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(54) HEAT EXCHANGER ASSEMBLY

(57) The present invention relates to a heat exchanger assembly (10) comprising a heat exchanger (12) having a core (20) with a plurality of heat exchanger tubes (26) for carrying a coolant fluid, the core (20) extending between two opposite manifolds (16, 18), a reinforcement member (30, 32) extending along each lateral side (24) of the core between the manifolds (16, 18); at least one mounting bracket (14, 114) fixed to the reinforcement member (30, 32), the mounting bracket comprising a body portion (14.1) and a mounting feature (70). The body portion (14.1) has an internal side (14.2) in contact with the reinforcement member (30, 32) and an opposite external side (14.3), and at least one opening (56) extending from the internal side to the external side. The reinforcement member (30, 32) comprises at least one recessed part (42) and a protrusion (40), arranged onto the recessed part, extending from the external side into said opening (56) in the body portion (14.1) of the bracket, the protrusion (40) having been plastically deformed from the external side to interlock with the opening (56) and lock the mounting bracket in place.

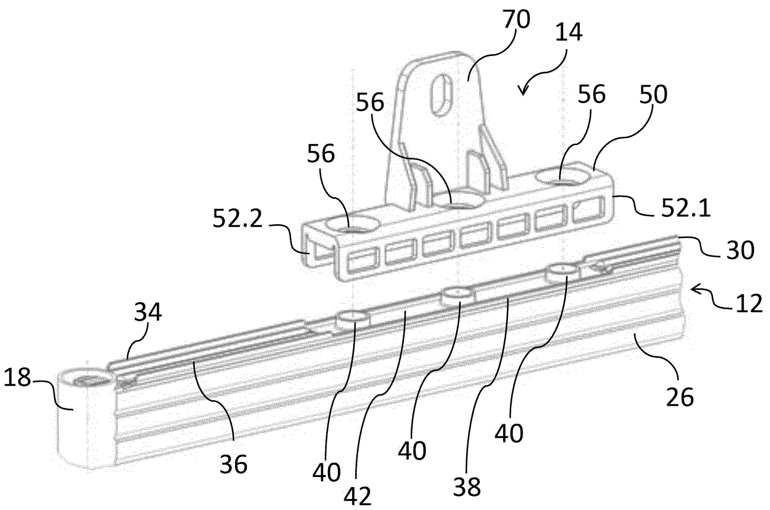

Figure 5

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Description

Technical Field

[0001] The invention generally relates to the field of heat exchangers, and specifically to a heat exchanger assembly comprising a mounting bracket.

Background Art

[0002] In vehicles such as passenger cars or trucks, heat exchangers are used as part of cooling circuits, which in turn are needed for cooling vehicle components like the engine, the transmission etc. Some of these cooling circuits employ a liquid heat exchange medium, which receives heat from the vehicle components and transfers heat to ambient air at the main heat exchanger, like a radiator, installed in the front of the vehicle. In other cases, the heat exchanger is a condenser, wherein the heat exchange medium (or fluid) enters the condenser in gaseous state, is condensed and cooled in the condenser and exits the condenser in liquid state.

[0003] Automotive heat exchangers generally include a central core made of regularly spaced tubes and featured with corrugated air fins. The tubes extend between a pair of tanks (or manifolds) at opposite ends of the core. A pair of reinforcement members extend along opposite edges of the core between the tanks. Two configurations are conventionally used for the heat exchangers: in the so-called crossflow configuration, the tanks are vertically oriented and the tubes forming the central core are horizontally oriented; alternatively, the heat exchanger tanks are horizontally oriented, and the tubes forming the central core are vertically oriented, which is referred to as downflow configuration.

[0004] A heat exchanger may be mounted directly into a vehicle but generally, two or more heat exchangers are used in combination. Such assemblies of multiple heat exchangers generally comprise a condenser, a radiator and a fan unit, thereby forming a cooling module, commonly referred to as CRFM, standing for Condenser Radiator and Fan Module. The condenser and radiator are rectangularly shaped of more or less comparable dimensions and placed in a closely-spaced, stacked relationship at a vehicle location where air flow therethrough is facilitated. In this regard, the fan unit is placed adjacent the condenser/radiator pair so as to assure air flow therethrough even in situations where the motor vehicle is stationary. The condenser is commonly mounted to the radiator by bracket(s) extending either from the header tanks or from the reinforcement members, wherein the bracket(s) accepts a fastener such as a bolt.

[0005] Conventionally, most of the brackets are metal pieces that are somehow held in place before the brazing operation and then are brazed into a fixed attachment. Such brackets are, e.g., disclosed in US 5,570,737. The bracket clamps on to the header tank prior to the furnace brazing of the heat exchanger assembly. The addition of the bracket during the furnace brazing introduces irregularities to the braze temperature distribution. In addition, such brackets are limited to locations on the pre-brazed heat exchanger that are able to receive and retain the bracket until after the brazing joins of the components. Moreover, such brackets are meant to be fastened to manifolds of a second heat exchanger and cannot be fastened to reinforcement members. Therefore, such brackets are not compatible with downflow cooling modules.

[0006] To avoid such drawbacks, a plastic bracket may be snapped onto the heat exchanger, such as disclosed in US 6,513,579. These plastic brackets are light molded pieces that are attached to the corners of the heat exchanger entirely post braze, in a press fit operation that requires no additional fasteners. However, they are shaped to be used only with rectangle or square-shaped tanks. Moreover, they include rigid snap on features that tend to damage the reinforcement members. Furthermore, such design is not compatible with packaging restrictions due to shape and position requirements of mounting brackets which are more and more frequently imposed by customers.

[0007] An alternative design for mounting brackets with a more compact design is disclosed in US 7,117,927. Such brackets have a U-shape and are merely clamped on the heat exchanger around the reinforcement members post-braze, i.e. away from the manifolds. However, such a design of mounting brackets presents enough robustness only because it uses the surface of the core like a clamp load, which gives rise to tube damage and center deformation. Moreover, such brackets may rotate or at least tilt around the reinforcement members, thereby complicating the assembly of heat exchangers or the mounting of CRFM.

Technical Problem

[0008] It is thus an object of the present invention to provide an alternative, improved design of a heat exchanger mounting bracket that does not comprise the above-mentioned drawbacks.

[0009] This problem is solved by a heat exchanger assembly as claimed in claim 1.

