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(54) CONNECTION ASSEMBLY FOR A HEAT EXCHANGER

VERBINDUNGSANORDNUNG FÜR EINEN WÄRMETAUSCHER

ENSEMBLE DE CONNEXION POUR UN ÉCHANGEUR DE CHALEUR

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Description

[0001] The present invention generally relates a heat exchanger, more particularly, to a connection assembly for coupling a housing and gas tanks of an EGR cooler. More specifically, the present invention relates to a heat exchanger as defined in the preamble of claim 1, and as illustrated in EP 2 787 211.

Background of the invention:

[0002] Generally, an Exhaust Gas Re-circulation cooler, hereinafter referred to as EGR cooler, is provided in a vehicle to cool exhaust gas before being re-circulated to an engine of the vehicle. The EGR cooler receives the part of exhaust gas from the engine of the vehicle and the exhaust gas rejects heat, so that the exhaust gas can be used in the vehicle. The EGR cooler may include a housing coupled to respective tanks to enable circulation of the exhaust gas in the EGR cooler. Ideally, the housing is assembled to the respective tank and brazed to form a rigid connection between the housing and the respective tank. However, in case connection between the housing and the respective tank is not stable enough, geometry of the EGR cooler may change during the brazing process, which leads undesirable problems. Also, while placing the housing and the respective tank in a brazing jig/tooling, geometry of the EGR cooler may change. Generally, radius of the housing is less than that of the tank to enable easy assembling of end portions of the housing to the respective tanks. Further, a gap is formed in between the end portions of the housing and the tank in order to permit brazing between the housing and the tank. In case the radius of the housing is substantially less than that of the tank, the gap between the end portions of the housing and the tank is substantial, which leads to deformation of geometry of the EGR cooler during the brazing process. Further, undesirable gap between the housing and the tank may cause leakage and affect performance of the EGR cooler. In case radius of the housing is substantially equal to of the tank, an external force is required to be applied on the housing to engage the end portions of the housing with the tank, such force may damage the housing or tank, and distort geometry of the housing and tank, thereby rendering the EGR cooler not usable in any vehicle.

[0003] Accordingly, there is a need for a connection assembly for enabling easy assembly of an EGR cooler. Further, there is a need for an EGR cooler having a connection assembly to assemble a housing with a tank without deformation of the housing and without deviating from geometry of the EGR cooler.

Description of the invention:

[0004] 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.

[0005] In view of the foregoing, an embodiment of the invention herein provides a heat exchanger, preferably an Exhaust Gas Re-circulation (EGR) cooler for a vehicle. The heat exchanger includes a housing, a pair of tanks, and at least one protuberance. The pair of tanks is adapted to receive respective end portions of the housing to form a first fluid circuit. The at least one protuberance is formed on the walls of the housing, in proximity to transverse edges of the walls of the housing, to engage with an inner wall of the pair of tanks when the end portions of the housing are received in the pair of tanks. The end portions of the housing is curved inwardly when the at least one protuberance is engaged with the inner wall of the pair of tanks.

[0006] In one embodiment, the at least one protuberance is formed on center of the walls of the housing at the respective end portions of the housing.

[0007] Further, the heat exchanger includes a plurality of heat exchange elements extended between a pair of headers of the housing, wherein the plurality of heat exchange elements is fluidically connected to the pair of tanks to form the first fluid circuit and enable circulation of a first fluid there-through.

[0008] In another embodiment, the heat exchanger includes a chamfer formed on the inner wall of the pair of tanks to enable sliding of the at least one protuberance on the chamfer to couple end portions of the housing with the pair of tanks.

[0009] In yet another embodiment, shape of the at least one protuberance is any one of rectangular, cylindrical, polygonal, triangle and chamfer shape, and height of the at least one protuberance is less than 300 micron.

[0010] Further, the end portions of the housing and the inner wall of the pair of tanks are brazed to form a rigid connection between the housing and the pair of tanks.

[0011] According to another aspect, a method for coupling a housing with at least one tank of an Exhaust Gas Recirculation cooler. The method include following steps. In step 1, at least one protuberance is formed on each side of walls of the housing, in proximity to transverse edges of the walls. In step 2, an end portion of the housing is received into the at least one tank. In step 3, the at least one protuberance is engaged with an inner wall of the at least one tank to couple the housing with the at least one tank. In step 4, the end portion of the housing is curved inwardly while the at least one protuberance is engaged with the inner wall of the at least one tank. In step 5, the end portion of the housing is brazed with the at least one tank to form a rigid connection between the housing and the at least one tank.

[0012] 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:

Brief description of the drawings:

[0013]

Fig. 1A illustrates a perspective view of an Exhaust Gas Recirculation cooler, in accordance with an embodiment of the present invention;

Fig. 1B illustrates an exploded view of the EGR cooler of Fig. 1A;

Fig. 1C illustrates a cross-section of a connection assembly of Fig. 1B depicting deformation of an end portion of a housing and engagement of the protuberance with the inner wall of a tank;

Fig. 2 illustrates a perspective view of a tank amongst the pair of tanks of Fig. 1A;

Fig. 3A illustrates a cross section of the connection assembly of Fig. 1B when the end portion of the housing is inserted into a tank amongst the pair of tanks;

Fig. 3B illustrates a schematic view of the protuberance formed on the housing of Fig. 1B;

Figs. 3C and 3D illustrate different shapes of the protuberance of Fig. 3B; and

Fig. 4 is a flowchart depicting a method of assembling a housing into a tank to form an EGR cooler, in accordance with an embodiment of the present invention.

Detailed description of the preferred embodiments:

[0014] 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 needs be. The invention should however not be limited to the embodiment disclosed in the description.

[0015] The present invention relates a heat exchanger, particularly an Exhaust Gas Recirculation (EGR) cooler, for a vehicle. The Exhaust Gas Recirculation (EGR) cooler, hereinafter referred to as EGR cooler, having a connection assembly for connecting a housing with respective tanks. The EGR cooler may receive a portion of exhaust gas from an engine of the vehicle and cool the exhaust before re-circulating the exhaust gas o the engine. The EGR cooler may include the housing coupled to the respective tanks. The tanks may receive end portions of the housing to form a fluid circuit, in which the exhaust gas from an engine of the vehicle flows through. The EGR cooler may further include one or more protuberances provided on each side of both end portions of the housing and adapted to engage with an inner wall of the respective tanks. As the one or more protuberances engaged with the inner wall of the respective tanks, the end portions of the housing are pressed inwardly to enable easy assembling of the housing into the respective tanks.

