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(54) **A HEAT EXCHANGER**

(57) The present invention discloses a heat exchanger provided with a connecting arrangement. The heat exchanger comprises a pair of manifolds, and a plurality of tubes stacked between the manifolds to provide a fluidal communication between the manifolds. Each manifold comprises an axis of elongation. The connecting arrangement is fixed to at least one manifold. The arrangement comprises a first connecting element having a hollow portion and at least one latch element. The hollow portion extends parallelly with respect to the axis of elongation of the manifold. The hollow portion enables rotation around the axis of elongation of the manifold so as to engage the first connecting element thereof. The latch element extends from a side of the hollow portion adapted to engage with the manifold to immobilize the first connecting element with respect to the manifold at least in an axis perpendicular to the axis of elongation of the manifold.

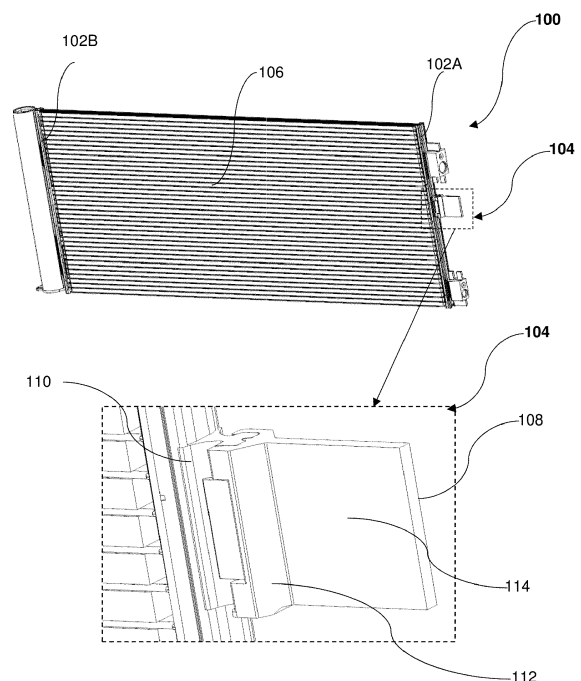


FIG. 1

Description

[0001] The present invention relates to a heat exchanger comprising a connecting arrangement. In particular, the invention relates to a connecting arrangement for coupling a heat exchanger to a support structure or another heat exchanger.

[0002] Heat exchangers, such as condensers may be provided with a connecting arrangement to secure it to another heat exchanger such as radiator, or structural base such as an automobile body. The radiator forms part of the engine cooling system to dissipate the heat from the engine and the condenser forms part of the air-conditioning loop of vehicle subsystem for ventilation, heating and/or air conditioning of the passenger compartment of the vehicle. The radiator is generally disposed in parallel to the condenser with the connecting arrangement so that they can sit within the same cooling airflow and one fan can provide the airflow through both heat exchangers.

[0003] The condenser usually comprises two condenser tanks with flow tubes arranged there between. Similarly, the radiator comprises two radiator tanks with heat exchange tubes arranged therebetween. The connecting arrangement generally comprises a flange mounted on the radiator tank and a bracket mounted adapted receive the flange mounted on the condenser tank. The flange and the bracket are provided with mounting holes. The condenser is aligned with the radiator such that the mounting holes of the flange align with the mounting holes of the bracket. Further, fasteners such as screws are inserted through the holes to attach the flange to the bracket to complete coupling of the condenser and radiator.

[0004] It may be required that the dimension of the condenser core is greater than the dimension of the radiator core. Because of the difference in the dimension of the condenser core and radiator core, the mounting holes of the flange cannot be aligned with the bracket and thus, a new design of connecting arrangement need to be developed. As another solution, the manufacturer can rework to change the dimension of the condenser core. This results in development of a number of different connecting arrangement designs or heat exchanger designs. Importantly, reuse of existing design or unification of technology is also not possible with the existing connecting arrangements.

[0005] Accordingly, there remains a need for providing a connecting arrangement for coupling of at least one heat exchanger to a structure such as frame of an automobile body or coupling at least two heat exchangers. There remains a further need for providing a design of the connecting arrangement that could be reused regardless of the dimensions, or type of heat exchanger. There remains a further need of a design of the connecting arrangement where at least some of the components of the arrangement could be reused regardless of the dimensions, characteristic, or type of heat exchanger.

[0006] 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.

[0007] In view of forgoing, the present invention discloses a heat exchanger having a connecting arrangement. The connecting arrangement attaches the heat exchanger, particularly a condenser, to a support structure. The support structure may be a vehicle frame or another heat exchanger, particularly a radiator. The heat exchanger comprises a pair of manifolds, and a plurality of heat exchange tubes stacked between the manifolds to provide a fluidal communication between the manifolds. The pair of manifolds includes a first manifold and a second manifold. The connecting arrangement configured to be fixed to at least one of the manifolds, for example, the first manifold of the heat exchanger.

