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(54) **Heat exchange device**

(57) The present invention provides a heat exchange device in which a first heat exchanger and a second heat exchanger are arranged in parallel along the air flow direction, and a side plate of the first heat exchanger is integrated with a tank communicating with tubes of the second heat exchanger through which a fluid flows.

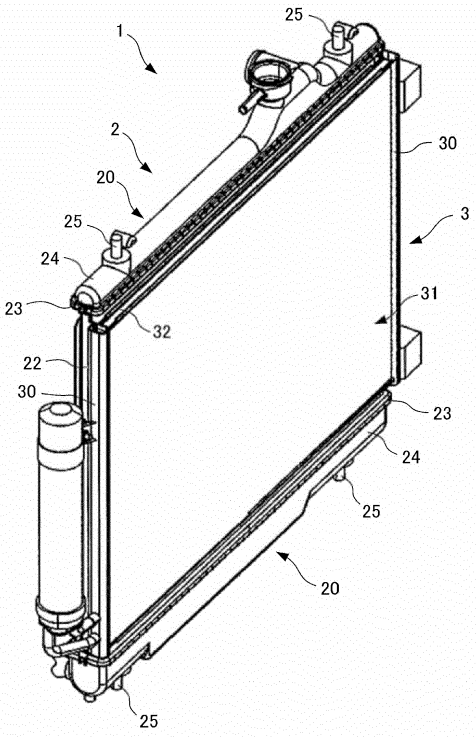


FIG.1

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## Description

### TECHNICAL FIELD OF THE INVENTION

**[0001]** The present invention relates to a heat exchange device.

### BACK GROUND OF THE INVENTION

**[0002]** JP11-223486A discloses a device in which a tank of a radiator and a side plate of a condenser are brazed and bonded to each other.

**[0003]** When a radiator and a condenser are individually attached to a vehicle body or the like, an attachment portion has to be provided for each of the radiator and the condenser. Thus, the number of parts is increased, weight is increased, and cost is increased. In addition, the processing man-hour is increased, so that working efficiency is not favorable.

**[0004]** In contrast, by using the above technique, the radiator and the condenser are bonded to each other and then attached to the vehicle body or the like. Thus, the number of parts can be reduced, so that the above problem can be solved.

**[0005]** However, in the above technique, by separately setting up and then brazing the radiator and the condenser, the radiator and the condenser are bonded to each other. Thus, there is a fear that bonding failure is generated by distortion due to thermal deformation at the time of bonding. When attached to the vehicle body or the like in such a state, the radiator or the condenser is attached to the vehicle body in an unstable state.

### SUMMARY OF THE INVENTION

**[0006]** The present invention is achieved in consideration with such a point, and an object thereof is to stably attach a condenser and a radiator while reducing the number of parts to reduce weight, suppress cost, and decrease the processing man-hour.

**[0007]** A heat exchange device according to an aspect of the present invention is a heat exchange device in which a first heat exchanger and a second heat exchanger are arranged in parallel along the air flow direction, wherein a side plate of the first heat exchanger is integrated with a tank communicating with tubes of the second heat exchanger through which a fluid flows.

**[0008]** According to this aspect, by integrating the tank and the side plate, bonding failure of the first heat exchanger and the second heat exchanger can be suppressed. Thus, the first heat exchanger and the second heat exchanger can be stably attached while reducing the number of parts to reduce weight, suppress cost, and decrease the processing man-hour.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]**

Fig. 1 is a perspective view of a heat exchange device for a vehicle in the present embodiment.

Fig. 2 is an enlarged perspective view of the upper end side of the heat exchange device.

Fig. 3 is a horizontally sectional view of a first side plate and a header tank.

Fig. 4 is a perspective view of a heat exchange device of a comparative embodiment.

Fig. 5 is a perspective view of a heat exchange device of a comparative embodiment.

Fig. 6 is a perspective view of a heat exchange device of a modified example of the present embodiment.

Fig. 7 is a perspective view of a heat exchange device of a modified example of the present embodiment.

Fig. 8A is a perspective view of the first side plate and the header tank of a modified example of the present embodiment.

Fig. 8B is a horizontally sectional view of the first side plate and the header tank of the modified example of the present embodiment.

Fig. 9A is a perspective view of the first side plate and the header tank of a modified example of the present embodiment.

Fig. 9B is a horizontally sectional view of the first side plate and the header tank of the modified example of the present embodiment.

Fig. 10A is a perspective view of the first side plate and the header tank of a modified example of the present embodiment.

Fig. 10B is a horizontally sectional view of the first side plate and the header tank of the modified example of the present embodiment.

