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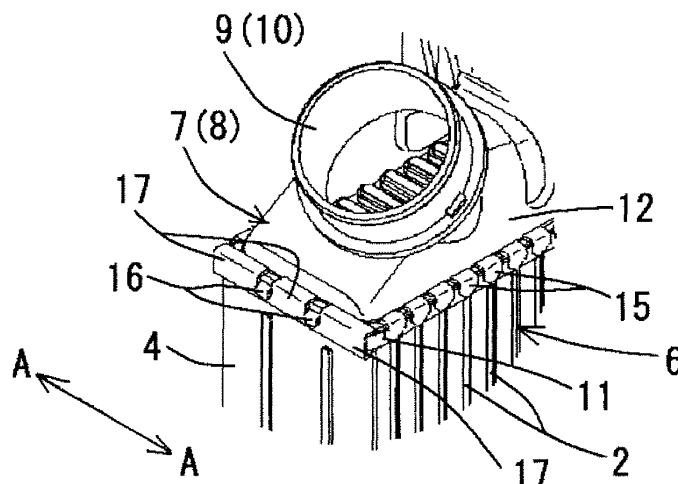
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(54) **Heat Exchanger**

(57) A heat exchanger (1) includes a tank (7, 8) having a seat plate (11) inserted with tubes (2) and a tank forming member (12) connected to the seat plate (11), and a side plate (4), wherein first claws (15) caulked to the tank forming member (12) and second claws (16) caulked to the side plate (4) are provided on an outer edge portion of the seat plate (11), and third claws (17)

caulked to the seat plate (11) and the tank forming member (12) are provided on the side plate (4). In the heat exchanger (1), while the processing ability of the seat plate (11) and the side plate (4) can be improved, the connecting strength between the seat plate (11) and the tank forming member (12) can be effectively increased, and ultimately, the pressure resistance and the sealability of the tank (7, 8) can be increased.

FIG. 2



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Description

[0001] The present invention relates to a heat exchanger, and, more specifically, to a heat exchanger suitable for vehicles, in particular, as an intercooler.

[0002] A so-called stacking type heat exchanger stacked with tubes and fins alternately is well known (for example, JP-A-2004-308970). Figs. 6 to 8 depict an example of such a conventional heat exchanger. Heat exchanger 100 has heat exchanger core portion 104 stacked with tubes 101 and fins 102 alternately and provided with side plate 103 at an outermost-layer position in the stacking direction. Tank 105 is provided on an end portion of heat exchanger core portion 104 in the extending direction of tubes 101. This tank 105 is formed from a seat plate 106 inserted with tubes 101 and a tank forming member 107. First claws 108 are provided on an outer edge portion of seat plate 106, and first claws 108 are caulked to a collar 109 provided on an outer edge portion of tank forming member 107. Further, second claws 110 are provided on an end portion of seat plate 106 in the longitudinal direction (a left/right direction in Fig. 8), and second claws 110 are caulked to side plate 103. A seal material 111 fitted into a groove 112 is provided on seat plate 106, and the gastight property of the inside of tank 105 is ensured by the seal material 111. In Fig. 8, although seal material 111 does not show its cross section, in order to distinguish seal material 111 from other portions, it is depicted as being hatched.

[0003] In the above-described heat exchanger 100, however, first claw 108 cannot be provided at a round portion (R portion) on a corner portion 113 of seat plate 106. Therefore, there is a fear that the connecting strength along the width direction of tank 105 (A-A direction in Fig. 6) may slightly decrease as compared with that of other portions. In order to compensate such a decrease of connecting strength, for example, a method may be considered wherein seat plate 106 is made from a high-strength material or formed as a thicker member, and the strength of first claw 108 is increased, thereby compensating the connecting strength, but, because seat plate 106 must be subjected to deep drawing, the processing ability of seat plate 106 may be reduced in such a method. Further, if the curvature of the above-described R portion on corner portion 113 is set smaller, the straight portion of seat plate 106 can be lengthened and consequently the connecting strength can be increased. However, if the curvature of the R portion on corner portion 113 becomes too small, cracks and the like may be generated on corner portion 113 when seat plate 106 is formed by pressing and the like. In a case where a material having a large elongation is employed and seat plate 106 is formed from such a material, there is a fear that the caulking strength of first claw 108, ultimately, the pressure resistance of tank 105, may decrease. Further, if the curvature of the R portion on corner portion 113 becomes small, the workability and the sealability at the time of fitting seal material 111 into groove

112 of seat plate 106 may be reduced.