[0008] The first connecting element comprises a hollow portion and at least one latch element. The hollow portion extends parallelly with respect to the axis of elongation of the manifold. The hollow portion enables rotation around the axis of elongation of the manifold so as to engage the first connecting element thereof. In one embodiment, the hollow portion is a U-shaped channel. The latch element extends from a side of hollow portion adapted to engage with the manifold to immobilize the first connecting element with respect to the manifold at least in an axis perpendicular to the axis of elongation of the manifold. In one embodiment, the latch element is a clip.

[0009] The connecting arrangement further comprises a second connecting element. The second connecting element comprises a block complementary to the hollow portion. The block is fixed to the manifold to enable coupling of the first connecting element thereof. The hollow portion is formed by a base, two spaced apart sidewalls extending from opposing sides of the base, an open end and a closed end. In one embodiment, at least one sidewall distally ends in a concave arcuate configuration and at least one sidewall extends as two spaced apart portions. The latch element extends alongside between the two spaced apart portions.

[0010] The open end of the hollow portion hooks around an end portion of the block and rotate around a remaining portion of the block to couple the first connecting element to the second connecting element. The closed end is adapted to prevent movement of the first connecting element along the axis of elongation of the manifold. In one embodiment, the hollow portion further comprises a recess complementary to a rib extending from the block of the second connecting element. The rib is received within the recess while coupling the first connecting element to the second connecting element.

[0011] In one embodiment, the block having a front surface, a rear surface and sidewalls extending between the front surface and the rear surface. The latch element may comprise an elongated portion extending along the side surface of the block and terminating at an end having a tab. The tab is configured to engage with the rear surface of the block to prevent movement of the first connecting element in a direction perpendicular to the axis of elongation. The first connecting element further comprising an engaging element extending from the rear portion of the base of the hollow portion to couple with the support structure.

[0012] In another embodiment, the present invention provides a heat exchanger module. The module comprising a first heat exchanger and a second heat exchanger. The connecting arrangement is located between the heat exchangers so as to enable the second heat exchanger to rotate and couple around the axis of elongation of the first heat exchanger.

[0013] 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:

FIG. 1 exemplarily illustrates a perspective view of a heat exchanger having a connecting arrangement, according to an embodiment of the present invention;

FIG. 2 exemplarily illustrates an exploded view of the connecting arrangement of FIG. 1;

FIG. 3 exemplarily illustrates a perspective view of a first connecting element of the connecting arrangement of FIG. 1;

FIG. 4 exemplarily illustrates a perspective view of a second connecting element of the connecting arrangement of FIG. 1;

FIG. 5 exemplarily illustrates the second connecting element engaging the first connecting element of the connecting arrangement of FIG. 1;

FIG. 6 exemplarily illustrates the second connecting element engaged with the first connecting element of the connecting arrangement of FIG. 1;

[0014] It must be noted that the figures disclose the invention in a detailed enough way to be implemented, said figures helping to better define the invention if needs be. The invention should however not be limited to the embodiment disclosed in the description.

[0015] The present invention discloses a heat ex-

changer having a connecting arrangement. The connecting arrangement attaches the heat exchanger, particularly condenser, to a support structure. The support structure may be a vehicle frame or another heat exchanger, for example, a radiator. The condenser may comprise a first manifold, a second manifold, and a plurality of heat exchange tubes arranged there between defining a condenser core. Similarly, the radiator may comprise a first manifold, a second manifold, and a plurality of heat exchange tubes arranged there between defining a radiator core. The connecting arrangement may comprise a first connecting arrangement having a first portion and a second portion. The first portion may be adapted to rotate around an axis of elongation of at least one manifold, for example, the first manifold of the condenser and locks with the first manifold of the condenser. The second portion may be configured to couple to the first manifold of the radiator so that the condenser could be positioned in parallel to the condenser. The design of the connecting arrangement reduces the number of parts required for coupling the condenser to the radiator. Furthermore, the design of connecting arrangement configured to couple the condenser to any type of component by only changing the second portion of the connecting arrangement. For example, considering the length of the condenser core being greater than the length of the radiator core and parallel alignment of the first manifold of the condenser to the first manifold of the radiator is not possible. Then, only the second portion of the connecting arrangement needs to be replaced to couple with the radiator to the condenser. Thus, the connecting arrangement promotes unification of technology and effective utilization of existing design of heat exchanger or existing technology.

[0016] Referring to FIG. 1, the heat exchanger 100, for example a condenser 100, comprises a pair of manifolds 102A, 102B, a plurality of heat exchange tubes 106 and at least one connecting arrangement 104. The plurality of tubes 106 stacked between the manifolds 102A, 102B to provide a fluidal communication between the manifolds 102A, 102B. The pair of manifolds 102A, 102B may comprise a first manifold 102A and a second manifold 102B. The connecting arrangement 104 may be configured to be fixed to at least one of the manifolds 102A, 102B, for example, the first manifold 102A of the heat exchanger 100. The connecting arrangement 104 may comprise a first connecting element 108 having a first portion 112 and a second portion 114.