### DESCRIPTION OF PREFERRED EMBODIMENT

**[0010]** A heat exchange device 1 of a first embodiment of the present invention will be described with reference to the drawings.

**[0011]** Fig. 1 is a perspective view of the heat exchange device 1 for a vehicle. Fig. 2 is an enlarged perspective view of the upper end side of the heat exchange device 1.

**[0012]** The heat exchange device 1 includes a radiator 2 and a condenser 3. The radiator 2 and the condenser 3 are arranged in parallel along the flow direction of running wind. The heat exchange device 1 to be mounted in the vehicle will be described herein. However, the present invention is not limited to this but only requires a plurality of heat exchangers such as the radiator 2 and the condenser 3 to be arranged in parallel along the air flow direction.

**[0013]** The radiator 2 includes radiator tanks 20, a first core portion 21, and first side plates 22.

**[0014]** Each of the radiator tanks 20 includes a metal plate 23, a resin tank body 24, and attachment portions 25 for attaching the radiator 2 and the condenser 3 to a vehicle body. The tank body 24 and the plate 23 are in-

tegrated by swaging and fixing a part of the plate 23 to the tank body 24.

**[0015]** The first core portion 21 includes first tubes 26 and first fins 27. The first tubes 26 extend along the vertical direction and have ends communicating with the plates 23 of the radiator tanks 20. The plurality of first tube 26 is arranged along the horizontal direction, and each of the first fins 27 is provided between the adjacent first tubes 26. In the first core portion 21, the first cooling water (fluid) whose temperature is increased by cooling for example an engine or the like flows through the first tubes 26, and the first cooling water is cooled by performing heat exchange with the air flowing outside the first tubes 26. By providing the first fins 27, a cooling performance in the first core portion 21 can be improved.

**[0016]** The first side plates 22 extend along the longitudinal direction of the first tubes 26, that is, along the vertical direction, and are arranged on the both end sides of the first core portion 21. The first side plates 22 are bonded to the radiator tanks 20 to reinforce the first core portion 21. The first side plates 22 are made of metal and integrated with header tanks 30 to be described later.

**[0017]** The condenser 3 includes the header tanks 30, a second core portion 31, and second side plates 32.

**[0018]** The header tanks 30 are made of metal and integrated with the first side plates 22 of the radiator 2.

**[0019]** The second core portion 31 includes second tubes 33 and second fins 34. The second tubes 33 extend along the horizontal direction and have ends communicating with the header tanks 30. The plurality of second tubes 33 is arranged along the vertical direction, and each of the second fins 34 is provided between the adjacent second tubes 33. In the second core portion 31, a cooling medium (fluid) pressurized by a compressor or the like (not shown) flows through the second tubes 33, and the cooling medium is cooled and liquefied by performing heat exchange with the air flowing outside. By providing the second fins 34, a cooling performance in the second core portion 31 can be improved. It should be noted that the longitudinal direction of the first tubes 26 and the longitudinal direction of the second tubes 33 are different by 90 degrees, and points where the first tubes 26 and the second tubes 33 are in contact with each other are bonded by brazing. Thereby, the radiator 2 and the condenser 3 can be bonded to each other by bonding the first core portion 21 of the radiator 2 and the second core portion 31 of the condenser 3.

**[0020]** It should be noted that an application example that strength of the entire core is enhanced by bonding the points where the first tubes 26 and the second tubes 33 are in contact with each other by brazing is shown in the present embodiment. However, the first tubes 26 and the second tubes 33 are not necessarily bonded to each other by brazing. Further, the first tubes 26 and the second tubes 33 are not necessarily in contact with each other. The first tubes 26 and the second tubes 33 may be arranged at right angles in a non-contact state where a gap is provided between the tubes.

**[0021]** The second side plates 32 extend along the longitudinal direction of the second tubes 33, that is, along the horizontal direction, and are arranged on the both end sides of the second core portion 31. The second side plates 32 are bonded to the header tanks 30 to reinforce the second core portion 31.

**[0022]** Fig. 3 shows a horizontally sectional view of the first side plate 22 and the header tank 30. In the present embodiment, by bending one metal plate and brazing an end of the plate bent into a tubular shape, the tubular header tank 30 is integrated with the first side plate 22 as shown in Fig. 3.

**[0023]** In the present embodiment, the metal first side plates 22, the header tanks 30, the first core portion 21, the second core portion 31, the second side plates 32, and the like are assembled while arranging a brazing material, and then brought into a heating furnace and heated, so that the brazing material is melted and the parts are brazed. In such a way, the radiator 2 is integrated with the condenser 3.