[0016] While aspects relating to one or more protuberances provided the EGR cooler as described above and henceforth can be implemented in symmetrical and non-symmetrical shapes on the EGR cooler for easy assembling of the EGR cooler, the embodiments are described in the context of the following system(s).

[0017] Figs. 1A, 1B and 1C illustrate different views of a heat exchanger 100, in accordance with an embodiment of the present invention. The heat exchanger 100, particularly an EGR cooler 100, includes a housing 102 and a pair of tanks 104. The heat exchanger 100 is the EGR cooler 100 and hereafter the present invention is described with respect to the EGR cooler 100. In one example, Fig. 1A is a perspective view of the EGR cooler 100, and Fig. 1B is an exploded view of the EGR cooler 100. The housing 102 is formed by connecting one or more walls 106. In one embodiment, the walls 106 can be lateral walls in case the housing 102 is rectangular, square and alike. For the sake of brevity of the document, the present invention is described with the housing 102 having rectangular shape with four lateral walls, however, the present invention is not limited to the housing 102 having rectangular shape only, and rather the housing 102 can be in square, cylindrical or any other shape.. The pair of tanks 104 is adapted to receive end portions 106A of the housing 102 to form a first fluid circuit 108, in which a first fluid, preferably the exhaust gas flows through. The housing 102 may include one or more heat exchange elements 110 extended between a pair of headers 112, and fluidically connected to the pair of tanks 104, in such a way that the pair of tanks 104 along with the one or more heat exchange elements 110, hereinafter referred to as heat exchange elements, forms the first fluid circuit 108.

[0018] The pair of tanks 104 may include a first inlet 112A and a first outlet 112B to enable circulation of the exhaust gas in the first fluid circuit 108. The first inlet 112A is adapted to ingress the exhaust gas into the heat exchange elements 110, and the first outlet 112B is adapted to egress the exhaust gas from the heat exchange elements 110. The housing 102 may include a second fluid circuit 114 formed around the heat exchange elements 110, in which a second fluid, preferably a coolant, flows through. The housing 102 may include a second inlet 116A and a second outlet 116B to circulate the coolant in the second fluid circuit 114, which is formed around the heat exchange elements 110. Further, the

exhaust gas flowing in the first fluid circuit 108 rejects heat to the coolant flowing in the second fluid circuit 114, thereby, cooling the exhaust gas for re-circulating back to the engine.

[0019] The EGR cooler 100 further comprising one or more protuberances 118 formed on the end portions 106A of the walls 106 of the housing 102. In one embodiment, the one or more protuberances 118 are formed on each side of the lateral walls, in such a way that the one or more protuberances 118 are in proximity to the transverse edges 120 of the housing 102. In other words, the one or more protuberances 118 are formed on each lateral wall of the housing 102 at the end portions 106A of the housing 102. According to an aspect of the present invention, the EGR cooler 100 includes at least one protuberance 118 formed on each lateral wall 106 of the housing 102 at of the end portions 106A of the housing 102. In other words, one protuberance 118 is formed on each of the four lateral walls 106 at the two end portions 106A of the housing 102, therefore, totally eight protuberances 118 are formed, four on each of the end portions 106A of the housing 102. For the sake of brevity and clarity, the present invention is described with one protuberance formed on one lateral wall at one end portion of the housing 102. The protuberance 118 is formed on center of the lateral walls 106 at the end portions 106A of the housing 102. In one embodiment, the protuberance 118 is formed in the center of the lateral walls 106 at the end portions 106A and in proximity to the transverse edges 120 of the housing 102.

[0020] The pair of tanks 104 receives the end portions 106A of the housing 102, in which the protuberance 118 is formed. Further, the protuberance 118 is adapted to engage with an inner wall 122 of the pair of tanks 104 upon receiving of the end portions 106A of the housing 102 in the pair of tank 104. Simultaneously, the end portions 106A of the housing 102 deforms inwardly to couple with the inner wall 122 of the pair of tanks 104. In other words, the end portions 106A of the housing 102 slightly deform inwardly to get coupled to the inner wall 122 of the pair of tanks 104. As the protuberance 118 is formed on the center of the lateral side at the end portions 106A, the end portions 106A of the housing 102 uniformly deforms inwards to enable easy assembling of the housing 102 into the pair of tanks 104 as shown in Fig. 1C. In one embodiment, the protuberance 118 along with the inner wall 122 of the pair of tanks 104 is collectively referred to as a connection assembly 118A. Fig. 1C illustrates a cross-section the connection assembly 118A of Fig. 1B depicting deformation of the end portions 106A of the housing 102 because of the engagement of the protuberance 118 with the inner wall 122 of the pair of tanks 104. As the end portions 106A of the housing 102 deform inwardly when the housing 102 is coupled to the pair of tanks 104, a gap 124 is formed between the end portions 106A of the housing 102 and the inner walls 122 of the pair of tanks 104. The gap 124 is necessary for brazing of the end portions 106A of the housing 102 with the pair of tanks 104, since the gap is filled with nickel brazing paste before brazing of the end portions 106A of the housing 102 to the inner walls 122 of the pair of tanks 104. Thereafter, the end portions 106A of the housing 102 is brazed with the inner wall 122 of the pair of tanks 104 to form a rigid connection between the housing 102 and the pair of tanks 104 as shown in Fig. 1A.

[0021] Fig. 2 illustrates a perspective view of a tank amongst the pair of tanks 104 of Fig. 1A. The pair of tanks 104 may include a chamfer 202 formed around periphery of the inner wall 122 of the pair of tanks 104 to enable easy assembling of the end portions 106A of the housing 102 into the pair of tanks 104. In one embodiment, the chamfer 202 is having an angled surface to enable sliding of the protuberance 118 on the angled surface of the chamfer 202. The angled surface of the chamfer 202 is angled towards the periphery of the pair of tanks 104, so that the protuberance 118 of the end portions 106A of the housing 102 slides easily into the pair of tanks 104. Simultaneously, the end portions 106A of the housing 102 is curved inwardly due to interaction of the protuberance 118 with the inner wall 122 of the pair of tank 104, which enables coupling of the housing 102 with the pair of tanks 104. In another embodiment, the chamfer 202 is having a round surface to enable sliding of the protuberance 118 on the chamber 202.