[0017] Referring to FIG. 2, the first portion 112 may comprise a hollow portion 116 and at least one latch element 118. The first portion 112 may be a bracket configured to rotate the first connecting element 108 around the axis of the first manifold 102A. The latch element 118 is configured to immobilize the first connecting element 108 with respect to the manifold 102A at least in an axis perpendicular to the axis of elongation of the first manifold 102A. The second portion 114 includes a mounting feature adapted to be secured to a support structure of the vehicle (not shown in Figures). In one embodiment, the

support structure is a radiator. In another embodiment, the support structure is a vehicle frame.

[0018] The connecting arrangement 104 may further comprise a second connecting element 110. The second connecting element 110 comprises a base portion 120 fixed to the first manifold 102A of the heat exchanger 100, a neck 122 extending from the base portion 120 and a block 124 extending from the neck 122. In one embodiment, the base portion 120 is brazed or welded to the first manifold 102A of the condenser 100. The block 124 may have a shape complementary to the shape of the hollow portion 116 of the first connecting element 108, which allows the block 124 to be snugly received within the hollow portion 116 and enable coupling of the first connecting element 108 to the first manifold 102A. In one embodiment, the hollow portion 116 may be a U-shaped channel. In one embodiment, the first connecting element 108 may be made of material including, but not limited to, synthetic material. In one embodiment, the second connecting element 110 may be made of metallic material including, but not limited to, aluminium.

[0019] Referring to FIG. 1, and FIG. 2, the hollow portion 116 may extend parallelly with respect to the elongation axis the first manifold 102A. The hollow portion 116 enables rotation around the elongation axis of the manifold 102A to engage the first connecting element 108 thereof. The latch 118 element extends from a side of the hollow portion 116 adapted to engage with the manifold 108A to immobilize the first connecting element 108 with respect to the first manifold 102A at least in an axis perpendicular to the axis of elongation of the first manifold 102A. The block 124 fixed to the first manifold 102A enables coupling of the first connecting element 108 thereof.

[0020] Referring to FIG. 3, the hollow portion 116 may be formed of a base 126 and a pair of spaced apart parallel sidewalls 128, 130 extending from opposing sides of the base 126. The pair of sidewalls 128, 130 may comprise a first sidewall 128 and a second sidewall 130. The first sidewall 128 may be formed of an elongated section 132 that terminates with an arcuate end 134. The end 134 has a concave arcuate configuration. The arcuate end 134 adapted to act as a hook, such that, once the bracket hooks around the received block 124, it cannot be removed therefrom. The hollow portion 116 may further comprise an open end 136 and a closed end 138. Referring to FIG. 5 and FIG. 6, the open end 136 facilitates the hollow portion 116 to hook around an end portion 140 of the block 124 and a remaining portion of the hollow portion 116 is introduced around the block 124 by rotating the hollow portion 116 around the block 124. The closed end 138 of the hollow portion 116 prevents further movement or slipping of the bracket longitudinally along an elongate axis of the block 124. However, rotation of the hollow portion 116 around the elongation axis of the block 124 is still possible.

[0021] In order to prevent rotation of the first connecting element 108 around the axis of elongation of the first

manifold 102A, the first connecting element 108 is provided with a latch element 118 along at least one sidewall 128, 130. In one embodiment, the at least one sidewall 128, 130, particularly, the second sidewall 130 formed as two spaced apart portions 130A, 130B extending from the side of the hollow portion 116. The latch element 118 disposed alongside and between the two spaced apart portions 130A, 130B. In one embodiment, the latch element 118 is a clip. The clip is adapted to engage with the block 124 to prevent rotation of the first connecting element 108. Referring to FIG. 3 and FIG. 4, the block 124 has a front surface 146, a rear surface 148 and side surfaces 150. In one embodiment, the block 124 is substantially rectangular in shape have a portion complementary to the hollow portion 116. In one embodiment, the hollow portion 116 generally has a U-shaped cross section. In one embodiment, the portion of the block 124 including the front surface 146 and side surfaces 156 generally has a U-shaped cross section complementary to the U-shaped cross section of the hollow portion 116.

[0022] The clip may comprise a widened elongated portion 160 that extends along the side surface 150 of the block 124, and terminates at its ends with hooks or clips with the rear surface 148 of the block 124. The end of the elongated portion 160 may comprise a tab 162 adapted to engage with or hook onto the flat rear surface 148 and prevent movement of the first connecting element 108 in a direction perpendicular to the axis of elongation of the first manifold 102A. Further, the base 126 of the hollow portion 116 may comprise a front portion 152 and a rear portion 154. The front portion 152 may comprise a rib 156 disposed along a length of the hollow portion 116. The rib 156 may be complementary to a recess 158 formed along a length of the front surface 146 of the block 124. The rib 156 of the first connecting element 108 and the complementary recess 158 of the second connecting element 110 acts as a guide to position the hollow portion 116 in place over the block 124. In one embodiment, the rib 156 generally has a u-shaped cross section, which is complementary to a U-shaped cross section of the recess 158.

[0023] Referring to FIG. 3, the second portion 114, herein after referred as an engaging element 114, is adapted to be secured to the support structure of the vehicle (not shown). The engaging element 114 may be a flat elongated member that extends from the rear portion 154 of the base 126 of the hollow portion 116 and terminates with an end. In one embodiment, the end of the engaging element 114 is directly welded or brazed to the support structure. In one embodiment, the engaging element 114 includes the mounting feature (not shown) adapted to be secured to the support structure of the vehicle. In one embodiment, the mounting feature is a bracket that could be fastened to the support structure. In another embodiment, the mounting feature is an opening that could be screwed to the support structure.