**[0024]** In a case where the present embodiment is not used and a radiator 40 and a condenser 41 are respectively attached to a vehicle body without integrating the radiator 40 with the condenser 41, attachment portions 42 of the radiator 40 and attachment portions 43 of the condenser 41 are respectively required as shown in Fig. 4. Thus, the number of parts is increased to increase weight. The radiator 40 and the condenser 41 are attached to the vehicle body after individually forming the radiator and the condenser. Thus, the processing man-hour is increased, so that working efficiency is deteriorated. Further, since a space for providing the attachment portions 42, 43 is required, a heat exchange device 45 cannot be downsized.

**[0025]** As shown in Fig. 5, a radiator 50 and a condenser 51 which are individually formed can be integrated with each other via connection members 52. However, in this case, the connection members 52 are required, so that the number of parts is increased to increase weight. In addition, the processing man-hour is increased, so that working efficiency is deteriorated. Furthermore, since a space for providing the connection members 52 is required, a heat exchange device 53 cannot be downsized.

**[0026]** In contrast, in the present embodiment, by integrating the first side plates 22 with the header tanks 30, the number of the attachment portions can be reduced. Since the radiator 2 can be integrated with the condenser 3 without using the connection members 52, the number of parts can be reduced to decrease weight. In addition, the processing man-hour is decreased, so that working efficiency can be improved. Furthermore, the heat exchange device 1 can be downsized.

**[0027]** Further, by integrating the first side plates 22 with the header tanks 30, bonding failure of the radiator 2 and the condenser 3 is suppressed, so that the radiator 2 and the condenser 3 can be stably attached to the vehicle body.

**[0028]** It should be noted that although the first side

plate 22 and the header tank 30 are formed by processing one metal plate, the first side plate and the header tank may be formed by a plurality of parts.

**[0029]** Although the radiator tank 20 using the resin tank body 24 is used, a metal radiator tank 20 may be used as shown in Fig. 6. As shown in Fig. 7, the metal radiator tank 20 may be integrated with the second side plate 32 of the condenser 3. By this, the same effect as the present embodiment can also be obtained.

**[0030]** The first side plates 22 may be integrated with the header tanks 30 and further, the radiator tanks 20 may be integrated with the second side plates 32. Thereby, the radiator 2 and the condenser 3 can be further stably attached to the vehicle body.

**[0031]** The first side plate 22 and the header tank 30 may be formed as shown in Figs. 8A and 8B. Fig. 8A is a perspective view of the first side plate 22 and the header tank 30, and Fig. 8B is a horizontally sectional view. An end of a plate bent into a tubular shape is bent outward and bonded to form the header tank 30.

**[0032]** Further, as shown in Figs. 9A and 9B, a projection portion 60 may be formed in the end of the first side plate 22 and the projection portion 60 may be inserted into a hole 61. Fig. 9A is a perspective view of the first side plate 22 and the header tank 30, and Fig. 9B is a horizontally sectional view. Further, as shown in Figs. 10A and 10B, a part of a point forming the first side plate 22 may be bent toward the header tank 30 and the end of the plate bent into a tubular shape may be held by the bent portions 62 from the outer side. Fig. 10A is a perspective view of the first side plate 22 and the header tank 30, and Fig. 10B is a horizontally sectional view. From these, a spring back of the tubular plate can be prevented, so that the bonding failure at the time of brazing can be suppressed.

**[0033]** The embodiment of the present invention is described above. However, the above embodiment does not limit the technical scope of the present invention to the specific configurations of the above embodiment but only shows a part of the application example of the present invention.

**[0034]** The present application claims priority based on Japanese Patent Application No. 2013-144765 filed to the Japan Patent Office on July 10, 2013, and all the contents of this application are incorporated herein by reference.

## Claims

1. A heat exchange device (1) in which a first heat exchanger (2) and a second heat exchanger (3) are arranged in parallel along the air flow direction, wherein
   a side plate (22) of the first heat exchanger (2) is integrated with a tank (30) communicating with tubes (33) of the second heat exchanger (3) through which a fluid flows.

2. The heat exchange device (1) according to claim 1, wherein
   a tank (20) communicating with tubes (26) of the first heat exchanger (2) through which a fluid flows is integrated with a side plate (32) of the second heat exchanger (3).

3. The heat exchange device (1) according to claim 1 or 2, wherein
   at least one of the tank (20) communicating with the tubes (26) of the first heat exchanger (2) through which the fluid flows and the tank (30) of the second heat exchanger (3) is formed by bending a metal plate (22), and an engagement portion (60, 62) that prevents the bent metal plate (22) from a spring back is provided.

4. The heat exchange device (1) according to any one of claims 1 to 3, wherein
   the tubes (26) through which the fluid of the first heat exchanger (2) flows and the tubes (33) of the second heat exchanger (3) are bonded to each other.