Summary of the Invention

[0010] According to the present invention, a heat exchanger assembly comprises a heat exchanger comprising a core with a plurality of heat exchanger tubes for carrying a coolant fluid, the core extending between two opposite manifolds, a reinforcement member extending along each lateral side of the core between the manifolds, and at least one mounting bracket fixed to the reinforcement member, the mounting bracket comprising a body portion and a mounting feature.

[0011] The body portion has an internal side in contact with the reinforcement member and an opposite external side, and at least one opening extending from the internal side to the external side.

[0012] According to the invention, the reinforcement member comprises at least one recessed part and a protrusion, arranged onto the recessed part, extending from the external side into said opening in the body portion of the bracket, the protrusion having been plastically deformed from the external side to interlock with the opening and lock the mounting bracket in place.

[0013] The recessed part may present any shape compatible with the shape of the reinforcement member and the mounting bracket while ensuring a sufficient reinforcement/stability increase of the heat exchanger. It is however preferred that the recessed part be dimensioned so as to be entirely covered by the mounting bracket.

[0014] The present invention is based on a reinforcement member having a protrusion and a mounting bracket having a through opening so that the bracket is securely, easily and rapidly attached to the reinforcement member by any means known to a skilled person to ensure a tight mechanical connection between two parts by physical deformation of one of the parts by inducing a plastic deformation of the protrusion. Preferably, the plastic deformation modifies the outer dimensions of the protrusion so as to ensure a mechanical form-fit connection between the protrusion of the reinforcement member and the opening of the bracket, i.e. between mounting bracket and heat exchanger, thereby securing the attachment.

[0015] In other words, upon assembly of the inventive heat exchanger assembly, the protrusion is plastically deformed from the external side of the bracket to lock the mounting bracket in place, i.e. securing the bracket to the reinforcement member. In embodiments, the protrusion is deformed at least in one radial direction of the opening, and such as to engage with a surface within the opening or with a rim area surrounding the opening on the external side. For example, the protrusion may be a hollow cylindrical element, whose diameter is expanded on the external side, or a pin-like element that is axially compressed to cause a radial expansion interlocking with the opening.

[0016] Such a concept allows the mounting of the bracket at a distance from the manifolds thereby allowing to better manage the proximity between different heat exchangers in close spaces, such as the proximity between condenser and radiator in CRFM assemblies.

[0017] The inventive mounting bracket is preferably a plastic mounting bracket which can be easily manufactured by injection molding (in one piece) and allows for rapid, firm and secure mounting onto the heat exchanger. The protrusion enables a fast and easy positioning of the mounting bracket upon assembly of the heat exchanger assembly, prior to effectively securing the connection between bracket and reinforcement member by plastic deformation.

[0018] The protrusion can take various forms and allows fixing the mounting bracket to the heat exchanger. In addition to facilitating the positioning of the bracket to the reinforcement member prior to attachment, it also improves resistance/solidity of the heat exchanger - mounting bracket assembly.

[0019] The present invention is of particular interest where the heat exchanger is a condenser with vertical manifolds, which is to be mounted on a downflow-type radiator with horizontal plastic manifolds.

[0020] In embodiments, the at least one protrusion is shaped as a collar (cylindrical element), the opening has an enlarged (e.g. stepped or flared-out) upper region and the protrusion is clinched, press-joined, swaged or press-deformed, preferably press-joined, in the opening of the bracket. Preferably, the bracket is assembled to the reinforcement member by inserting a punching tool through the collar-shaped protrusion so as to enlarge its diameter thereby fixedly/securely attaching the bracket to the reinforcement member.

[0021] In embodiments, the reinforcement member may comprise a U-shaped profile with two edge walls extending from a bottom wall away from the sides of the core. The edge walls of the recessed part are shorter than in the remaining part of the reinforcement member. The protrusion is arranged on the bottom wall in the recessed part. Such a shape of the recessed part advantageously further facilitates the positioning of the mounting bracket onto the heat exchanger prior to its attachment by plastic deformation of the protrusion.

[0022] According to the same or other embodiments, the body portion of the mounting bracket comprises a socket portion embracing the reinforcement member, the socket portion including a central wall extending along the reinforcement member and two opposite lateral walls projecting from the central wall on opposite sides of the core, and the opening is arranged through the central wall. In preferred embodiments, the socket portion embraces the recessed part of the reinforcement member.

[0023] Advantageously the socket portion further increase stability and enhance stiffness of the heat exchanger assembly by preventing rotation or tilting of the bracket.

[0024] Preferably, the opening is arranged at equal distance from the lateral walls.

[0025] According to some preferred embodiments, the reinforcement member comprises a plurality of protrusions arranged on the bottom wall of the recessed part (such as e.g. 2, 3 or 4 protrusions) and the mounting bracket comprises a plurality of openings matching the protrusions. Preferably, the protrusions are evenly spaced. In some more preferred embodiments the protrusions are arranged in the recessed part and evenly spaced along the recessed part.

[0026] In embodiments, the lateral walls of the mounting bracket each comprise at least one aperture, preferably a plurality of, more preferably evenly spaced, apertures. Such apertures are advantageously designed such that heat exchange would be prevented as few as possible by the lateral walls of the mounting bracket.

[0027] Depending on the embodiments, the mounting feature may be formed as a flange, in particular a flat flange with an opening therein for a fastening member (such as e.g. a pin or a screw) or as a tab, in particular a reinforced tab.

[0028] One, preferably both, of the manifolds of the heat exchanger may be a round, one-piece manifold.

[0029] According to another aspect, the present invention relates to a cooling module as claimed in claim 13.

[0030] According to yet another aspect, the present invention relates to a method for assembling a mounting bracket to a heat exchanger as claimed in claim 14 or 15.

Brief Description of the Drawings

[0031] Embodiments of the invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which:

Fig.1 is a perspective view of a heat exchanger assembly according to the invention;

Fig.2 is a perspective view of a detail of the heat exchanger assembly of Fig.1;

Fig.3 is a perspective view of a mounting bracket of the heat exchanger assembly of Fig.1;

Fig.4 is a perspective view of a reinforcement member prior to assembly of the mounting bracket of the heat exchanger assembly of Fig.1;

Fig.5 is an exploded view of the heat exchanger and mounting bracket of the assembly of Fig.1 prior to their assembly;

Fig.6 are principle cross-sectional views illustrating the assembly of the mounting bracket to the heat exchanger;

Fig.7 are detail views of Fig. 6.

Description of Preferred Embodiments

[0032] Referring to the Figures, a heat exchanger assembly 10 generally comprises a heat exchanger 12 e.g. a condenser, radiator, or the like and at least one mounting bracket 14, 114.