[0024] In another embodiment, the present invention discloses a heat exchanger module. The module com-

prises a first heat exchanger, a second heat exchanger and the connecting arrangement 104. In one embodiment, the first heat exchanger is the condenser 100. In one embodiment, the second heat exchanger is the radiator. The connecting arrangement 104 is located between the heat exchangers so as to enable the second heat exchanger to rotate and couple around the axis of elongation of the first heat exchanger.

[0025] 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 heat exchanger(100), comprising:

a pair of manifolds (102A, 102B), wherein each manifold (102A, 102B) comprises an axis of elongation;

a plurality of tubes (106) stacked between the manifolds (102A, 102B) to provide a fluidal communication between the manifolds (102A, 102B), and

at least one connecting arrangement (104) configured to be fixed to at least one of the manifolds (102A, 102 B), **characterized in that** the arrangement (104) comprises,

a hollow portion (116) extending parallelly with respect to the axis of elongation of at least one manifold (102A), wherein the hollow portion (116) enables rotation around the axis of elongation of the manifold (102b) so as to engage the first connecting element (108) thereof, and
at least one latch element (118) extending from a side of hollow portion (116) adapted to engage with the manifold (102A) to immobilize the first connecting element (108) with respect to the manifold (102A) at least in an axis perpendicular to the axis of elongation of the manifold (102A).

2. The heat exchanger (100) according to claim 1, wherein the heat exchanger (100) further comprises a second connecting element (110) comprising a block (124) complementary to the hollow portion (116), the block (124) being fixed to the manifold (102A) to enable coupling of the first connecting element (108) thereof.

3. The heat exchanger (100) according to claim 1, wherein the hollow portion (116) is a U-shaped channel.

4. The heat exchanger (100) according to claims 1 and 2, wherein the hollow portion (116) has a U-shaped cross-section and the block (124) has a portion having a U-shaped cross-section complementary to the hollow portion (116).

5. The heat exchanger (100) according to claim 1, wherein the hollow portion (116) comprises a base (126), two spaced apart sidewalls (128, 130) extending from opposing sides of the base (126), an open end (136) and a closed end (138).

6. The heat exchanger (100) according to claim 2 and 5, wherein the open end (136) of the hollow portion (116) hooks around an end portion (140) of the block (124) and rotate around a remaining portion of the block (124) to couple the first connecting element (108) to the second connecting element (110), and the closed end (138) adapted to prevent movement of the first connecting element (108) along the axis of elongation of the manifold (102A).

7. The heat exchanger (100) according to claim 1 and 2, wherein the hollow portion (116) comprises a recess (158) complementary to a rib (156) extending from the block (124) of the second connecting element (110), the rib (156) being received within the recess (158) while coupling the first connecting element (108) to the second connecting element (110).

8. The heat exchanger (100) according to claim 7, wherein the rib (156) comprises a U-shaped cross section.

9. The heat exchanger (100) according to claim 7, wherein the recess (156) comprises a U-shaped cross section.

10. The heat exchanger (100) according to claim 5, wherein at least one sidewall (128) ends distally in a concave arcuate configuration.

11. The heat exchanger (100) according to claim 5, wherein at least one sidewall (130) extends as two spaced apart portions (130A, 130B).

12. The heat exchanger (100) according to claim 1, wherein the latch element (118) extends alongside between the two spaced apart portions (130A, 130B).

13. The heat exchanger (100) according to claim 1, wherein the latch element (118) is a clip.

14. The heat exchanger (100) according to claim 2, wherein the block (124) comprises a front surface (146), a rear surface (148) and sides walls (150) extending between the front surface (146) and the rear

surface (148).

15. The heat exchanger (100) according to claim 12 and 14, wherein the latch element (118) comprises an elongated portion (160) extending along the side surface (150) of the block (124) and terminates at an end having a tab (162), wherein the tab (162) is configured to engage with the rear surface (148) of the block (124) to prevent movement of the first connecting element (108) in a direction perpendicular to the axis of elongation.