5. The heat exchange device (1) according to any one of claims 1 to 4, wherein
   a fin (27, 34) is provided in at least one of a part between the adjacent tubes (26) of the first heat exchanger (2) and a part between the adjacent tubes (33) of the second heat exchanger (3).

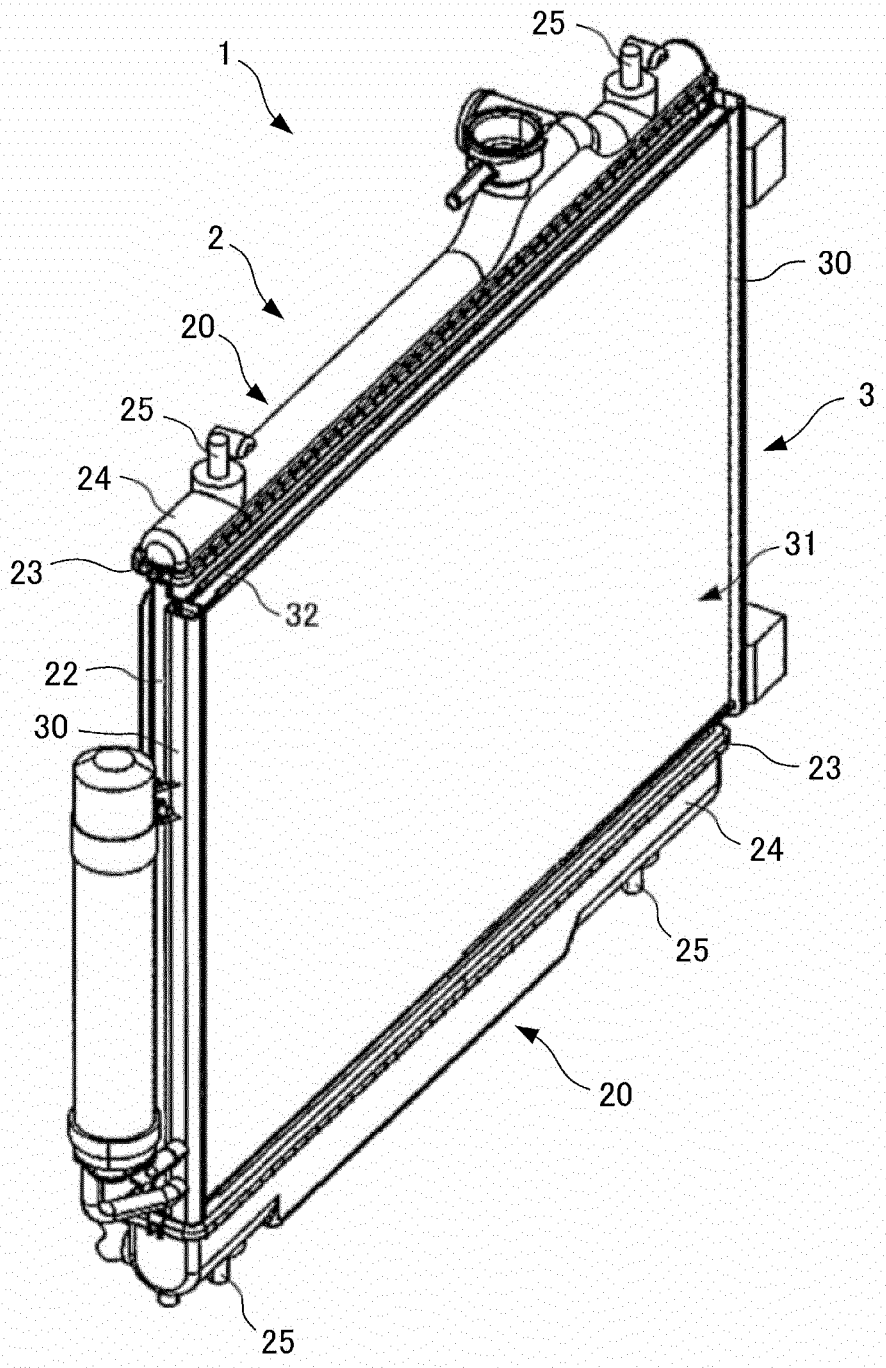



FIG.1

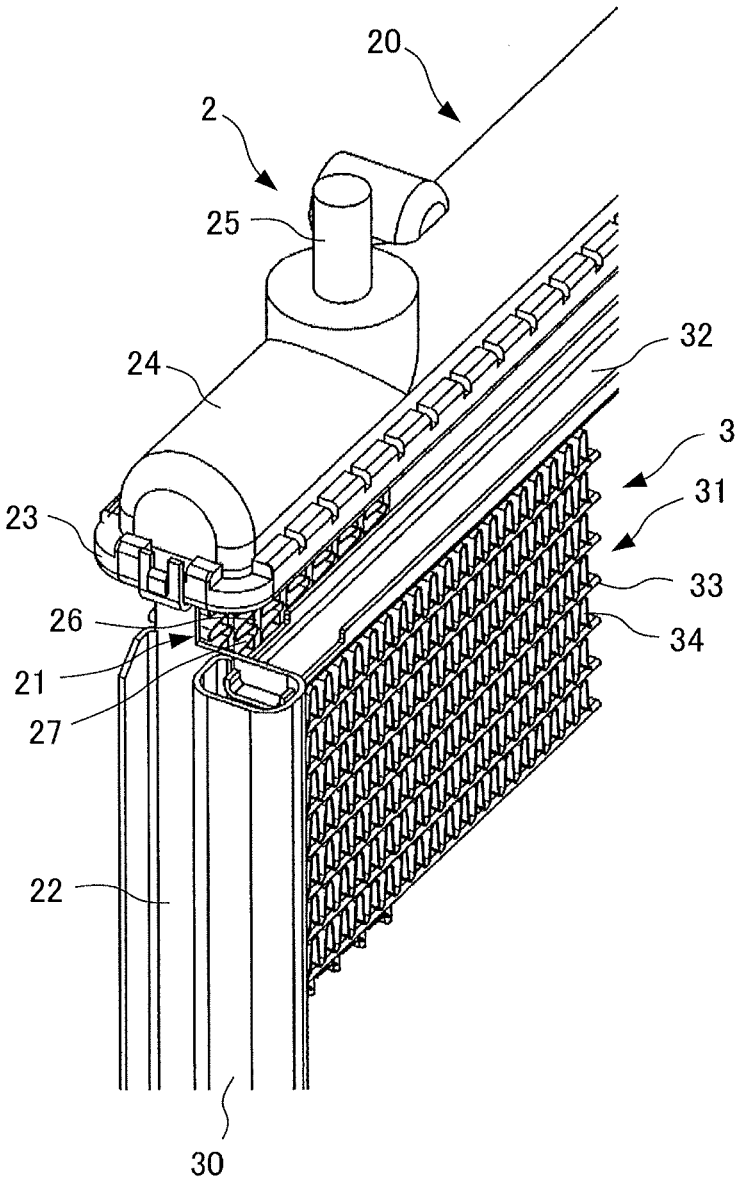



FIG.2

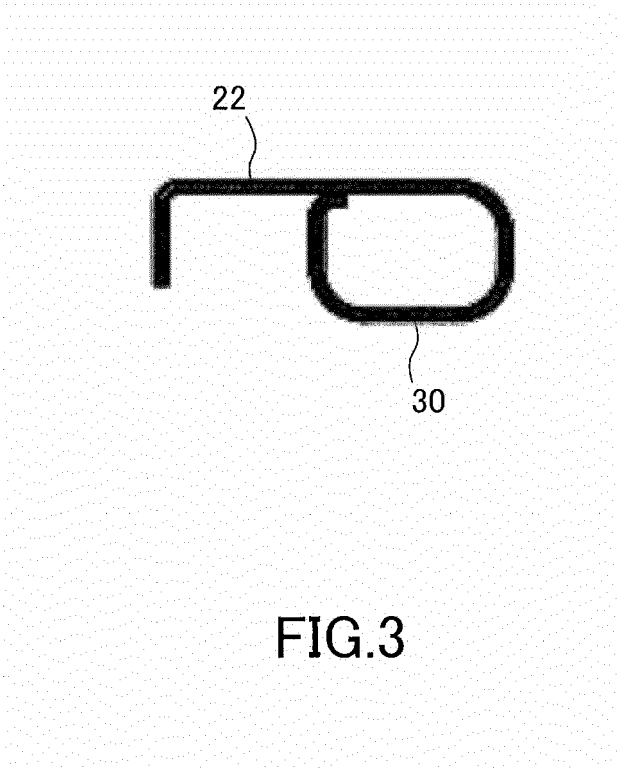