[0004] It would be desirable to provide a heat exchanger suitable as an intercooler, capable of increasing the caulking strength between a seat plate and a tank forming member forming a tank, ultimately, increasing the pressure resistance and sealability of the tank.

[0005] A heat exchanger according to the present invention comprises a heat exchanger core portion stacked with tubes and fins alternately and having a side plate provided at each outermost-layer position in the stacking direction, and tanks provided at both sides in the extending direction of the tubes of the heat exchanger core portion and each having a seat plate inserted with the tubes and a tank forming member connected to the seat plate, and is characterized in that first claws caulked to the tank forming member and second claws caulked to the side plate are provided on an outer edge portion of the seat plate, and third claws caulked to the seat plate and the tank forming member are provided on the side plate.

[0006] In such a structure, since third claws caulked to the seat plate and the tank forming member are provided on the side plate and it is possible to provide the third claw at a position closer to an end of the tank in the width direction of the tank than a position of the first claw provided on the seat plate, the caulking strength of the tank along its width direction, ultimately, the pressure resistance of the tank, may be increased. Further, by providing third claws, because the connecting strength between the seat plate and the tank forming member can be increased without making the curvature of a round portion on a corner portion of the seat plate, the processing ability of the seat plate may be improved as well as the assembling ability of a seal material may be improved. Furthermore, since generally a side plate has a simple form as compared with that of a seat plate, even if a high-strength material or a thick material is used as a raw material for forming the side plate, the processing ability of the side plate may not be damaged.

[0007] In the heat exchanger according to the present invention, it is preferred that a dimension in the width direction of the side plate is set to be equal to or less than a dimension in the width direction of the seat plate. For example, if the dimension in the width direction of the side plate is set to be equal to the dimension in the width direction of the seat plate, the seat plate may be caulked by the third claws of the side plate over a broad range in the width direction of the seat plate. Further, if the dimensional relationship in the width direction between the side plate and the seat plate is set as described above and the third claws are provided on both end portions in the width direction of the side plate, the caulking strength may be efficiently increased.

[0008] Further, it is preferred that the second claws and the third claws are disposed alternately in the width direction of each tank. In such a structure, both the second claws and the third claws may properly function, respectively.

[0009] The structure of the heat exchanger according

to the present invention can be applied to a so-called stacking type heat exchanger in which tubes and fins are stacked alternately, and it is suitable for a heat exchanger for vehicles, in particular, as an intercooler for vehicles.

[0010] Thus, in the heat exchanger according to the present invention, while the processing ability of the seat plate and the side plate can be improved, the connecting strength between the seat plate and the tank forming member can be effectively increased, and ultimately, the pressure resistance and the sealability of the tank can be increased.

[0011] Further features and advantages of the present invention will be understood from the following detailed description of the preferred embodiments of the present invention with reference to the accompanying figures, of which:

Fig. 1 is an elevational view of an intercooler as a heat exchanger according to an embodiment of the present invention.

Fig. 2 is a partial perspective view of a tank portion of the intercooler depicted in Fig. 1, showing a connecting state between a seat plate and a tank forming member which form a tank.

Fig. 3 is a partial perspective view of a tank portion according to another embodiment of the present invention.

Fig. 4 is an enlarged vertical sectional view of a connection portion between a seat plate and a tank forming member which form a tank of the intercooler depicted in Fig. 1.

Fig. 5 is an enlarged partial plan view of a seat plate of the intercooler depicted in Fig. 1.

Fig. 6 is a partial perspective view of a tank portion of a conventional heat exchanger, showing a connecting state between a seat plate and a tank forming member which form a tank.

Fig. 7 is an enlarged vertical sectional view of a connection portion between a seat plate and a tank forming member which form a tank of the heat exchanger depicted in Fig. 6.

Fig. 8 is an enlarged partial plan view of a seat plate of the heat exchanger depicted in Fig. 6.

