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(54) **AIR CONDITIONER FOR VEHICLE**

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(57) **ABSTRACT**

Disclosed is an air conditioner for a vehicle with an improved structure, which prevents condensate generated inside an air conditioning case from leaking through a joint part of cases and ensures smooth drainage of the condensate to a desired location. The air conditioner for a vehicle includes: an air conditioning case in which an air passage and a plurality of air discharge ports are formed; and a cooling heat exchanger and a heating heat exchanger sequentially arranged in the air passage of the air conditioning case in an airflow direction, wherein the air conditioning case is formed by assembling a plurality of cases, and includes a condensate guide part provided at a joint part of the cases to guide the condensate generated inside the air conditioning case toward the interior of the air conditioning case.

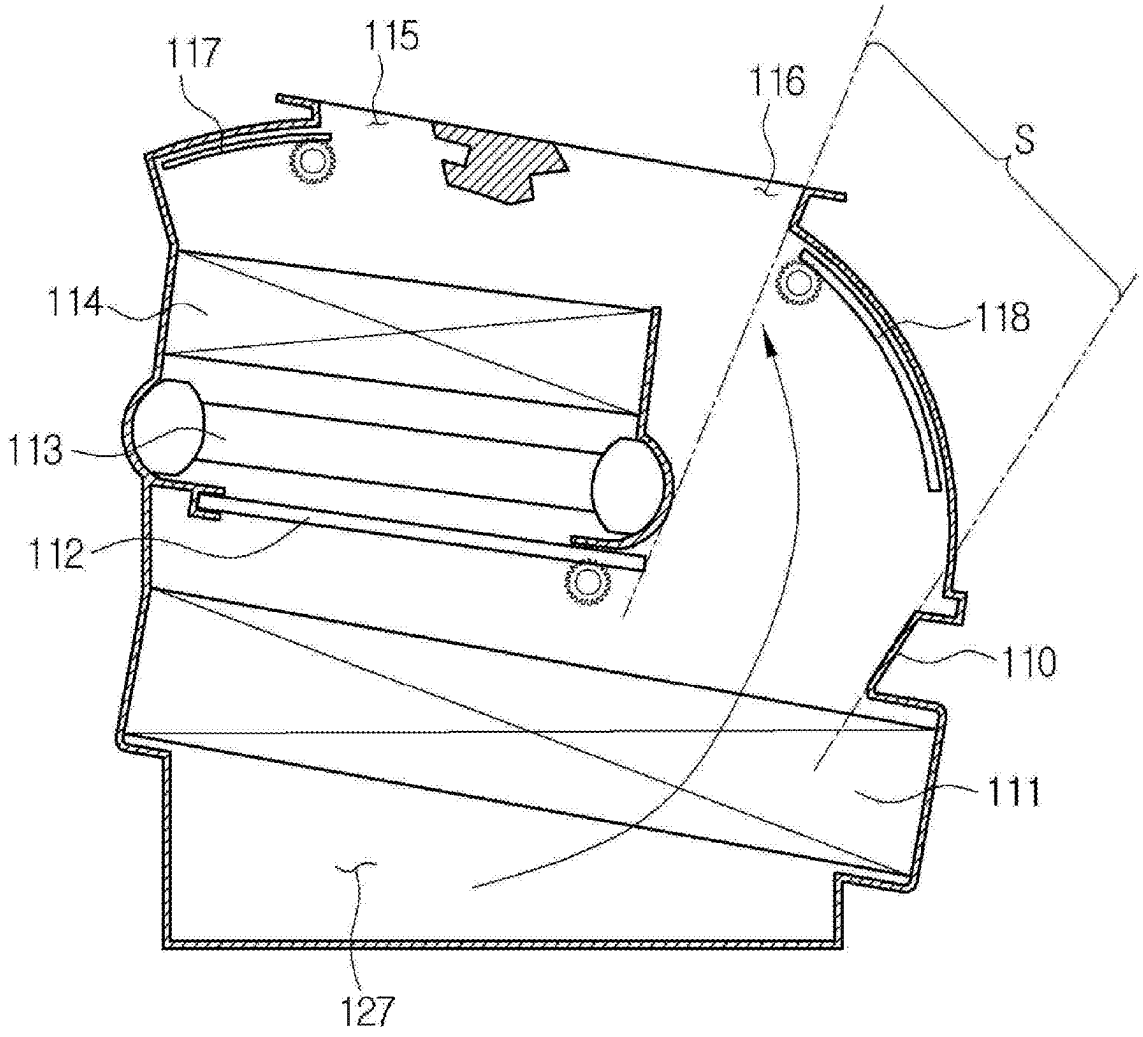
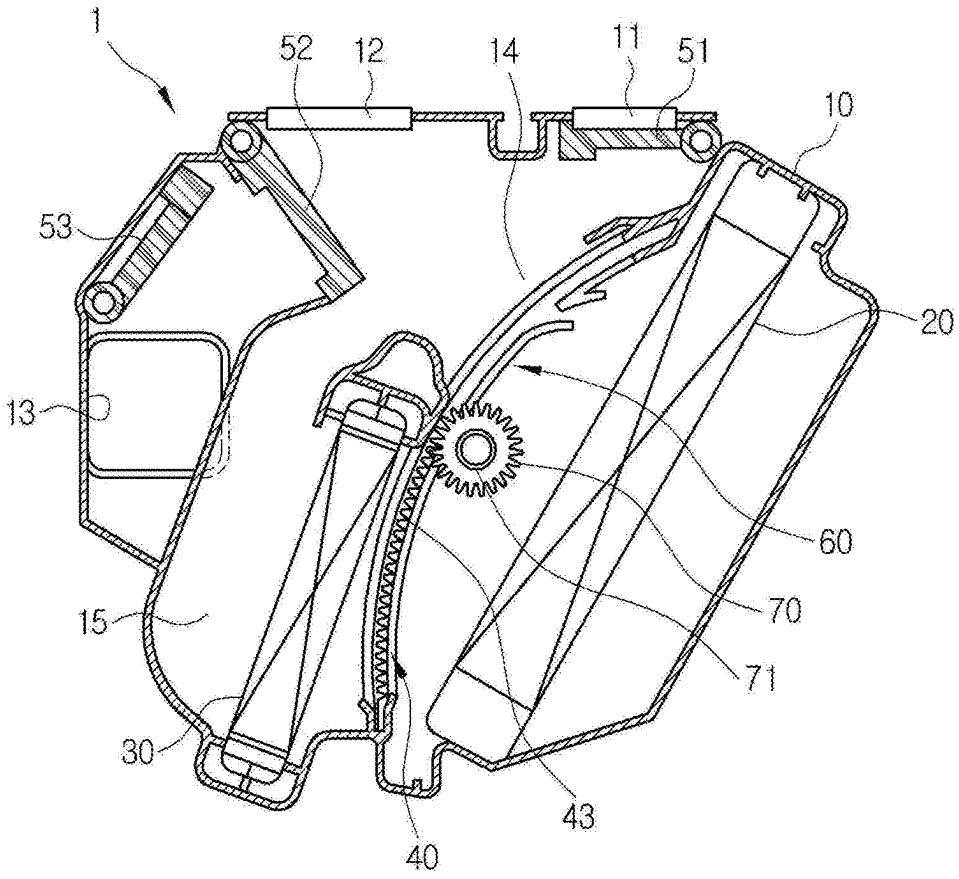
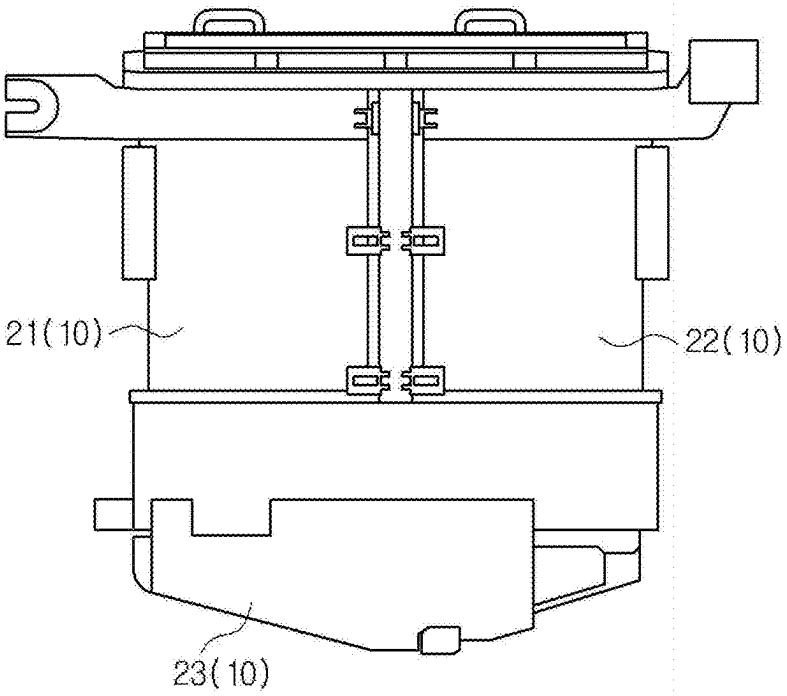