FIG.3

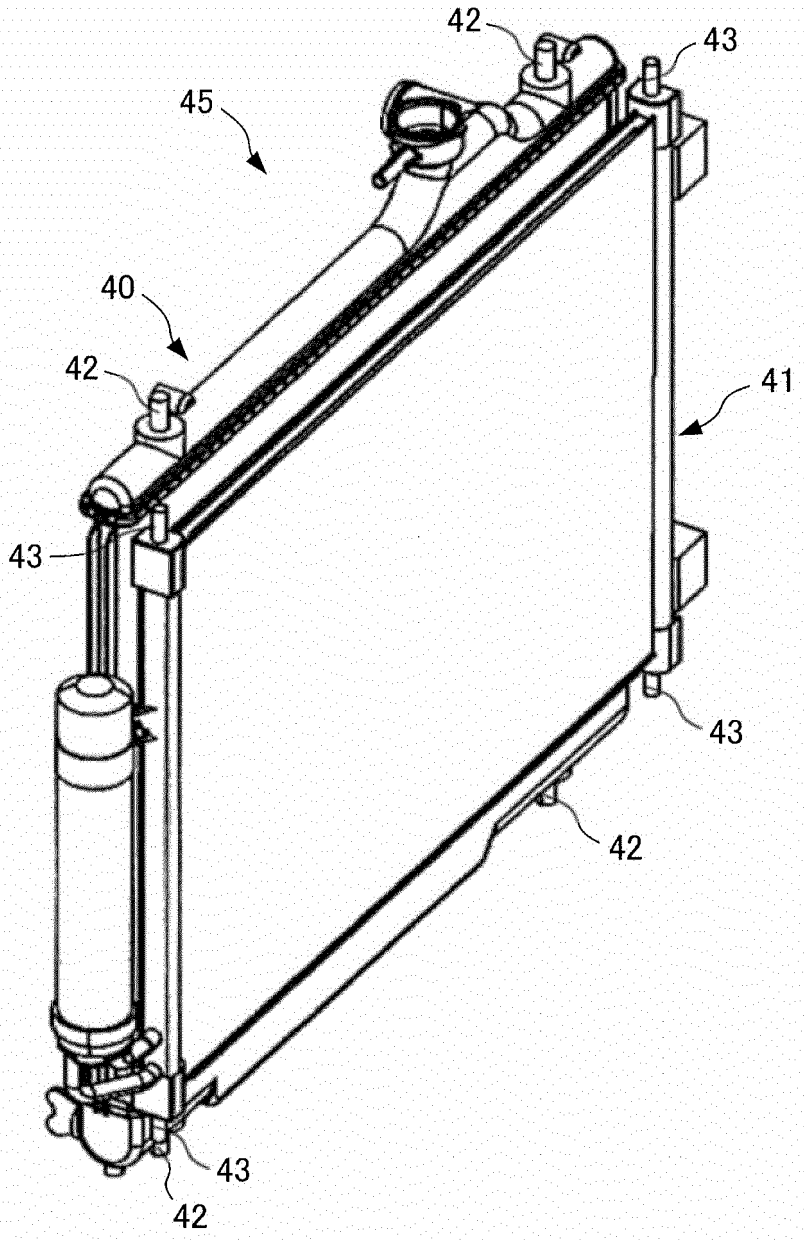



FIG.4

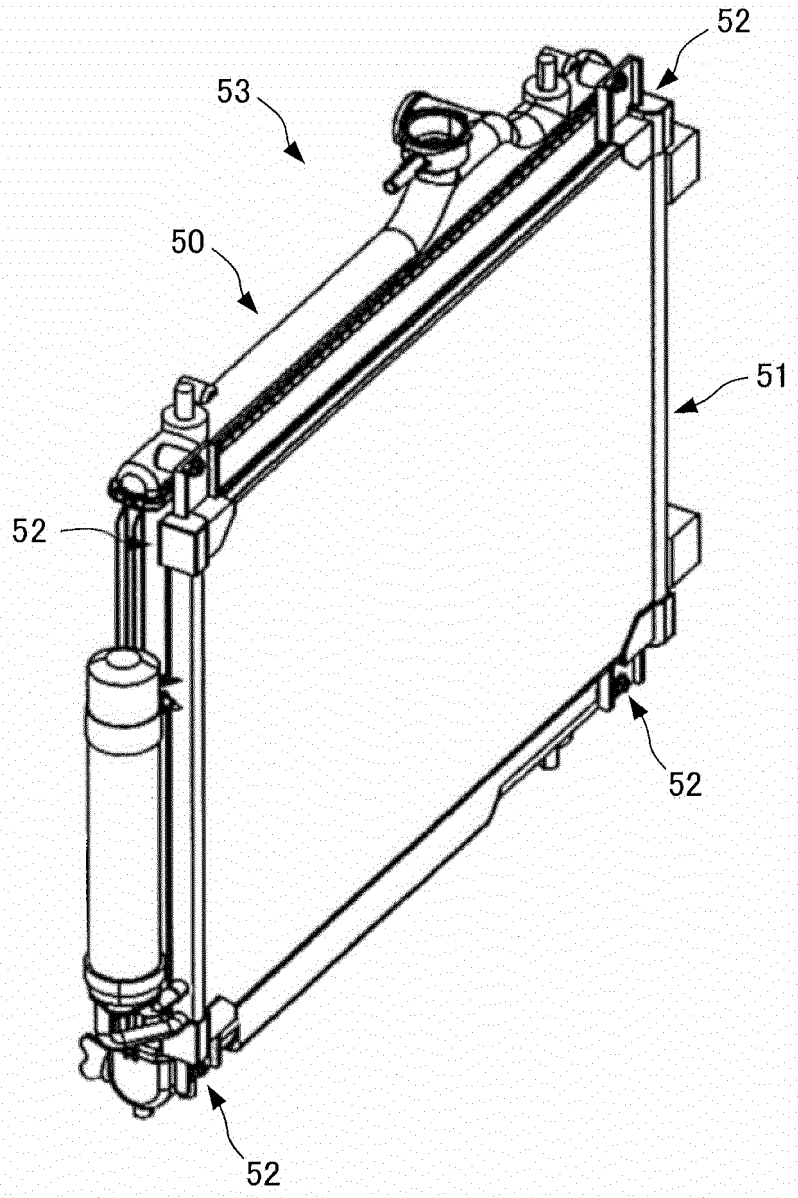



FIG.5

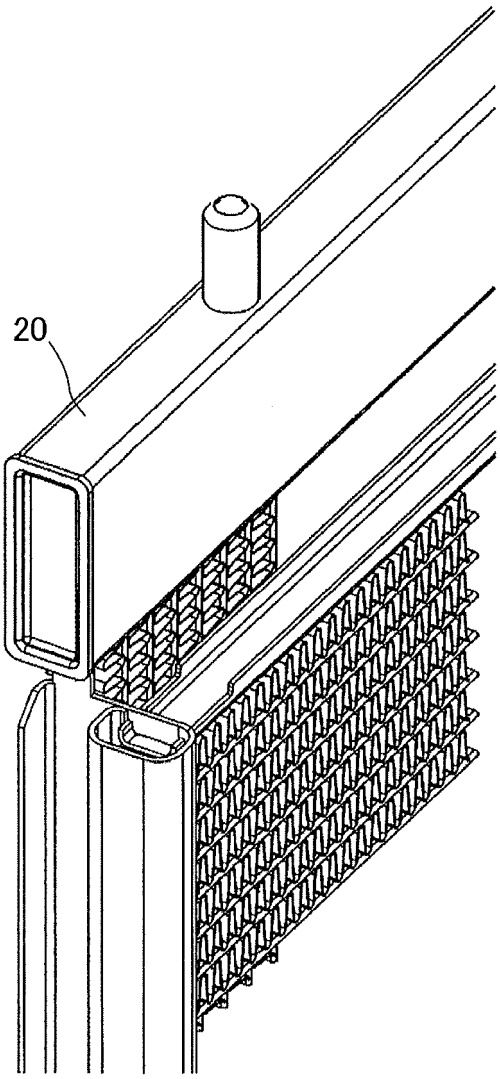



FIG.6

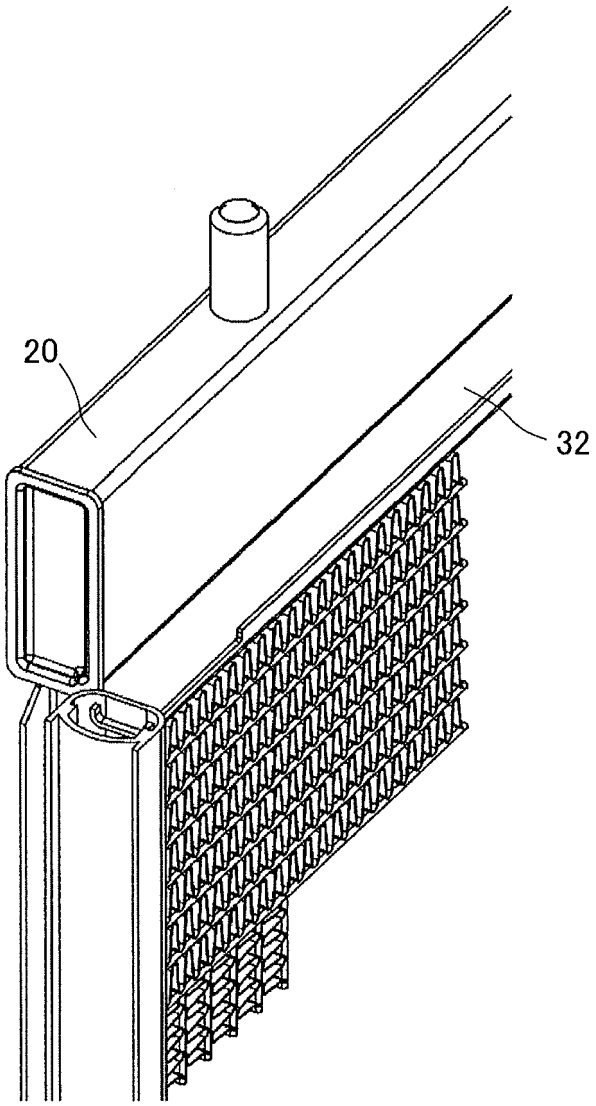