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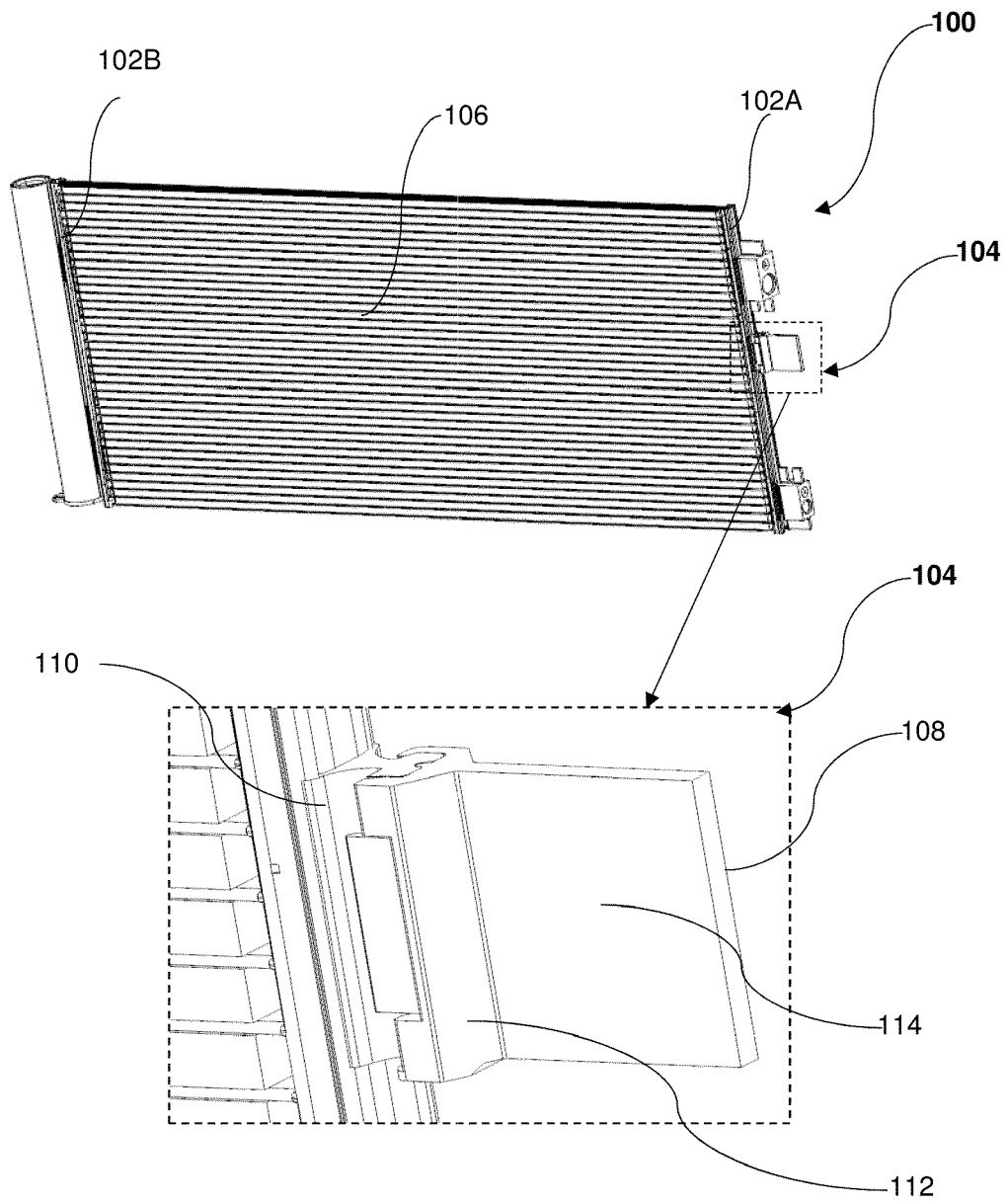


