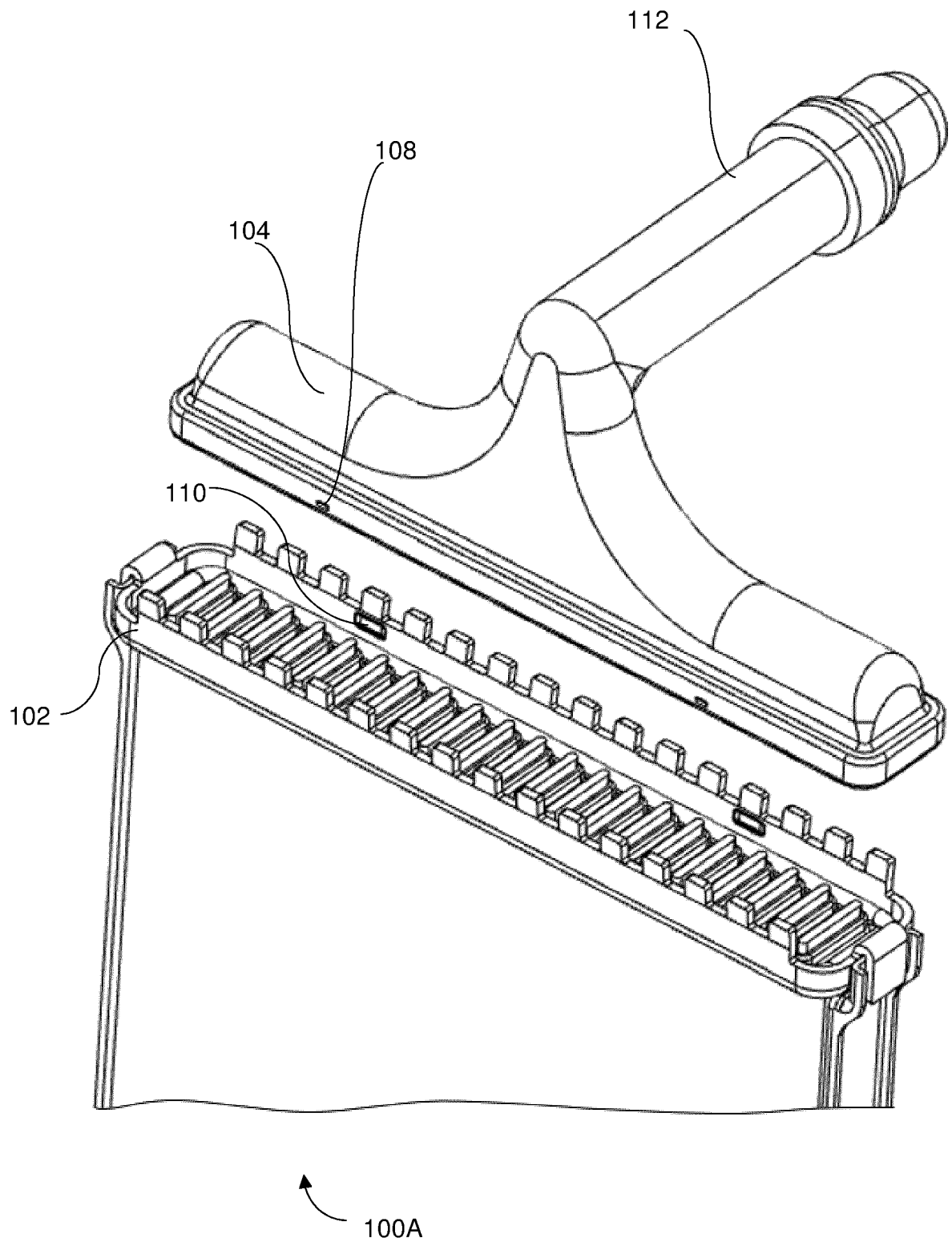


FIG. 8



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 46 1528

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 989 772 A1 (VALEO SYSTEMES THERMIQUES [FR]) 25 October 2013 (2013-10-25) * page 5, line 18 - page 14, line 23; figures 1-3 *	1,3-5, 7-10	INV. F28D1/04
X	US 4 651 815 A (LOGIC JEFFREY A [US] ET AL) 24 March 1987 (1987-03-24) * column 3, line 20 - column 5, line 7; figures 1-6 *	1,2,4,5, 7-10	
X	DE 27 03 528 A1 (LAENGERER & REICH KUEHLER) 3 August 1978 (1978-08-03) * the whole document *	1,2,4,5, 7-10	
X	EP 3 421 920 A1 (MAHLE INT GMBH [DE]) 2 January 2019 (2019-01-02) * abstract; figures 1-4 *	1,3-5, 7-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			F28F F28D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 September 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			

 1
 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 46 1528

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-09-2020

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2989772	A1	25-10-2013	NONE
US 4651815	A	24-03-1987	NONE
DE 2703528	A1	03-08-1978	NONE
EP 3421920	A1	02-01-2019	NONE

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82