[0033] The heat exchanger 12 comprises a core 20 (or exchanger core) with flow tubes 26 and intervening air centers or air fins, which are not shown in detail. The exchanger core 20 extends along a first axis Z as well as along a second axis Y, which in the exemplary embodiments of Fig.1 are respectively a vertical axis and a lateral axis of the vehicle. The exchanger core thickness then extends along the third axis X. The heat exchanger core 20 therefore presents faces 22.1, 22.2 in the Y-Z plan and lateral sides 24 in the X-Y plan, i.e. here at top and bottom. The heat exchanger 12 here offers a crossflow configuration, whereby the tubes 26 extend along the Y axis.

[0034] The core 20 is surrounded by a four sided, generally rectangular frame. Two sides of the frame are comprised of a pair of manifolds 16, 18, also referred to as header tanks, typically metal (e.g. brazeable aluminum alloy) or plastic, and the other two sides are a pair of reinforcement members (or core reinforcements) 30, 32. The reinforcement members 30, 32 extend along the edges (lateral sides 24) of the core (Y direction) and are fixed at both ends to the manifolds 16, 18, thereby forming four right angle corners.

[0035] The first manifold 18 is fluidly connected by the exchanger core 20 to the second manifold 16. The first manifold 18 and the second manifold 16 each have a roughly circular shape and are elongate along the first axis Z, which is a vertical axis of the vehicle when the heat exchanger 12 is in the embodiment of Fig.1. Both manifolds 16, 18 are identically shaped. It should be noted that the shape of the manifolds is roughly circular in the embodiment presented in the figures, but they may be generally cylindrical with various kinds of cross-section, including prismatic shapes.

[0036] The fluid to be cooled may enter the heat exchanger via the first manifold 18 and flows through the tubes of the exchanger core 20, where it is cooled by ambient air, to the second manifold 16. The first and second manifolds can be respectively inlet and outlet manifolds. However, according to other non-limiting exemplary embodiments, the first manifold 18 can present an inlet fluid portion and an outlet fluid portion. The inlet portion receives a fluid through an inlet port during operation of the heat exchanger. The fluid is then distributed to a lower part of the exchanger core and guided to the second manifold. From there, it is distributed to an upper part of the exchanger core and guided to the outlet portion of the first manifold, which communicates with an outlet port to evacuate the fluid.

[0037] Referring to Fig.1, the heat exchanger 12 is shown with four brackets 14, 114 so that the heat exchanger assembly 10 comprises four mounting brackets, namely two upper mounting brackets 14 and two lower mounting brackets 114. Each bracket 14, 114 is preferably an injection molded, hollow plastic part, attached to the reinforcement members 30, 32 of the heat exchanger 12 post braze and without the use of any separate fasteners (only the use of a deforming/stamping tool upon installation/attachment of the bracket).

[0038] Turning to Fig.4, an embodiment of reinforcement members will be described in detail.

[0039] The reinforcement members 30, 32, which are typically metal bars, e.g. with U-shaped cross section, rest over and protect the outermost pair of air centers, thereby allowing the core to be banded together prior to brazing. In the variant of Fig.4 the reinforcement member presents a U-shape with two legs or edge walls 34, 36 extending from the faces 22.1, 22.2 of the core 20 and a central portion or bottom wall 38 extending over a side 24 of the core.

[0040] In other words, the reinforcement member presents a U-shaped profile with two edge walls 34, 36 extending from a bottom wall 38 away from the sides of the core 20. The two edge walls 34, 36 may have similar or different heights. Two recessed parts 42, one near each extremity, are provided on each reinforcement member 30, 32. The edges walls 34, 36 are shorter in the recessed part 42 than in the remaining part of the reinforcement member 30, 32. For example, edge walls 34, 36 in the recessed part 42 may have a height of about 25 to 60% of the height of the respective edge wall 34, 36 in the remaining part of the reinforcement member 30, 32.

[0041] The reinforcement member 30, 32 has at least one protrusion 40 arranged on the bottom wall 38 in the recessed part 42. The protrusion 40 may be of any appropriate shape that protrudes from the bottom wall 38 in a direction away from the core 20 of the heat exchanger 12 and that can be mechanically deformed to ensure attachment to the mounting bracket 14, 114. In the embodiment of the figures, a plurality of, namely three, protrusions 40 are arranged in each recessed part 42, so as to further secure the brackets14, 114 to the respective reinforcement member 30, 32. The protrusions 40 are shaped as collars (sleeve-like or cylindrical elements) and can be deformed by a punching tool to increase their outer diameter (at least on the external side) so as to ensure a form-fit connection with the mounting bracket 14, 114.

[0042] Advantageously, the protrusions are arranged to stably assemble the bracket 14, 114 to the heat exchanger 12 by preventing tilting of the bracket 14, 114 around the direction of the Y-axis prior to deforming the protrusion.

[0043] Turning now to Fig.3, an embodiment of the upper mounting brackets 14 will be described in details.

[0044] Each mounting bracket 14 has a body 14.1 with an internal side 14.2 and an opposite external side 14.3. In the non-limiting embodiment of the figures, the body portion 14.1 comprises a socket portion 50. The socket portion 50 is dimensioned to closely match the shape and dimensions of the recessed part 42, in particular to present substantially the same length, along the direction of the Y axis, as the recessed part it is to be mounted thereto. The socket portion 40 is also configured to tightly enclose the recessed part 42 along the direction of the X axis. In other words, the socket portion 50 acts as a closely-fitted cap above the recessed part 42 of the reinforcement member 30.

[0045] The socket portion presents a generally U-shaped cross-section with two lateral walls 52.1, 52.2 extending from a central wall 54. The central wall 54 extends in a direction along the reinforcement member 30 while the lateral walls 52.1, 52.2 project over opposite sides of the core 20. That is to say, the lateral walls 52.1, 52.2 with the central wall 54 form a channel which tightly embraces (fits around) the upper side and recessed part 42 of reinforcement member 30 of the heat exchanger 12 in the assembled state of the heat exchanger assembly 10.

[0046] The central wall 54 presents opening(s) 56 with shape and dimensions matching the shape and outer dimension of the protrusion(s) 40 of the recessed part 42 of the reinforcement member 30 prior to assembling the mounting bracket 4 and the heat exchanger 12. As shown on Fig. 3, the openings 56 may have a circular cross-section to match the form of the collar-shaped protrusions 40 of the reinforcement member 30 (see e.g. Fig. 4 and Fig. 5).