FIG. 1



PRIOR ART

FIG. 2



PRIOR ART

FIG. 3

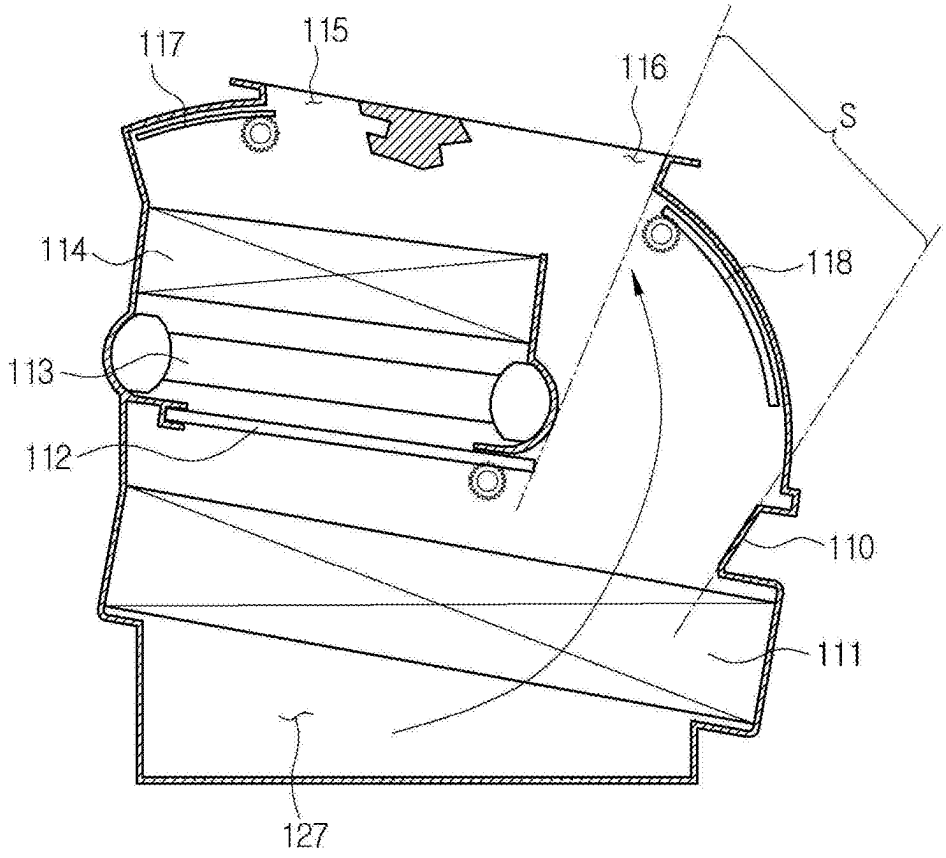


FIG. 4