[0022] Fig. 3A illustrates a cross section of the connection assembly 118A of Fig. 1B when the end portion 106A of the housing 102 is inserted into a tank amongst the pair of tanks 104. In one embodiment, a radius of the pair of tanks 104 is substantially same as a radius of the housing 102. When an insertion force is applied on the longitudinal axis 302 of the housing 102 towards the tank, the end portions 106A of the experience an elastic force in a transverse axis 304 as the protuberance 118 is engaged with the chamfer 202 formed on the inner wall 122 of the tank 104. Therefore, a friction force is formed between the end portion 106A of the housing 102 and the inner wall 122 of the tank 104 that maintains the housing in a fixed position. Thereafter, the housing 102 is brazed with the tank 104 to form a rigid connection between the housing 102 and the tank 104.

[0023] Fig. 3B illustrates a schematic view of the protuberance 118 of Fig. 1B. In one embodiment, a width of the protuberance is 1.25mm and a height of the protuberance is 0.25mm. In another embodiment, the height of the protuberance is less than 0.3mm or 300 microns to keep the gap 124 between the inner wall 122 of the pair of tank 104 and the end portion 106A of the housing 102 minimal, thereby, eliminating substantial deformation of the housing 102. Fig. 3C illustrates different shapes of the protuberance 118 of Fig. 3B. In one embodiment, the protuberance 118 can have a rectangular cross section 310, circular cross section 312, triangular shape 312 as illustrated in FIG. 3C and is configured with a chamfer 316 as depicted in the cross section depicted in FIG. 3D.

[0024] Fig. 4 is a flowchart depicting a method 400 for

assembling a housing 102 into a tank 104 of an EGR cooler 100, in accordance with an embodiment of the present invention. The order in which the method described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any order or can be performed in parallel to employ the method 400, or an alternative method. Additionally, individual blocks may be deleted from the methods without departing from the spirit and scope of the present subject matter described herein. The method may perform following steps to couple the housing 102 into the tank 104 to form the EGR cooler 100. The method 400 is to be understood with reference to the details described along with Fig. 4.

[0025] Method begins at block 402. At block 402, at least one protuberance 118 is formed on each side of lateral walls 106 of the housing 102 in such a way that the at least one protuberance 118 is in proximity to transverse edges 120 of the lateral walls 106. Thereafter, at block 404, an end portion 106A of the housing 102 is received into the at least one tank 104, by providing an insertion force along the longitudinal axis of the housing 102. Simultaneously, at block 406, the at least one protuberance 118 is engaged with an inner wall 122 of the at least one tank 104 to couple the housing with the at least one tank 104. Simultaneously, at block 408, the end portion 106A of the housing 102 is curved inwardly while the at least one protuberance 118 is engaged with the inner wall 122 of the at least one tank 104. Thereafter, at block 410, the end portion 106A of the housing 102 is brazed with the at least one tank 104 to form a rigid connection between the housing 102 and the at least one tank 104. As the protuberance 118 formed on the housing 102 slightly deforms the housing 102 inwards, assembling and disassembling of the housing 102 into the at least one tank 104 is hassle free.

Claims

1. A heat exchanger (100), comprising:

a housing (102);
a pair of tanks (104) adapted to receive respective end portions (106A) of the housing (102) to form a first fluid circuit (108); the heat exchanger being **characterized by**
at least one protuberance (118) formed on walls (106) of the housing (102), in proximity to transverse edges (120) of the walls (106) of the housing (102), to engage with an inner wall (122) of the pair of tanks (104) when the end portions (106A) of the housing (102) are received in the pair of tanks (104), wherein the end portions (106A) of the housing (102) are curved inwardly when the at least one protuberance (118) is engaged with the inner wall (122) of the pair of tanks (104).

2. The heat exchanger (100) as claimed in claim 1, wherein the at least one protuberance (118) is formed on center of the walls (106) of the housing (102) at the respective end portions (106A) of the housing (102).

3. The heat exchanger (100) as claimed in claim 1, wherein the heat exchanger (100) is an Exhaust Gas Recirculation cooler.

4. The heat exchanger (100) as claimed in claim 1, further comprising a plurality of heat exchange elements (110) extended between a pair of headers (112) of the formed in housing (102), wherein the plurality of heat exchange elements (110) is fluidically connected to the pair of tanks (104) to form the first fluid circuit (108) and enable distribution of a first fluid there-through.

5. The heat exchanger (100) as claimed in any of preceding claims, further comprising a chamfer (202) formed on the inner wall (122) of the pair of tanks (104) to enable sliding of the at least one protuberance (118) on the chamfer (202) to couple the end portions (106A) of the housing (102) with the pair of tanks (104).

6. The heat exchanger (100) as claimed in any of preceding claims, wherein shape of the at least one protuberance (118) is any one of rectangular, cylindrical, polygonal, triangle and chamfer shape.

7. The heat exchanger (100) as claimed in claim 1, wherein height of the at least one protuberance (118) is less than 300 micron.

8. The heat exchanger (100) as claimed in any of preceding claims, wherein the end portions (106A) of the housing (102) and the inner wall (122) of the pair of tanks (104) are brazed to form a rigid connection between the housing (102) and the pair of tanks (104).

9. A method (400) for coupling a housing (102) with at least one tank (104) of an Exhaust Gas Recirculation cooler (100), comprising:

forming, at least one protuberance (118) on each side of walls (106) of the housing (102, in proximity to transverse edges (120) of the walls (106) of the housing (102);
receiving, an end portion (106A) of the housing (102) into the at least one tank (104);
engaging, the at least one protuberance (118) formed on the housing (102) with an inner wall (122) of the at least one tank (104); and
curving, the end portion (106A) of the housing (102) inwardly while the at least one protuber-

ance (118) formed on the housing (102) is engaged with the inner wall (122) of the at least one tank (104).

10. The method (400) as claimed in claim 9, further comprising:
brazing, the end portion (106A) of the housing (102) with the inner wall (122) of the at least one tank (104) to form a connection between the housing (102) and the at least one tank (104).