[0047] The lateral walls 52.1, 52.2 of the socket portion 50 each comprise a plurality of apertures 58, or windows, evenly spaced along the whole length of the socket portion 50, in the direction of the Y axis. The apertures 58 are shaped and dimensioned so as to maximize heat exchanges between the core 20 of the heat exchanger 12 and ambient environment while ensuring a sufficient stiffness of the mounting bracket 14 for allowing an easy manipulation and mounting thereof. The apertures 58 are preferably formed during the injection molding of the mounting bracket 14. It is however also possible to further process a bracket molded with full i.e. not opened lateral walls by cutting/carving apertures into the lateral walls.

[0048] The mounting bracket 14 further comprises an integral mounting feature 70 extending from the central wall 54 of the socket portion 50 in the direction opposite to the first and second lateral walls 52.1, 52.2. The mounting feature 70 is here a flat flange provided with a through hole 72 to allow the mounting bracket 14 to be secured to a structure in the vehicle, or to another heat exchanger or heat exchanger assembly. The dimensions of the through hole 72 will be adapted in practice depending in the type/size of the matching fixing member, such as e.g. a screw, pin, rivet, etc.

[0049] Mounting brackets 114, arranged on the lower side of heat exchanger 12, are similar to mounting brackets 14, and include identical socket portions, however the mounting feature is different. Indeed, the mounting feature of mounting bracket 114 is designed as a fixing tab (see Fig. 1) that is mounted by engagement into a mating feature on the vehicle or on another heat exchanger, or for mating with other components or insulators. The fixing tab may advantageously be reinforced by ribbing for increased stiffness (not shown).

[0050] Fig.6 schematically illustrates the assembling of an upper mounting bracket 14 to a heat exchanger assembly 12 according to an embodiment of the present invention, in particular the steps of assembling and attaching i.e. securing the mounting bracket to the reinforcement member. Lower mounting brackets 114 are assembled in a similar way.

[0051] A heat exchanger 12 with reinforcement members 30, 32 as described above with respect to a non-limiting embodiment presenting recessed parts 42 is assembled (not shown). A mounting bracket 14 with a body 14.1 according to a non-limiting embodiment comprising a socket portion 50, apertures 58 on the lateral walls and at least one opening 56 in the central wall 54 of the socket portion 50 is provided and aligned with the recessed part 42 on the reinforcement member 30 (Fig. 6a). The mounting bracket 14 is then placed i.e. positioned onto the recessed part 42 of the reinforcement member 30, the protrusions 40 being engaged into the openings 56. The protrusions 40 advantageously act as positioning and centering tools, facilitating the positioning and alignment of the bracket 14 to the reinforcement member 30 (Fig. 6b).

[0052] A punching tool 80 is employed to deform the protrusions 40 of the recessed part so as to secure the mounting bracket 14 to the reinforcement member 30 by deforming the protrusions 40 inserted in the corresponding openings 56 of the bracket 14. The punching tool 80 may present three punching fingers 82 to be respectively inserted in the collar-shaped protrusions 40 so as to deform them by increasing their outer diameters (fig. 6c). After deforming the protrusions, the punching tool is removed and the heat exchanger assembly 10 is obtained (not shown).

[0053] The deformation occurring during the press deformation process is shown in detail in Fig.7. Fig.7a shows the collar before deformation. It has cylindrical shape with constant diameter. It may be noted that the collar itself is manufactured by stamping body; accordingly, it defines a through passage. The opening has profiled longitudinal cross section: on the internal side the opening has a straight section, which transforms into a flared-out (outwardly tapering) section on the external side, here frustoconical. As can be observed, the free end of the finger comprises a frustoconical section ending with a nipple. The nipple forms a centering element which is sized to fit inside the collar without interference (i.e. smaller diameter or core-section). The conical portion is wider than the collar inner diameter. Hence, when moving downward, the frustoconical portion will deform the collar, which is then flared out, as shown on Fig.7b. It may be observed that the flared-out section of the opening and the frustoconical portion of the finger may have a similar aperture angle (i.e. fairly similar). After the press-joining step, the collar is thus outwardly folded over the flared-out section, blocking the bracket in an interlocking manner on the reinforcement element.

[0054] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

Claims

1. A heat exchanger assembly (10) comprising:

a heat exchanger (12) comprising a core (20) with a plurality of heat exchanger tubes (26) for carrying a coolant fluid, the core (20) extending between two opposite manifolds (16, 18), a reinforcement member (30, 32) extending along each lateral side (24) of the core between the manifolds (16, 18);

at least one mounting bracket (14, 114) fixed to the reinforcement member (30, 32), the mounting bracket comprising a body portion (14.1) and a mounting feature (70);

wherein the body portion (14.1) has an internal side (14.2) in contact with the reinforcement member (30, 32) and an opposite external side (14.3), and at least one opening (56) extending from the internal side to the external side;

wherein the reinforcement member (30, 32) comprises a protrusion (40) extending from the external side into said opening (56) in the body portion (14.1) of the bracket, the protrusion (40) having been plastically deformed from the external side to interlock with the opening (56) and lock the mounting bracket in place,

wherein the reinforcement member (30, 32) comprises at least one recessed part (42), the protrusion (40) being arranged onto the recessed part.

2. The heat exchanger assembly (10) according to claim 1, wherein the protrusion is collar-shaped, wherein the opening has an enlarged upper region, and wherein the protrusion (40) is press-joined to the opening (56) of the bracket (14, 114).

3. The heat exchanger assembly (10) according to claim 1, wherein the reinforcement member (30, 32) comprises a U-shaped profile with two edge walls (34, 36) extending from a bottom wall (38) away from the sides of the core,

wherein the edge walls (34, 36) of the recessed part (42) are shorter than in the remaining part of the reinforcement member (30, 32) and
wherein the protrusion (40) is arranged on the bottom wall (38) in the recessed part (42).

4. The heat exchanger assembly (10) according to any one of the preceding claims wherein the body portion of the mounting bracket (14, 114) comprises a socket portion (50) embracing the reinforcement member (30, 32), the socket portion (50) including a central wall (54) extending along the reinforcement member (30, 32) and two opposite lateral walls (52.1, 52.2) projecting from the central wall (54) on opposite sides of the core (20), the opening being arranged through the central wall.

5. The heat exchanger assembly (10) according to the previous claim, wherein the opening (56) is arranged at equal distance from the lateral walls (52.1, 52.2).