FIG. 1

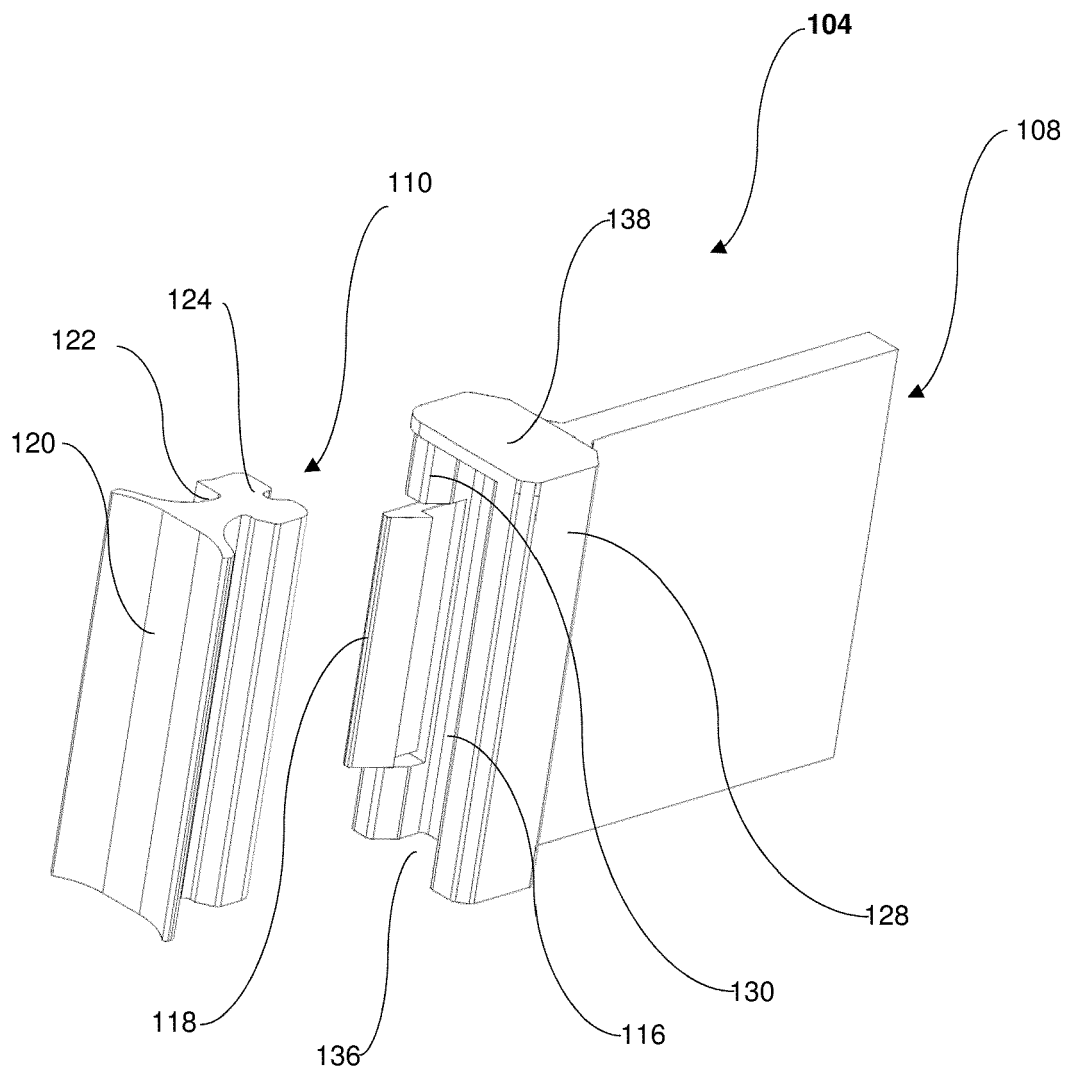


FIG. 2

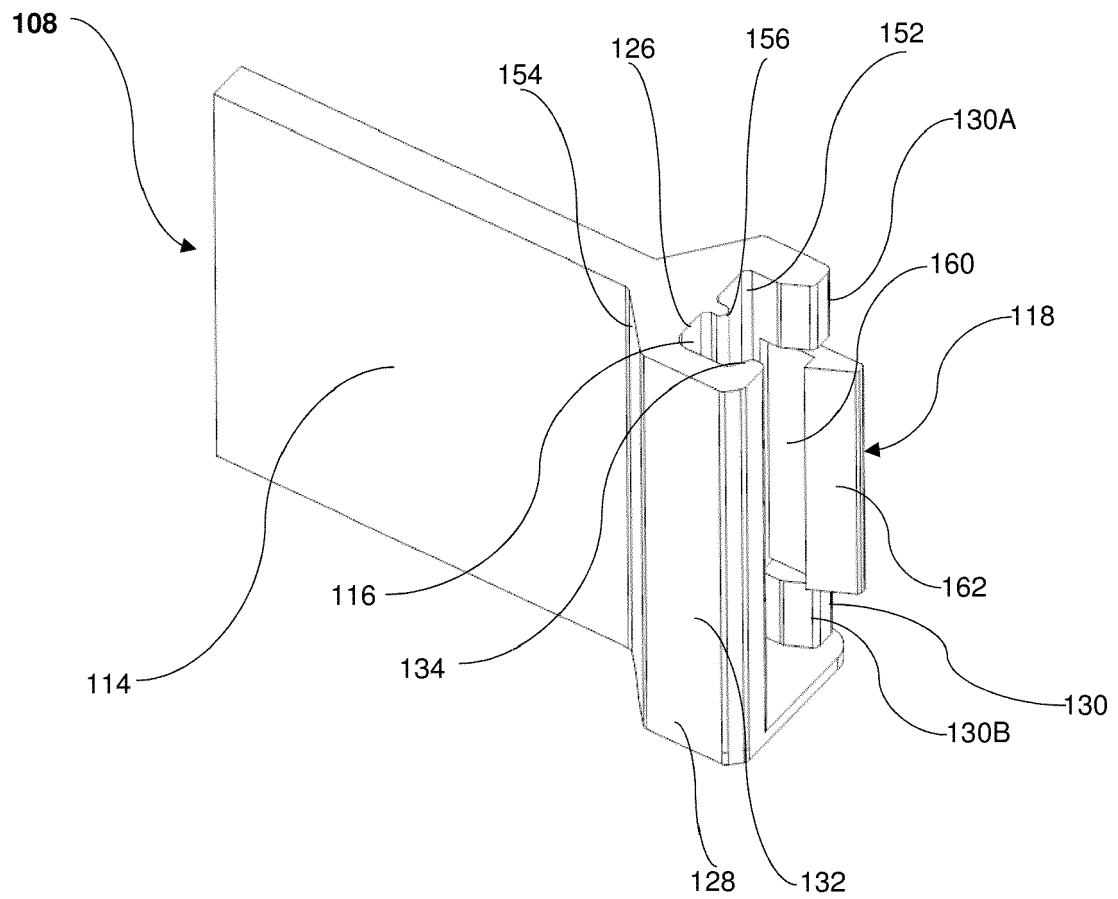


FIG. 3

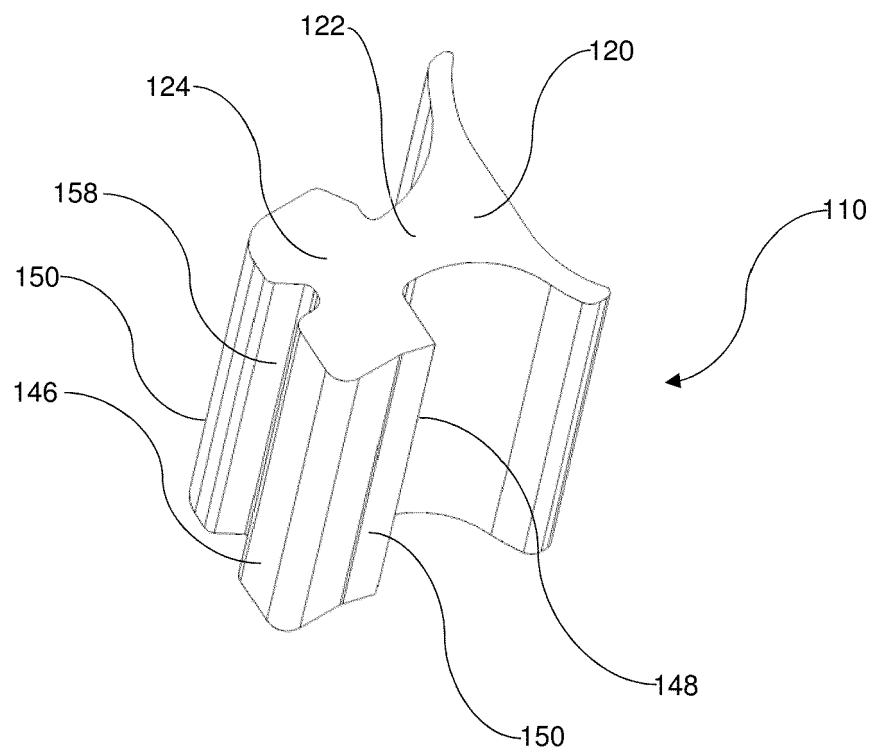


FIG. 4

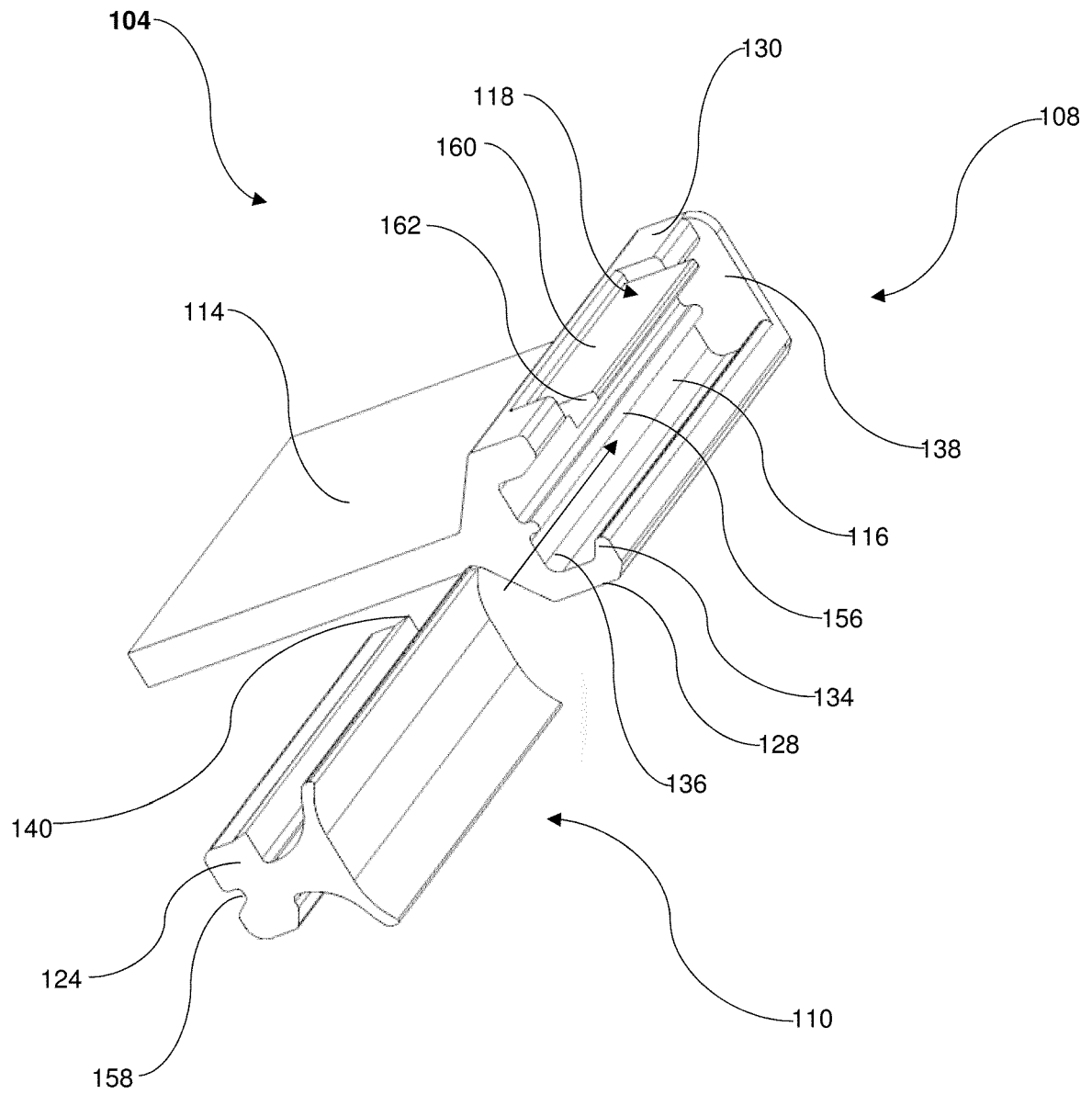


FIG. 5