Patentansprüche

1. Wärmetauscher (100), umfassend:

ein Gehäuse (102),
ein Paar Behälter (104), die zur Aufnahme jeweiliger Endabschnitte (106A) des Gehäuses (102) ausgeführt sind, um einen ersten Fluidkreislauf (108) zu bilden, wobei der Wärmetauscher **gekennzeichnet ist durch**
mindestens einen Vorsprung (118), der an Wänden (106) des Gehäuses (102) in der Nähe von Querrändern (120) der Wände (106) des Gehäuses (102) ausgebildet ist, um mit einer Innenwand (122) des Paars Behälter (104) in Eingriff zu kommen, wenn die Endabschnitte (106A) des Gehäuses (102) in dem Paar Behälter (104) aufgenommen sind, wobei die Endabschnitte (106A) des Gehäuses (102) nach innen gekrümmt sind, wenn der mindestens eine Vorsprung (118) mit der Innenwand (122) des Paars Behälter (104) in Eingriff steht.

2. Wärmetauscher (100) nach Anspruch 1, wobei der mindestens eine Vorsprung (118) in der Mitte der Wände (106) des Gehäuses (102) an den jeweiligen Endabschnitten (106A) des Gehäuses (102) ausgebildet ist.

3. Wärmetauscher (100) nach Anspruch 1, wobei der Wärmetauscher (100) ein Abgasrückkühler ist.

4. Wärmetauscher (100) nach Anspruch 1, ferner umfassend eine Vielzahl von Wärmetauscherelementen (110), die sich zwischen einem Paar Verteiler (112) des Gehäuses (102) erstrecken, wobei die Vielzahl von Wärmetauscherelementen (110) fluidisch mit dem Paar Behälter (104) verbunden sind, um den ersten Fluidkreislauf (108) zu bilden und die Verteilung eines ersten Fluids dort hindurch zu ermöglichen.

5. Wärmetauscher (100) nach einem der vorhergehenden Ansprüche, ferner umfassend eine Abschrägung (202), die an der Innenwand (122) des Paars Behälter (104) ausgebildet ist, damit der mindestens eine Vorsprung (118) auf der Abschrägung (202) gleiten kann, um die Endabschnitte (106A) des Gehäuses (102) mit dem Paar Behälter (104) zu koppeln

6. Wärmetauscher (100) nach einem der vorhergehenden Ansprüche, wobei die Gestalt des mindestens einen Vorsprungs (118) eine beliebige einer rechteckigen, zylindrischen, polygonalen, dreieckigen und abgeschrägten Gestalt ist.

7. Wärmetauscher (100) nach Anspruch 1, wobei die Höhe des mindestens einen Vorsprungs (118) weniger als 300 Mikron ist.

8. Wärmetauscher (100) nach einem der vorhergehenden Ansprüche, wobei die Endabschnitte (106A) des Gehäuses (102) und die Innenwand (122) des Paars Behälter (104) hartverlötet sind, um eine starre Verbindung zwischen dem Gehäuse (102) und dem Paar Behälter (104) zu bilden.

9. Verfahren (400) zum Koppeln eines Gehäuses (102) mit mindestens einem Behälter (104) eines Abgasrückkühlers (100), umfassend:

Bilden mindestens eines Vorsprungs (118) an jeder Seite von Wänden (106) des Gehäuses (102) in der Nähe von Querrändern (120) der Wände (106) des Gehäuses (102),
Aufnehmen eines Endabschnitts (106a) des Gehäuses (102) in dem mindestens einen Behälter (104),
Ineingriffbringen des mindestens einen an dem Gehäuse (102) ausgebildeten Vorsprungs (118) mit einer Innenwand (122) des mindestens einen Behälters (104) und
Krümmen des Endabschnitts (106A) des Gehäuses (102) nach innen, während der mindestens eine an dem Gehäuse (102) ausgebildete Vorsprung (118) mit der Innenwand (122) des mindestens einen Behälters (104) in Eingriff steht.

10. Verfahren (400) nach Anspruch 9, ferner umfassend:
Hartverlöten des Endabschnitts (106A) des Gehäuses (102) mit der Innenwand (122) des mindestens einen Behälters (104) zum Bilden einer Verbindung zwischen dem Gehäuse (102) und dem mindestens einen Behälter (104).

Revendications

1. Échangeur de chaleur (100), comprenant :

un carter (102) ;

une paire de réservoirs (104) prévus pour recevoir des parties d'extrémité (106A) respectives du carter (102) pour former un premier circuit de fluide (108) ; l'échangeur de chaleur étant **caractérisé par**

au moins une protubérance (118) formée sur des parois (106) du carter (102), à proximité de bords transversaux (120) des parois (106) du carter (102), afin de venir en prise avec une paroi interne (122) de la paire de réservoirs (104) lorsque les parties d'extrémité (106A) du carter (102) sont reçues dans la paire de réservoirs (104), les parties d'extrémité (106A) du carter (102) étant incurvées vers l'intérieur lorsque l'au moins une protubérance (118) est mise en prise avec la paroi interne (122) de la paire de réservoirs (104).

2. Échangeur de chaleur (100) selon la revendication 1, l'au moins une protubérance (118) étant formée au centre des parois (106) du carter (102) au niveau des parties d'extrémité (106A) respectives du carter (102).

3. Échangeur de chaleur (100) selon la revendication 1, l'échangeur de chaleur (100) étant un refroidisseur de recirculation de gaz d'échappement.

4. Échangeur de chaleur (100) selon la revendication 1, comprenant en outre une pluralité d'éléments d'échange de chaleur (110) étendus entre une paire de collecteurs (112) du carter (102), la pluralité d'éléments d'échange de chaleur (110) étant raccordés fluidiquement à la paire de réservoirs (104) afin de former le premier circuit de fluide (108) et de permettre une distribution d'un premier fluide à travers celui-ci.

5. Échangeur de chaleur (100) selon l'une quelconque des revendications précédentes, comprenant en outre un chanfrein (202) formé sur la paroi interne (122) de la paire de réservoirs (104) afin de permettre un glissement de l'au moins une protubérance (118) sur le chanfrein (202) pour accoupler les parties d'extrémité (106A) du carter (102) à la paire de réservoirs (104).

6. Échangeur de chaleur (100) selon l'une quelconque des revendications précédentes, la forme de l'au moins une protubérance (118) étant l'une quelconque parmi une forme rectangulaire, cylindrique, polygonale, triangulaire et de chanfrein.