6. The heat exchanger assembly (10) according to any one of the preceding claims, wherein the reinforcement member (30, 32) comprises a plurality of protrusions (40) and wherein the mounting bracket (14) comprises a plurality of openings (56) matching the protrusions (40).

7. The heat exchanger assembly (10) according to the preceding claim, wherein the protrusions (40) are evenly spaced, preferably the protrusions are arranged in and evenly spaced along the recessed part (42).

8. The heat exchanger assembly (10) according to any one of claims 4 to 7, wherein the lateral walls (52.1, 52.2) of the mounting bracket (14) each comprise at least one aperture (58), preferably a plurality of, more preferably evenly spaced, apertures (58).

9. The heat exchanger assembly (10) according to any one of the preceding claims, wherein the mounting feature (70) is formed as a flange, in particular a flat flange (70) with an opening (72) therein for a fastening member or as a tab, in particular a reinforced tab.

10. The heat exchanger assembly (10) according to any one of the preceding claims, wherein the mounting bracket (14, 114) is formed by injection molding.

11. The heat exchanger assembly (10) according to any one of the preceding claims, wherein at least one, preferably both, of the manifolds (16, 18) of the heat exchanger is a round, one-piece manifold.

12. Use of a heat exchanger assembly (10) according to any one of the preceding claims as a condenser.

13. A cooling module comprising:

- a heat exchanger assembly (10) as claimed in any one of the preceding claims; and
- at least a second heat exchanger;

wherein the first heat exchanger (12) is mounted to the second heat exchanger by way of the mounting features (70) of the mounting brackets (14, 114) installed onto the reinforcement members (30,32) of the first heat exchanger (12).

14. A method for assembling a heat exchanger assembly (10) comprising the steps of:

a. providing a heat exchanger (12) comprising a core (20) with a plurality of heat exchanger tubes (26) for carrying a coolant fluid, the core (20) extending between two opposite manifolds (16, 18), a reinforcement member (30, 32) extending along each lateral side (24) of the core between the manifolds (16, 18), wherein each reinforcement member comprises at least one protrusion extending away from the core (20), wherein the reinforcement member (30, 32) comprises at least one recessed part (42), the protrusion (40) being arranged onto the recessed part,
b. providing at least one plastic mounting bracket (14, 114) comprising a body portion and a mounting feature, wherein the body portion has an internal side and an opposite external side, and at least one opening extending from the internal side to the external side;
c. positioning the mounting bracket (14, 114) onto the heat exchanger so that the internal side contacts the reinforcement member and the protrusion traverses the opening; and
d. plastically deforming the protrusion (40) from the external side to lock the mounting bracket in place.

15. The method according to the preceding claim, wherein the at least one protrusion (40) is collar-shaped and the step of deforming the protrusion (40) is performed by press-joining the protrusion to the opening (56).