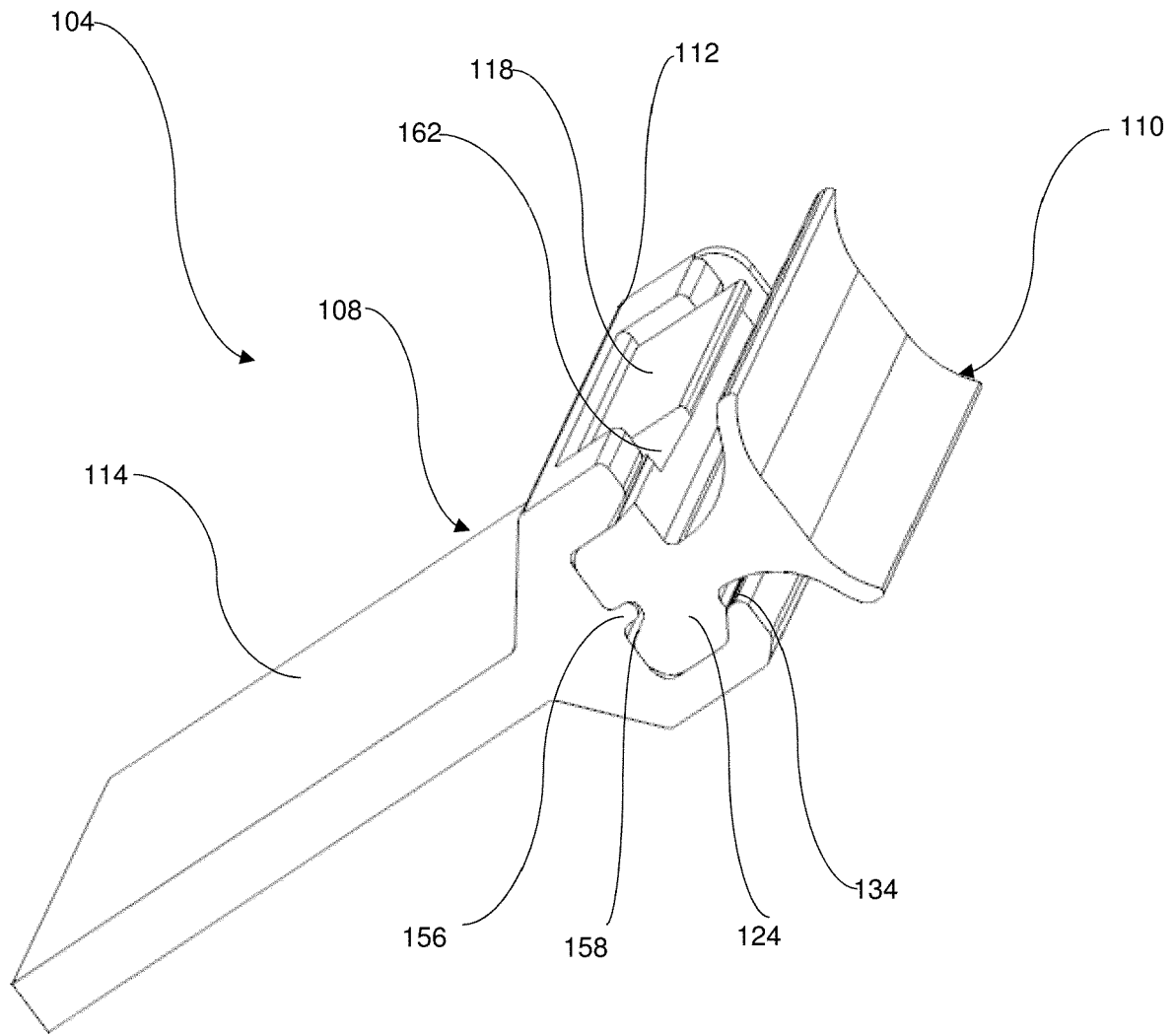


FIG. 6



EUROPEAN SEARCH REPORT

Application Number

EP 21 19 5552

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			F28F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 February 2022	Examiner Martínez Rico, Celia
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 19 5552

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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