[0012] Figs. 1, 2 and 4, 5 depict a heat exchanger according to an embodiment of the present invention. In this embodiment, the heat exchanger is formed as an intercooler. Intercooler 1 has a heat exchanger core portion 6 stacked with tubes 2 and fins 3 alternately and having a side plate 4 provided at each outermost-layer position in the stacking direction. On each side of heat exchanger core portion 6 in the extending direction of tubes 2, an introduction tank 7 for introducing a heat medium (in this embodiment, supercharged gas) into respective tubes 2 and a discharge tank 8 for sending the heat medium (gas) discharged from the respective tubes 2 to an external side (an engine side) are provided. Inlet pipe connecting portion 9 connected to an inlet pipe (not

shown) for introducing the heat medium into introduction tank 7 is provided on the introduction tank 7. Outlet pipe connecting portion 10 connected to an outlet pipe (not shown) for discharging the heat medium from discharge tank 8 is provided on the discharge tank 8.

[0013] Each of introduction tank 7 and discharge tank 8 is formed from a seat plate 11 and a tank forming member 12. As shown in Fig. 5, tube insertion holes 13 being inserted with tubes 2 are provided on seat plate 11. A plurality of first claws 15, being caulked to a color 14 formed on an outer-edge portion of tank forming member 12, are provided on an outer-edge portion of seat plate 11. At least one second claw 16, being caulked to side plate 4, is provided on each end in the longitudinal direction of seat plate 11. In a case where a plurality of second claws 16 are provided on each longitudinal end of seat plate 11, they are disposed along the width direction of seat plate 11 (along A-A direction depicted in Fig. 2 and along the vertical direction in Fig. 5). Further, third claws 17, being caulked to seat plate 11 and color 14 of tank forming member 12, are provided on each longitudinal end of side plate 4 and they are arranged along the width direction of side plate 4 (along A-A direction depicted in Fig. 2 and along the vertical direction in Fig. 5). In this embodiment, third claws 17 are provided on both end portions in the width direction of side plate 4 (in the vertical direction in Fig. 5).

[0014] As shown in Fig. 2, second claws 16 and third claws 17 are disposed alternately in the width direction of tank 7, 8 (in A-A direction depicted in Fig. 2). Where, as another embodiment is shown in Fig. 3, it is possible to provide second claw 16 at a central position in the width direction of tank 7, 8 and provide third claws 17 on both sides thereof. Further, in this embodiment, the dimension in the width direction of side plate 4 is set to be smaller than the dimension in the width direction of seat plate 11 (in A-A direction depicted in Fig. 2 and in the vertical direction in Fig. 5).

[0015] As shown in Fig. 5, a groove 19 is defined on seat plate 11, and a seal material 18 formed from a rubber and the like is fitted into the groove 19, thereby ensuring the gastight property of tank 7, 8 by the seal material 18.

[0016] In this embodiment, because third claws 17 being caulked to seat plate 11 and color 14 of tank forming member 12 are provided on side plate 4 and the third claws 17 can be provided at positions closer to the ends in the width direction of tank 7, 8 as compared with claws provided in a conventional seat plate (claws 108 depicted in Fig. 8), the caulking strength of tank 7, 8 in its width direction, ultimately, the pressure resistance of the whole of the tank, can be increased. Further, as shown in Fig. 4, because third claw 17 is caulked at a condition where the edge portion of seat plate 11 becomes a fulcrum of the caulking, the working of the caulking can be easily carried out. Further, by providing third claws 17, the connecting strength between seat plate 11 and tank forming member 12 can be increased without making the curvature of the round portion on corner portion 20 of seat plate

11. Therefore, the processing ability of seat plate 111 can be improved as well as the assembling ability of seal material 18 can be improved. Furthermore, since side plate 4 generally has a simple form as compared with a form of seat plate 11, even if a high-strength raw material or a thick raw material is used as a material for forming side plate 4, the processing ability of side plate 4 is not injured.

[0017] Further, since the dimension in the width direction of side plate 4 is set to be equal to or less than the dimension in the width direction of seat plate 11, seat plate 11 can be caulked by third claws 17 of side plate 4, effectively and over a broad range in the end portion in the width direction of seat plate 11, and the caulking strength can be increased efficiently.

[0018] The present invention can be applied to any heat exchanger wherein a tank is formed with two members by caulking, and particularly it is suitable as an intercooler for vehicles.