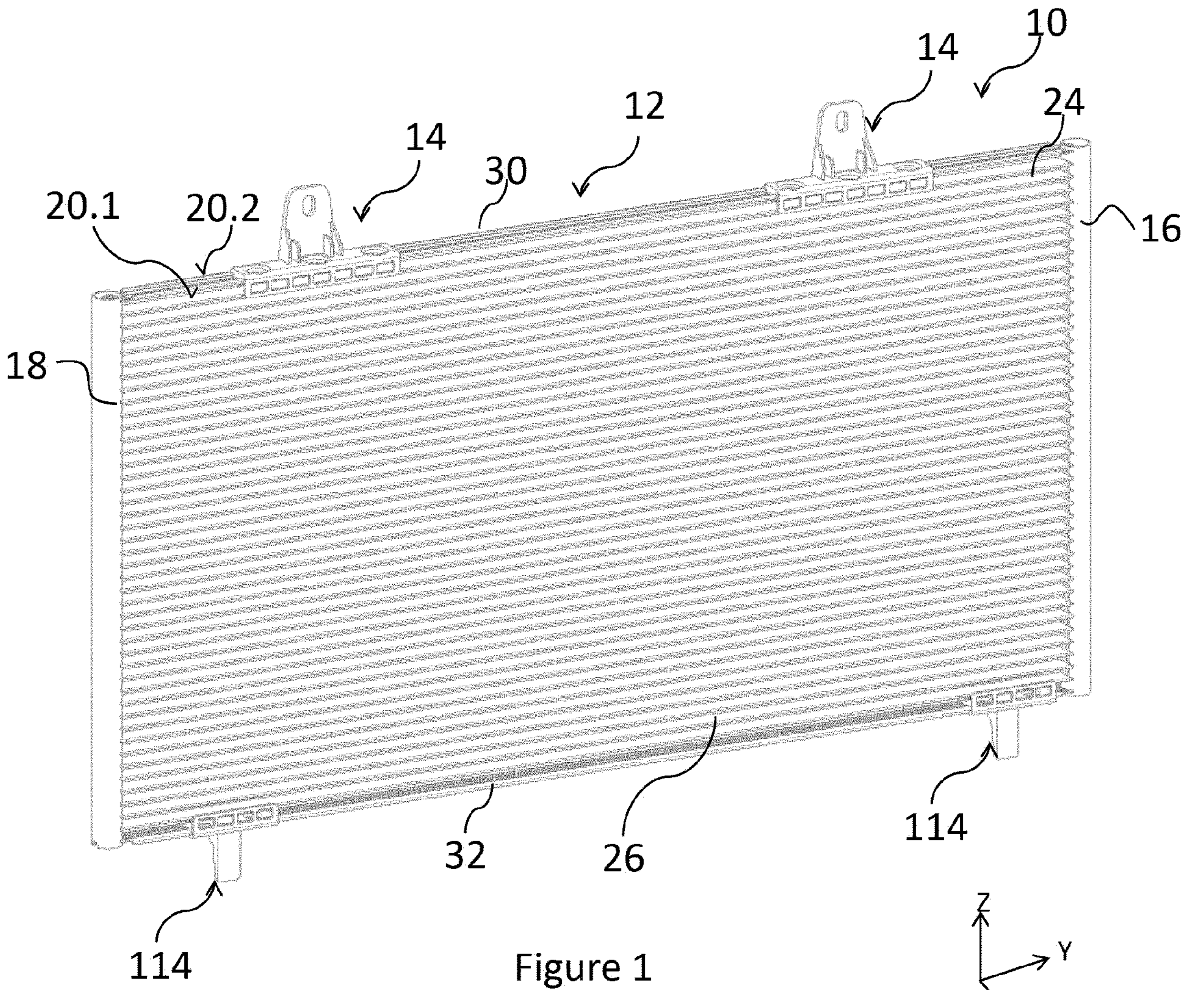

Figure 1

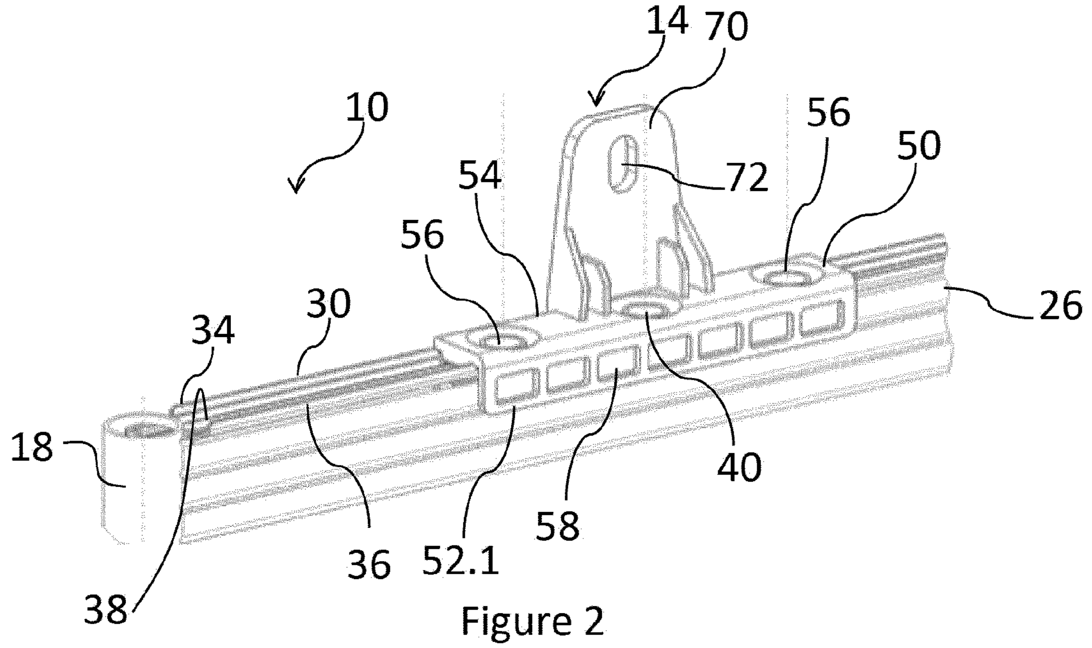

Figure 2

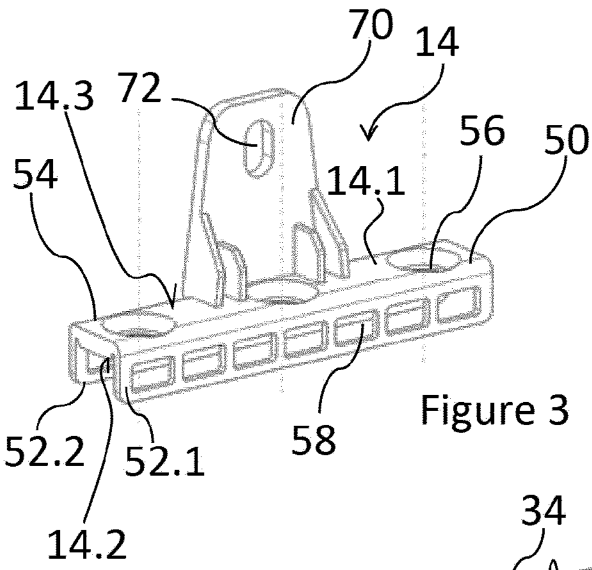

Figure 3

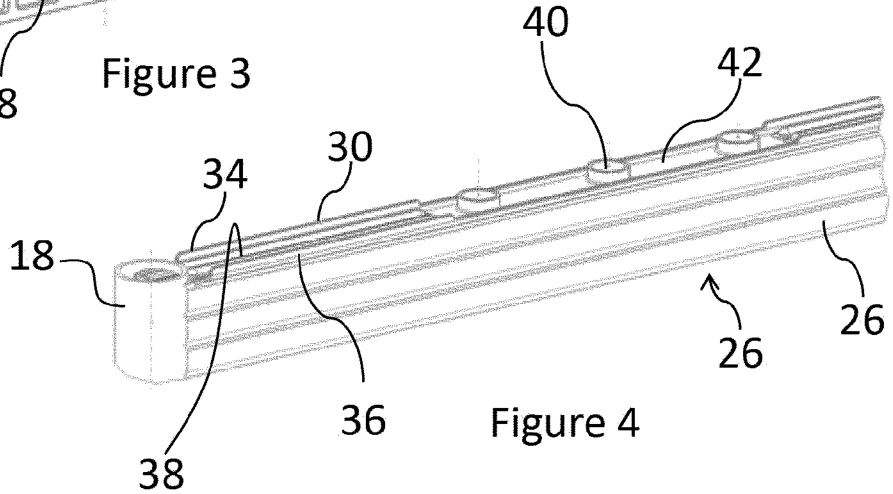

Figure 4

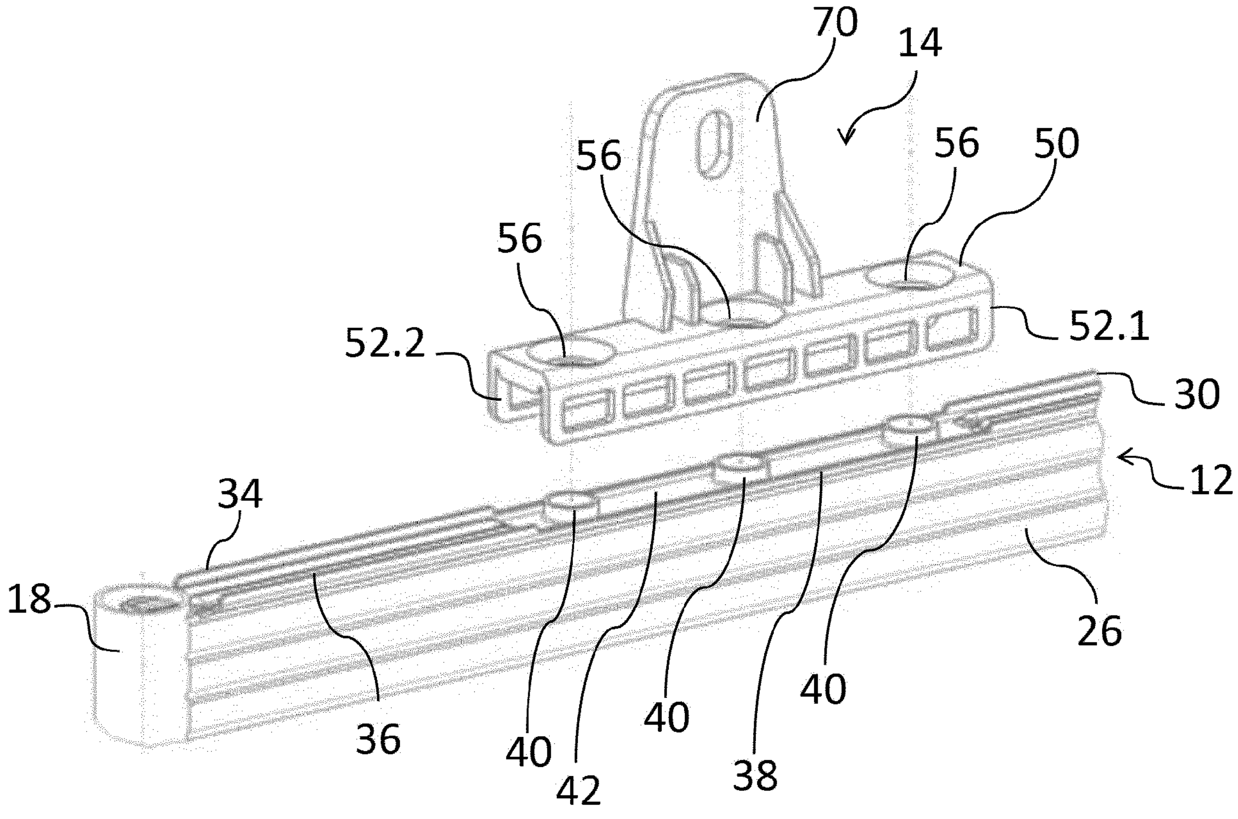