7. Échangeur de chaleur (100) selon la revendication 1, la hauteur de l'au moins une protubérance (118) étant inférieure à 300 microns.

8. Échangeur de chaleur (100) selon l'une quelconque des revendications précédentes, les parties d'extrémité (106A) du carter (102) et la paroi interne (122) de la paire de réservoirs (104) étant brasées pour former un raccordement rigide entre le carter (102) et la paire de réservoirs (104).

9. Procédé (400) pour l'accouplement d'un carter (102) à au moins un réservoir (104) d'un refroidisseur de recirculation de gaz d'échappement (100), comprenant :

la formation d'au moins une protubérance (118) de chaque côté de parois (106) du carter (102) à proximité de bords transversaux (120) des parois (106) du carter (102) ;

la réception d'une partie d'extrémité (106A) du carter (102) dans l'au moins un réservoir (104) ;

la mise en prise de l'au moins une protubérance (118) formée sur le carter (102) avec une paroi interne (122) de l'au moins un réservoir (104) ; et

la courbure de la partie d'extrémité (106A) du carter (102) vers l'intérieur tandis que l'au moins une protubérance (118) formée sur le carter (102) est mise en prise avec la paroi interne (122) de l'au moins un réservoir (104).

10. Procédé (400) selon la revendication 9, comprenant en outre :

le brasage de la partie d'extrémité (106A) du carter (102) avec la paroi interne (122) de l'au moins un réservoir (104) pour former un raccordement entre le carter (102) et l'au moins un réservoir (104).