FIG.7

FIG.8A

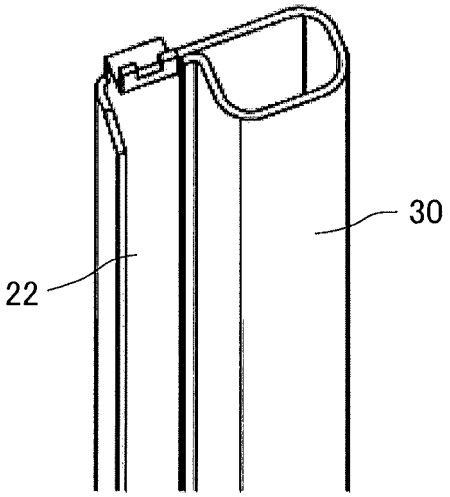



FIG.8B

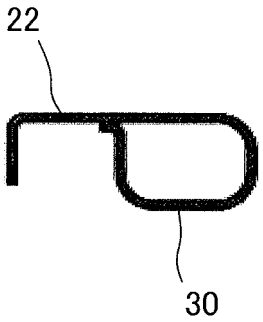


FIG.9A

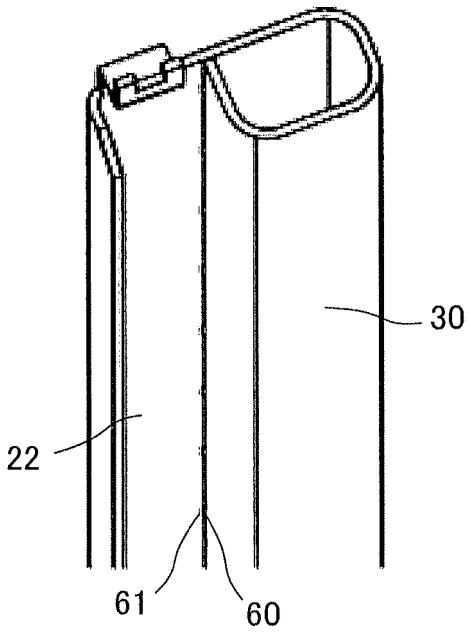



FIG.9B

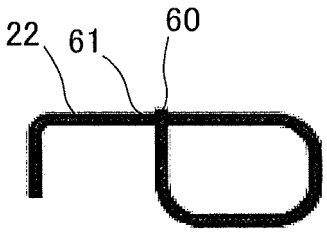