Figure 5

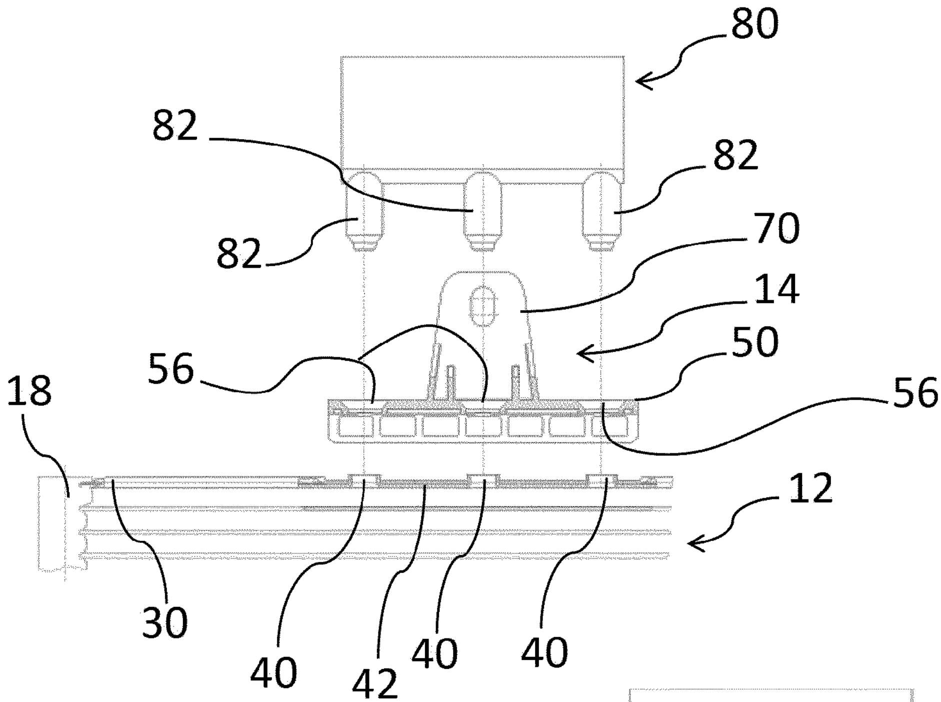

Figure 6a

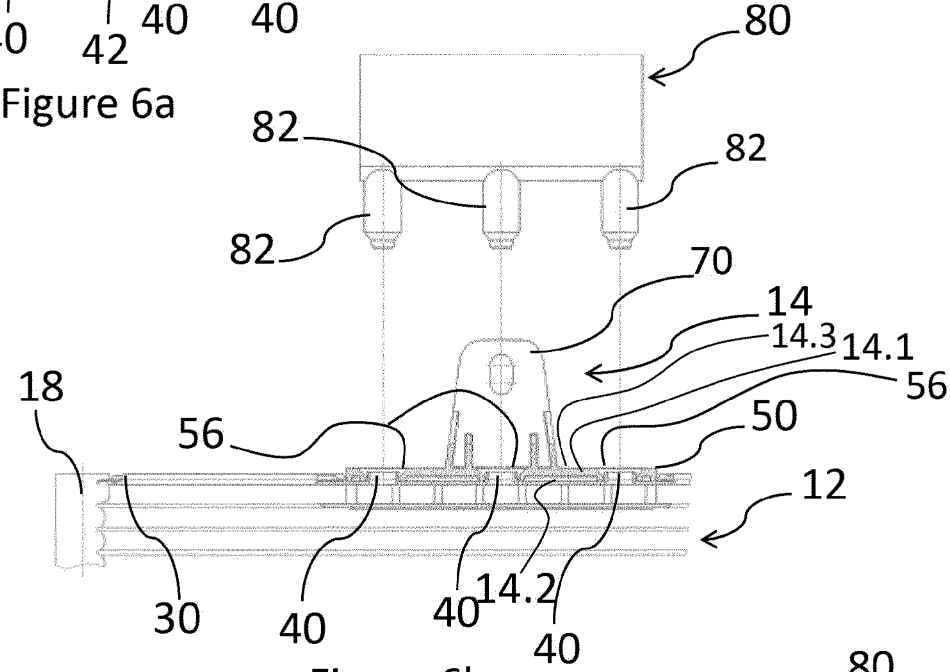

Figure 6b

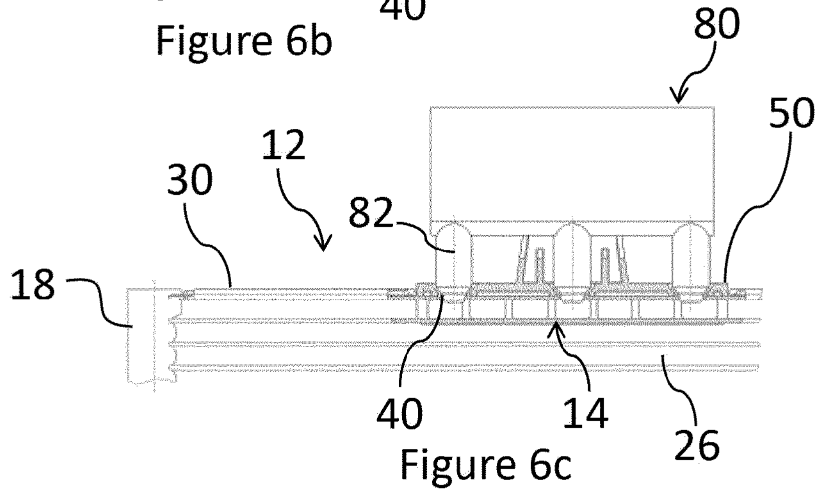

Figure 6c

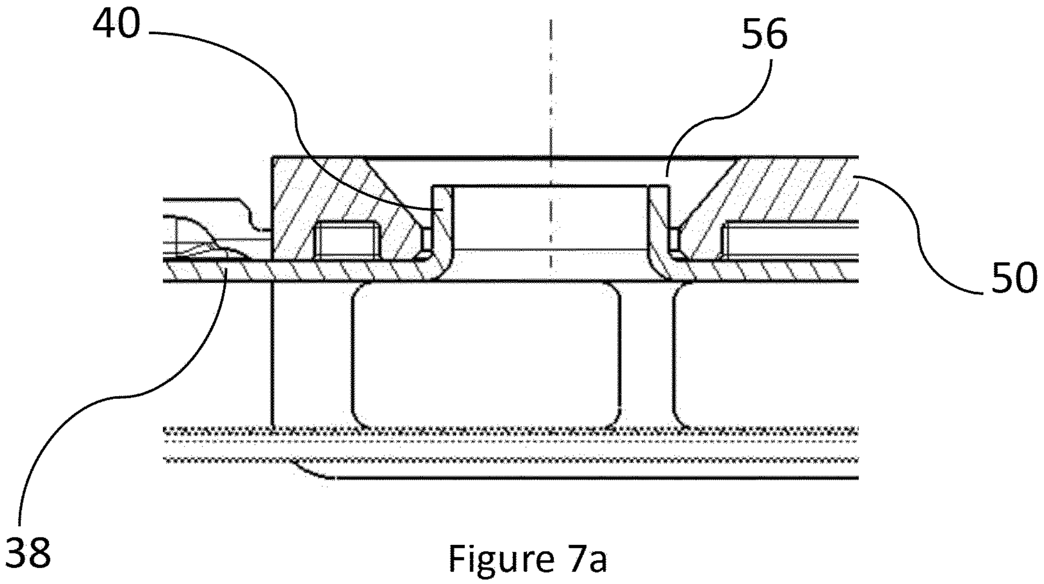

Figure 7a