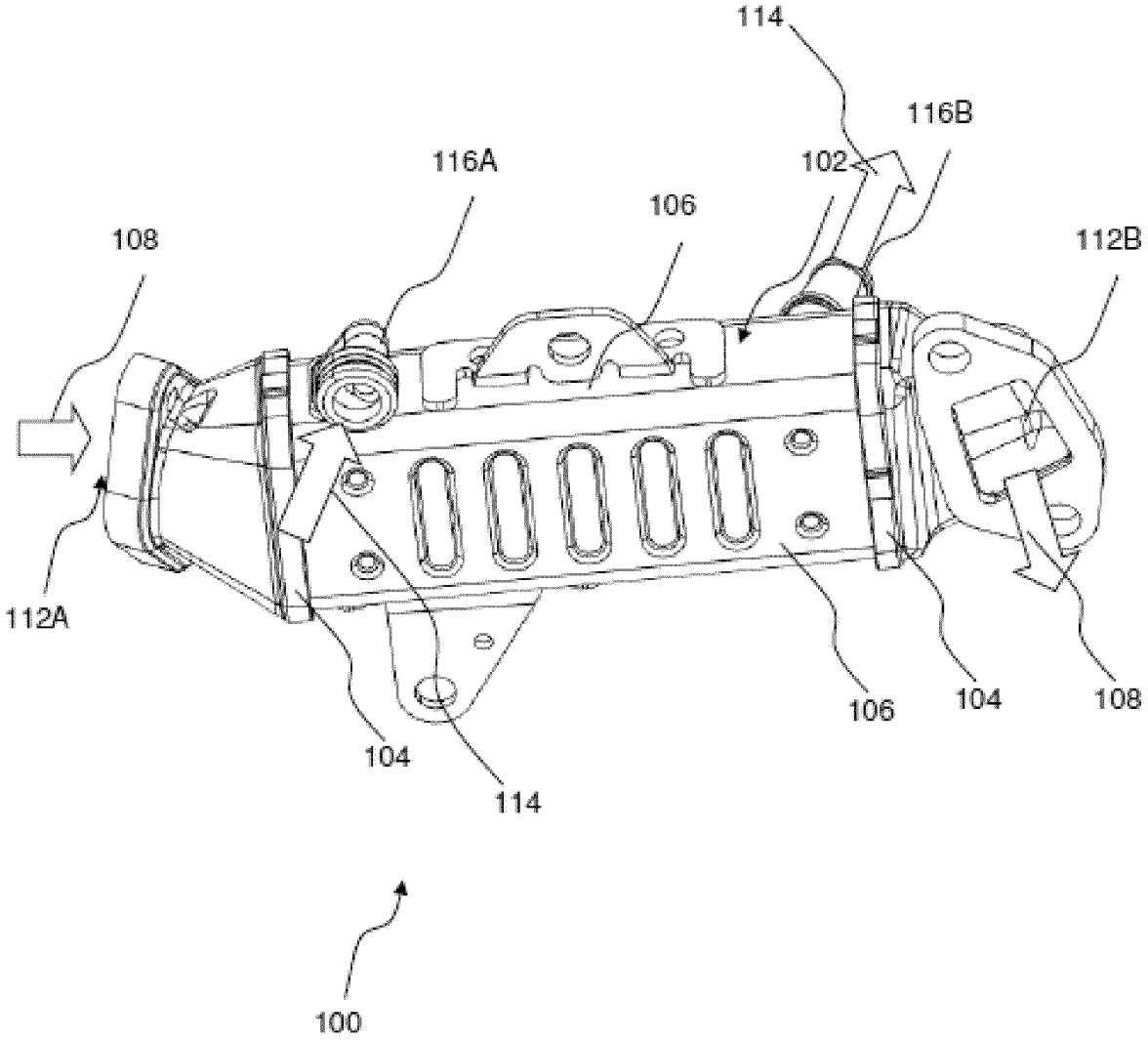

FIG. 1A

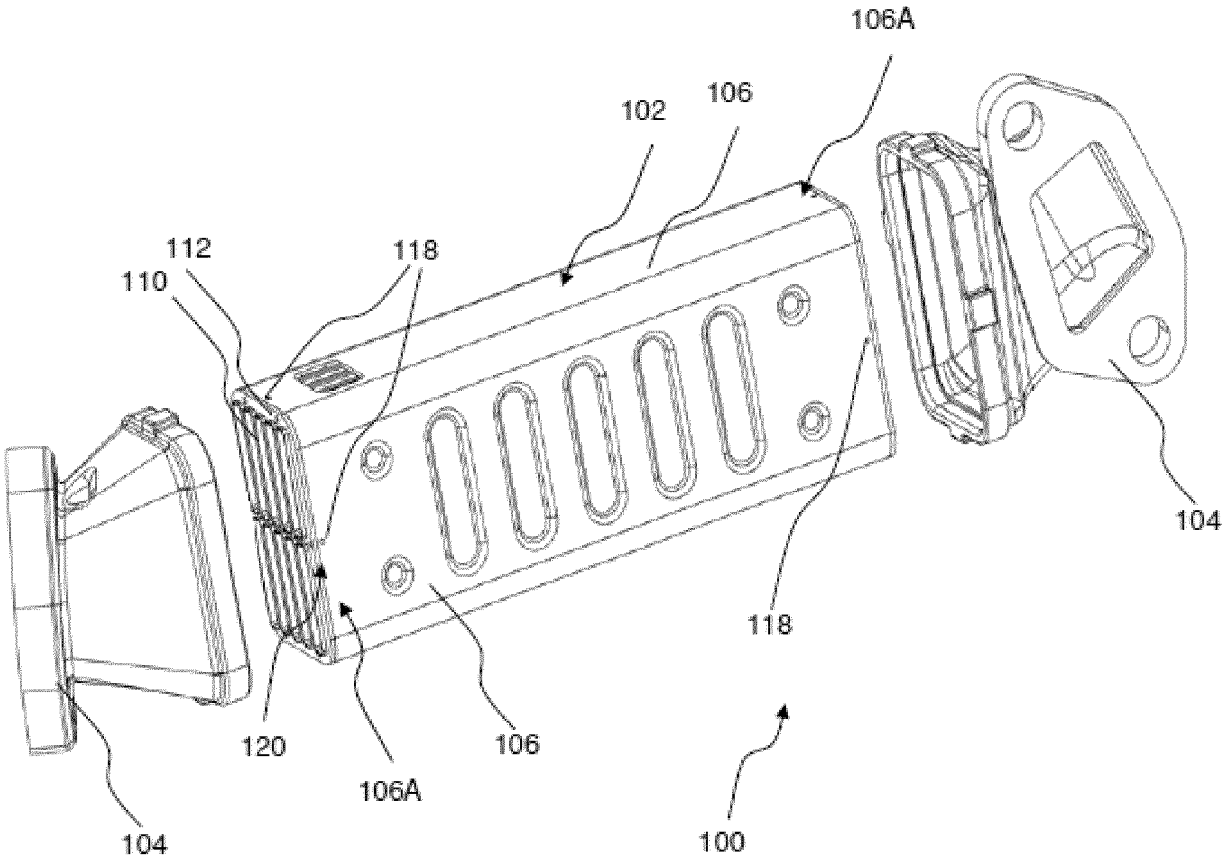

FIG. 1B

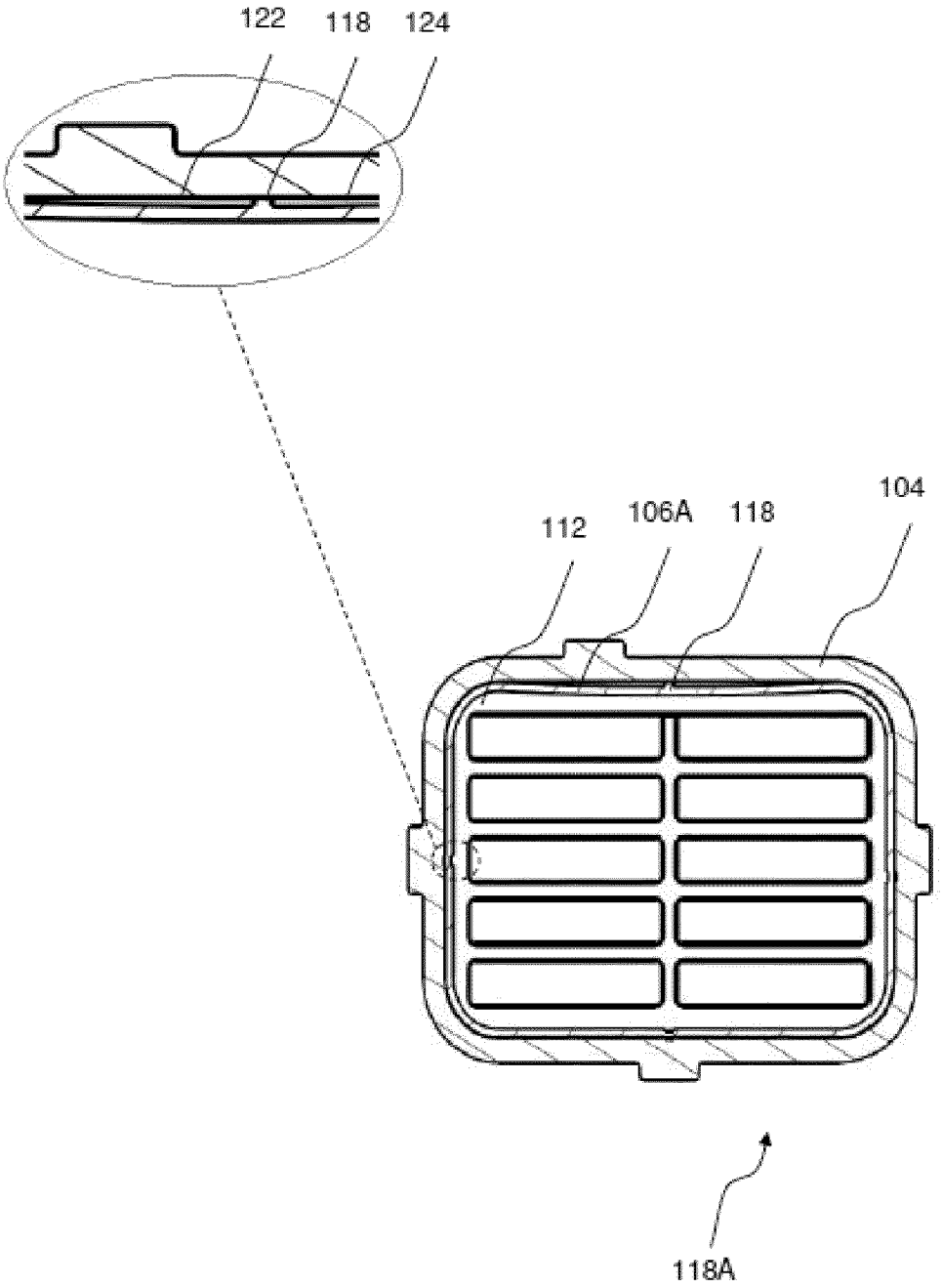

FIG. 1C

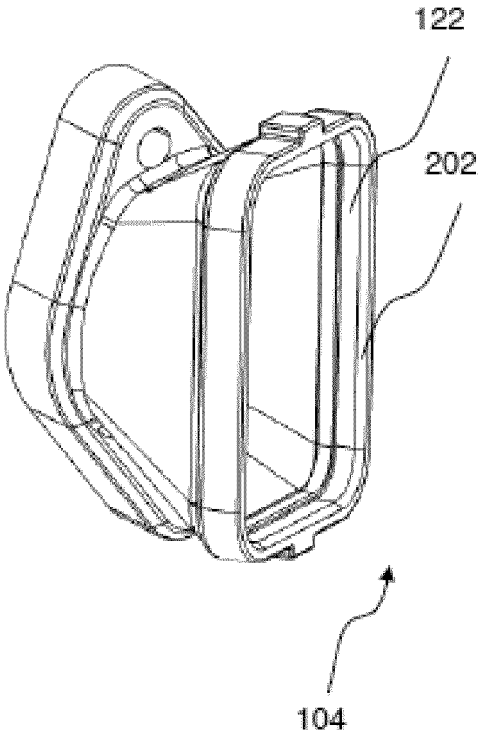

FIG. 2

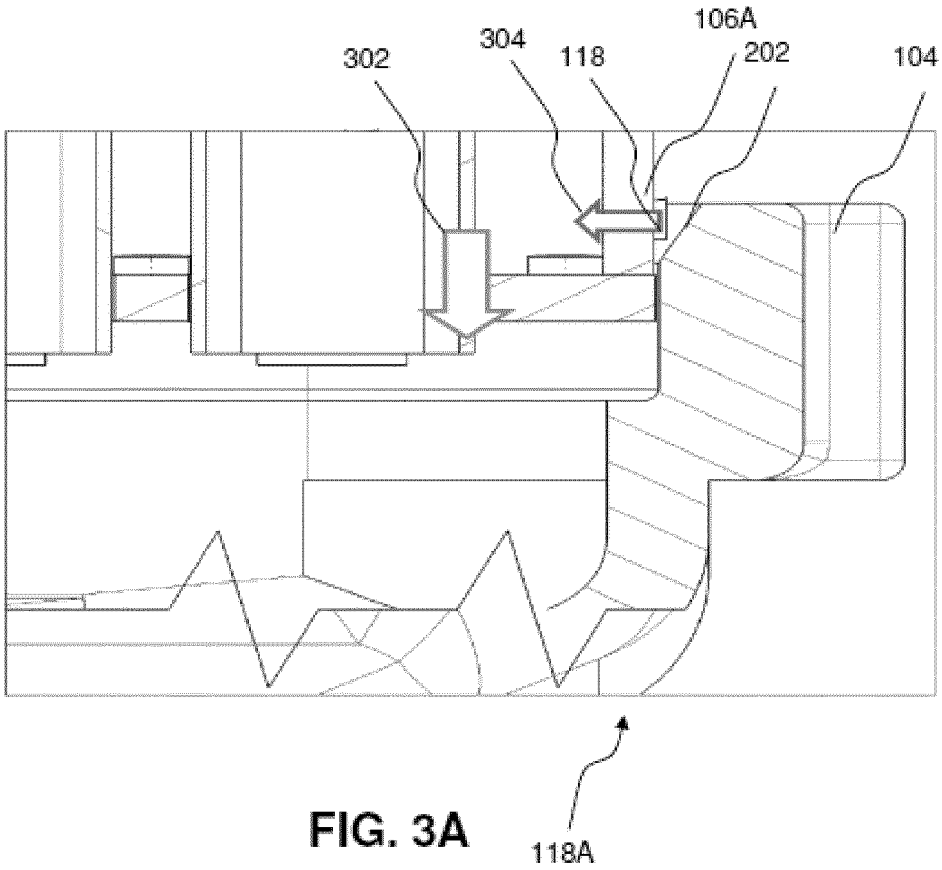

FIG. 3A

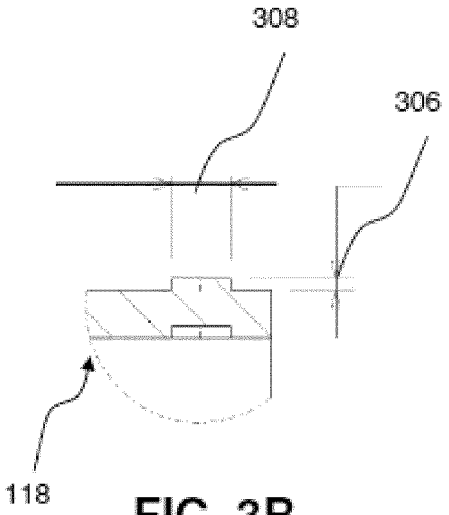

FIG. 3B

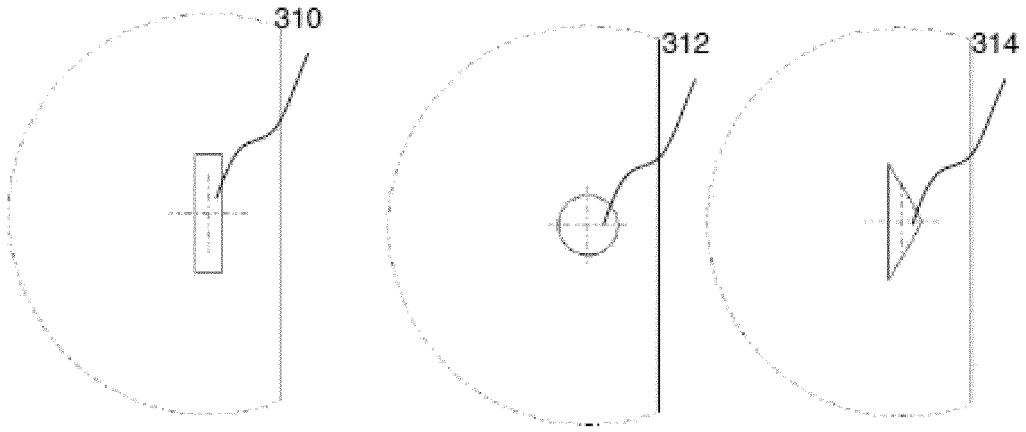

FIG. 3C

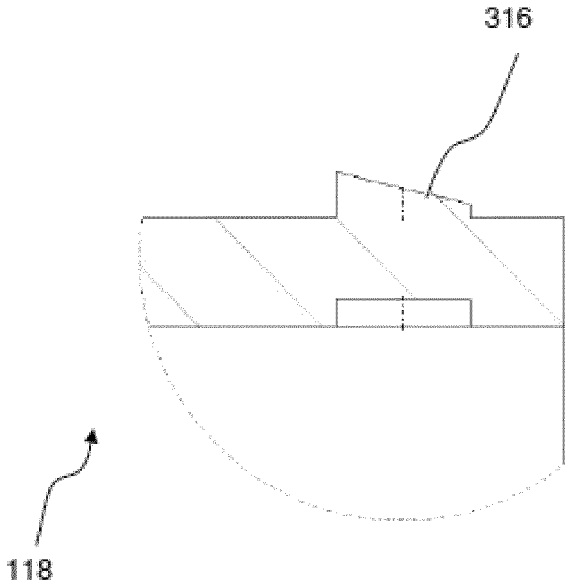

FIG. 3D