FIG.10A

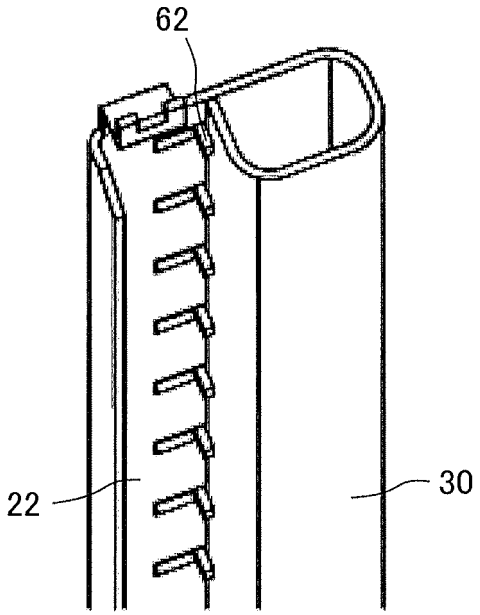
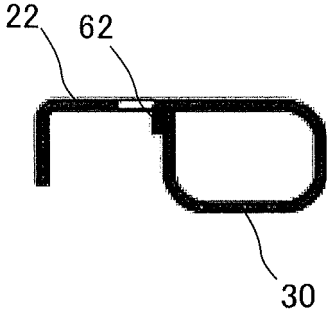



FIG.10B



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 11223486 A **[0002]**
- JP 2013144765 A **[0034]**