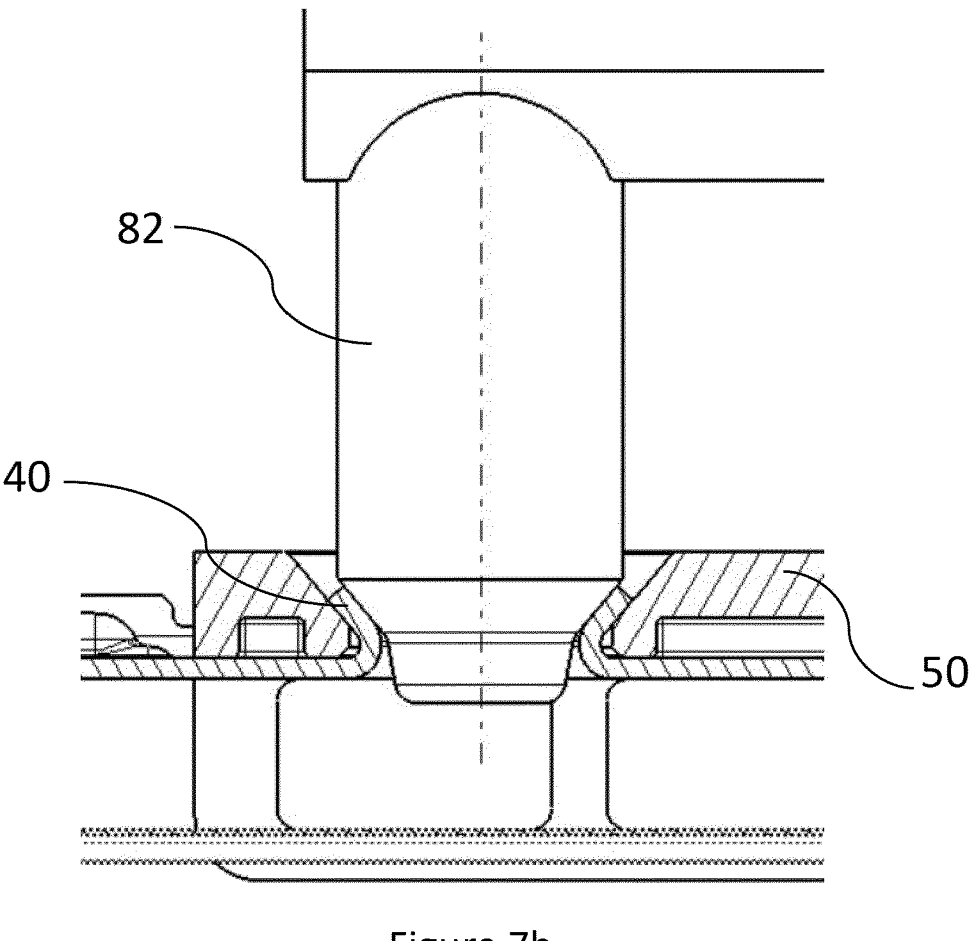

Figure 7b

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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	13 March 2025	Vassoille, Bruno

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