Claims

1. A heat exchanger comprising a heat exchanger core portion stacked with tubes and fins alternately and having a side plate provided at each outermost-layer position in the stacking direction, and tanks provided at both sides in the extending direction of said tubes of said heat exchanger core portion and each having a seat plate inserted with said tubes and a tank forming member connected to said seat plate, **characterized in that** first claws caulked to said tank forming member and second claws caulked to said side plate are provided on an outer edge portion of said seat plate, and third claws caulked to said seat plate and said tank forming member are provided on said side plate.
2. The heat exchanger according to claim 1, wherein a dimension in the width direction of said side plate is set to be equal to or less than a dimension in the width direction of said seat plate.
3. The heat exchanger according to claim 1 or 2, wherein said third claws are provided on both end portions in the width direction of said side plate.
4. The heat exchanger according to any preceding claim, wherein said second claws and said third claws are disposed alternately in the width direction of said each tank.
5. The heat exchanger according to any preceding claim, wherein said heat exchanger is a heat exchanger for vehicles.
6. The heat exchanger according to claim 5, wherein said heat exchanger for vehicles is an intercooler.

FIG. 1

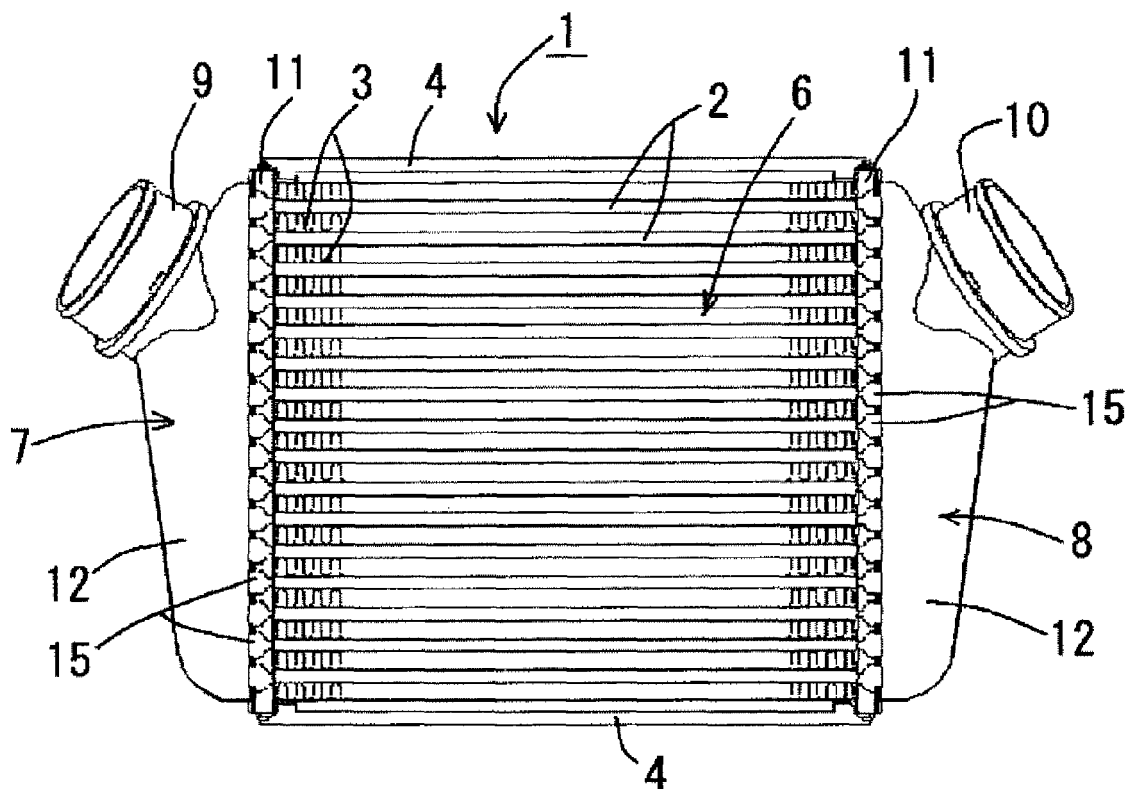


FIG. 2

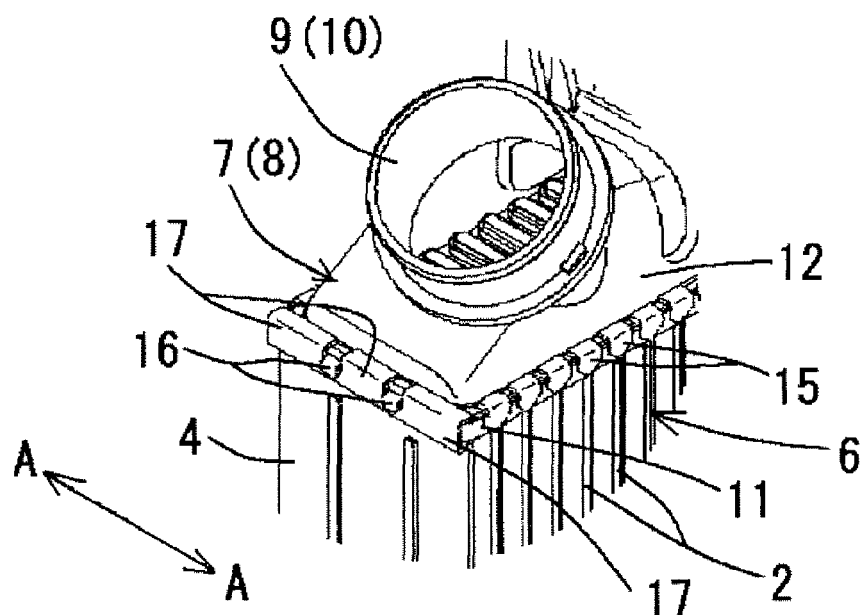


FIG. 3

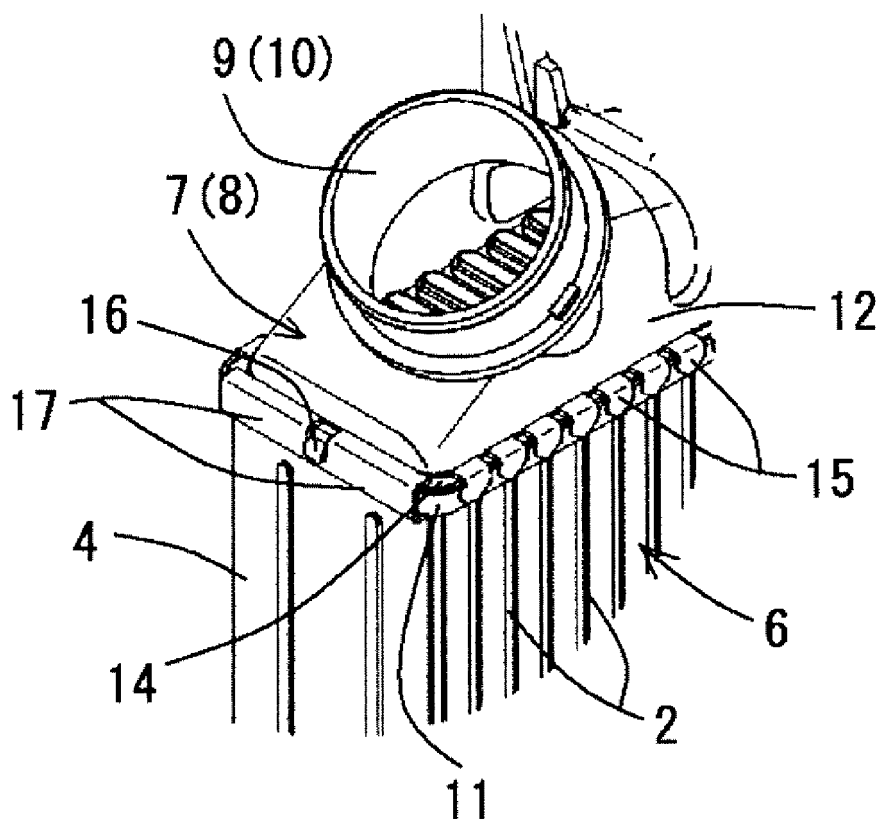


FIG. 4

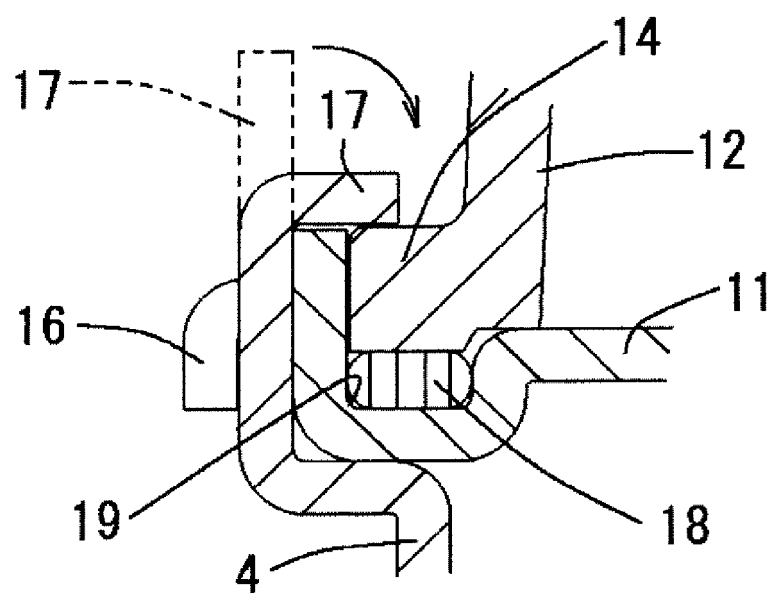


FIG. 5

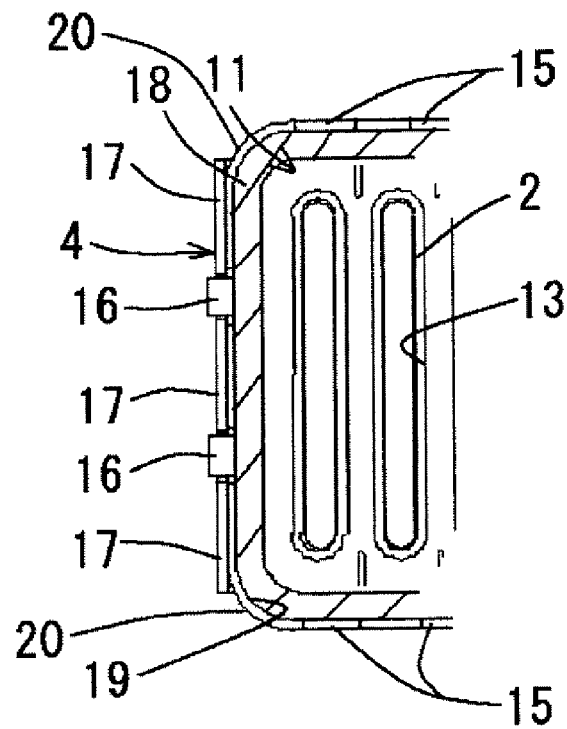


FIG. 6

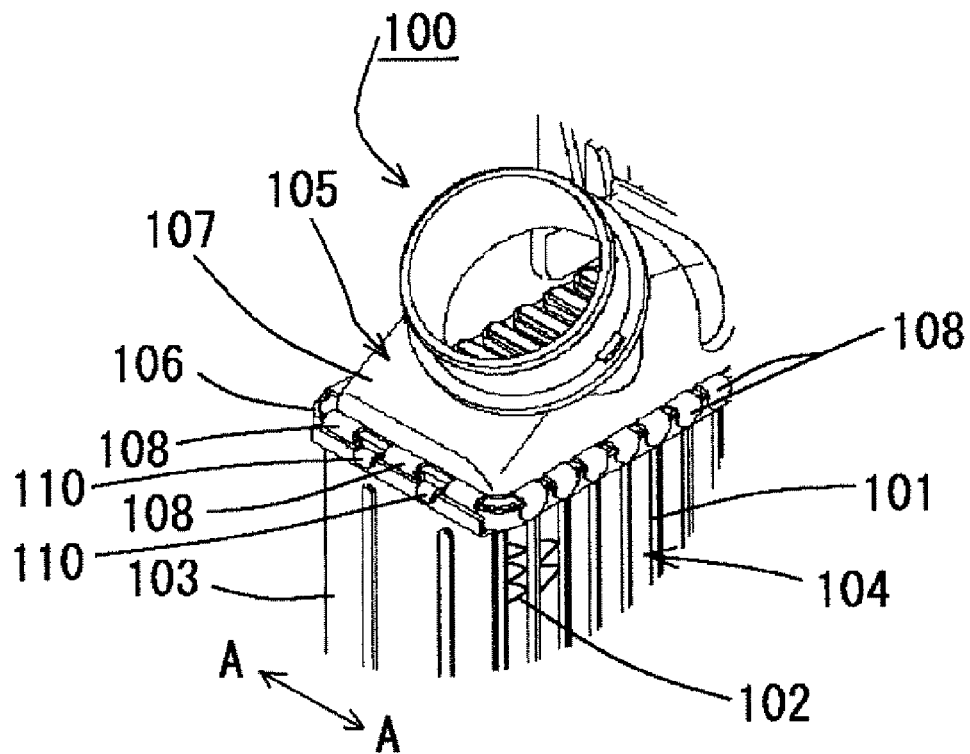


FIG. 7

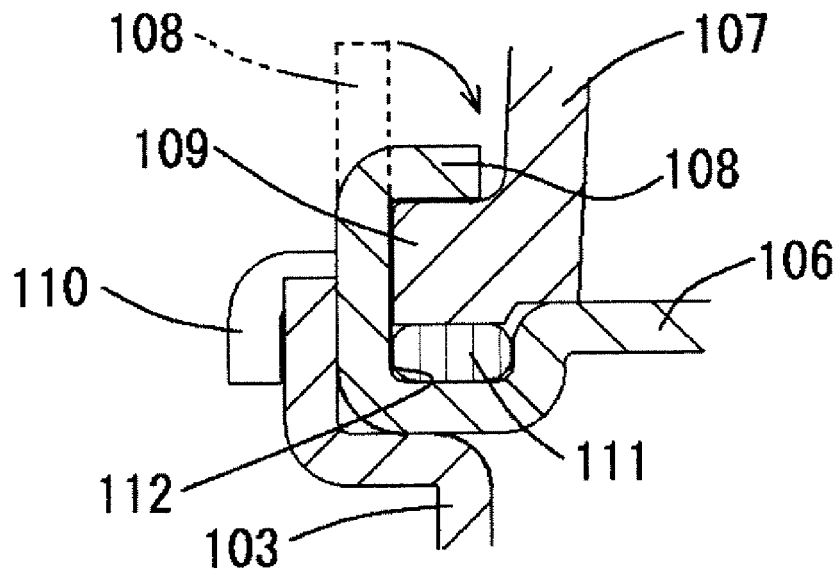
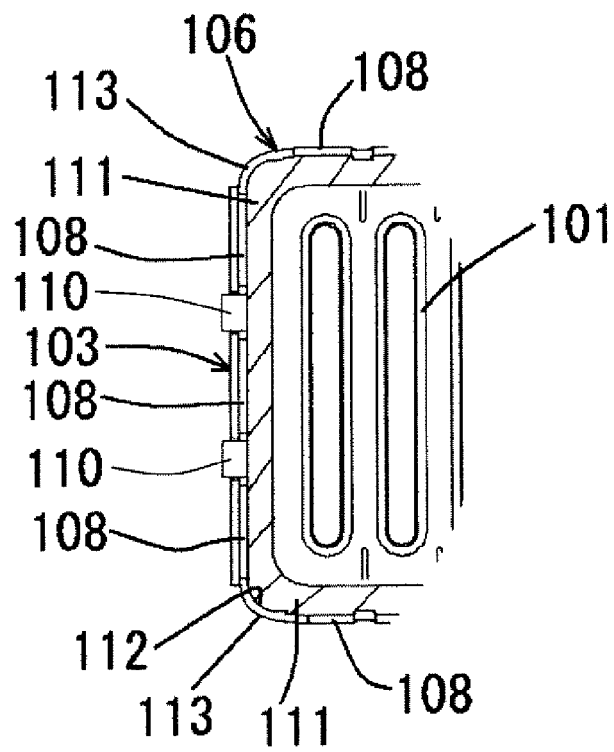


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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