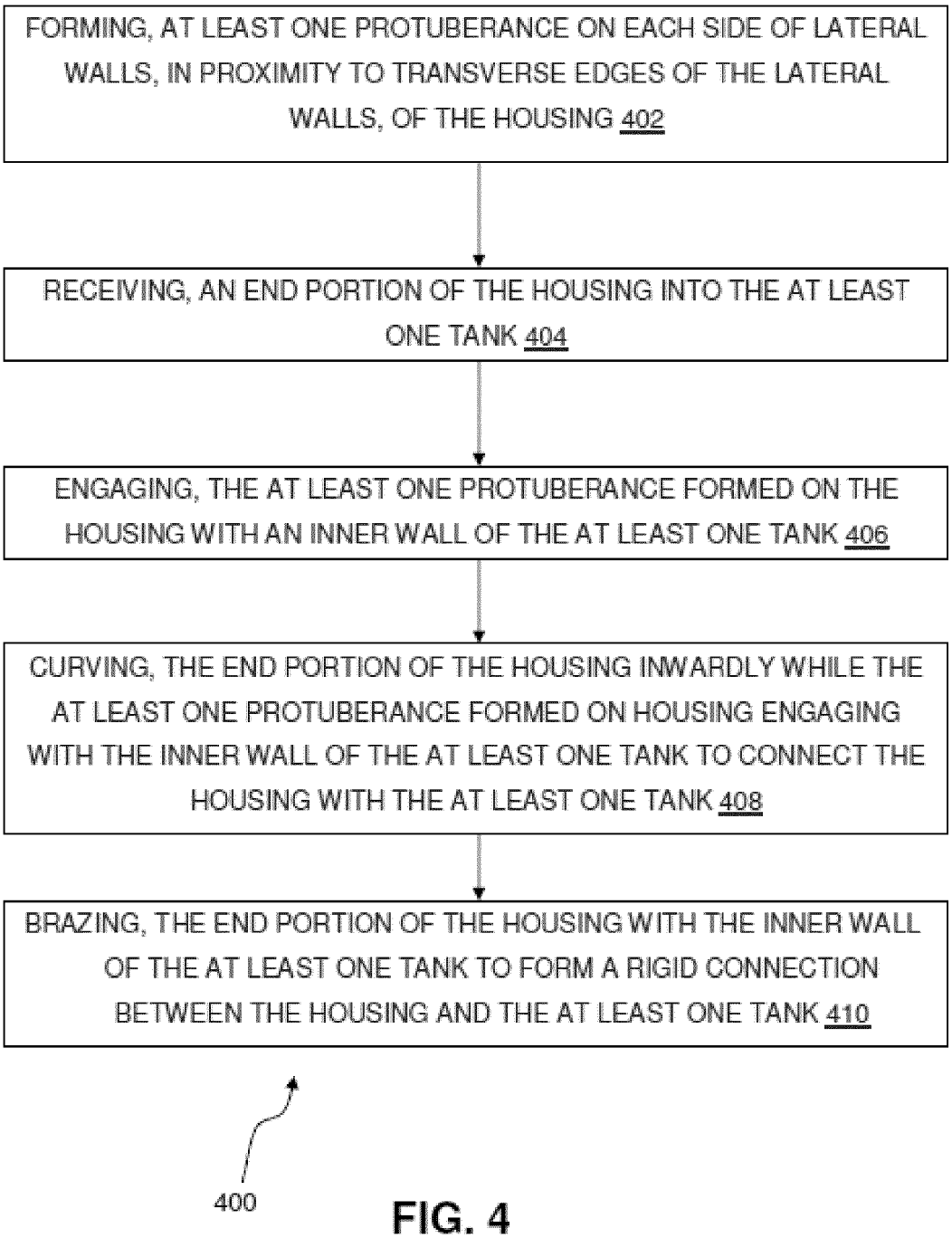
FORMING, AT LEAST ONE PROTUBERANCE ON EACH SIDE OF LATERAL WALLS, IN PROXIMITY TO TRANSVERSE EDGES OF THE LATERAL WALLS, OF THE HOUSING 402
RECEIVING, AN END PORTION OF THE HOUSING INTO THE AT LEAST ONE TANK 404
ENGAGING, THE AT LEAST ONE PROTUBERANCE FORMED ON THE HOUSING WITH AN INNER WALL OF THE AT LEAST ONE TANK 406
CURVING, THE END PORTION OF THE HOUSING INWARDLY WHILE THE AT LEAST ONE PROTUBERANCE FORMED ON HOUSING ENGAGING WITH THE INNER WALL OF THE AT LEAST ONE TANK TO CONNECT THE HOUSING WITH THE AT LEAST ONE TANK 408
BRAZING, THE END PORTION OF THE HOUSING WITH THE INNER WALL OF THE AT LEAST ONE TANK TO FORM A RIGID CONNECTION BETWEEN THE HOUSING AND THE AT LEAST ONE TANK 410
400

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2787211 A **[0001]**