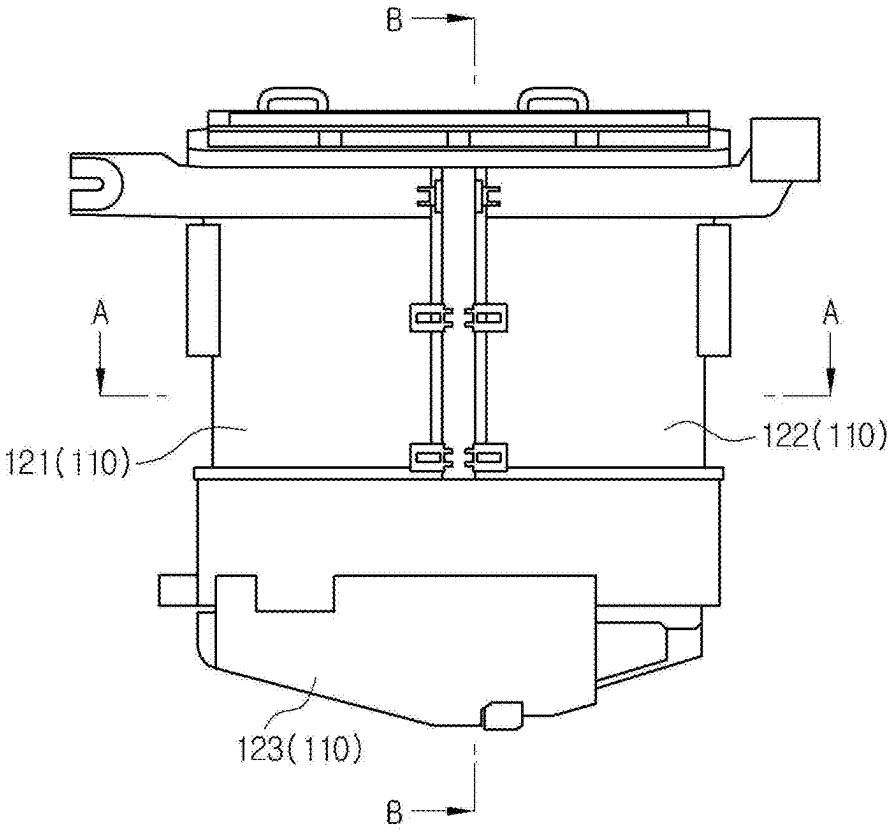


FIG. 5

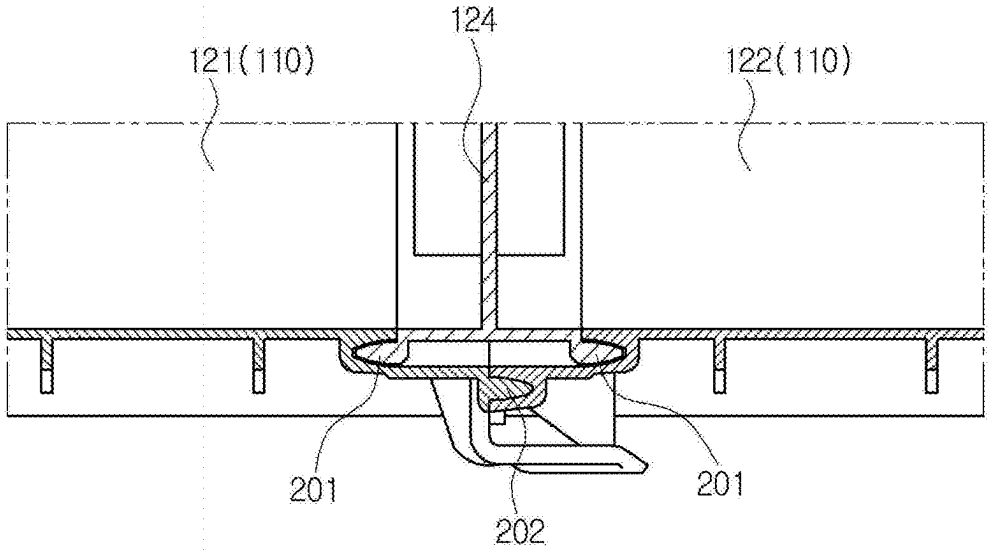


FIG. 6

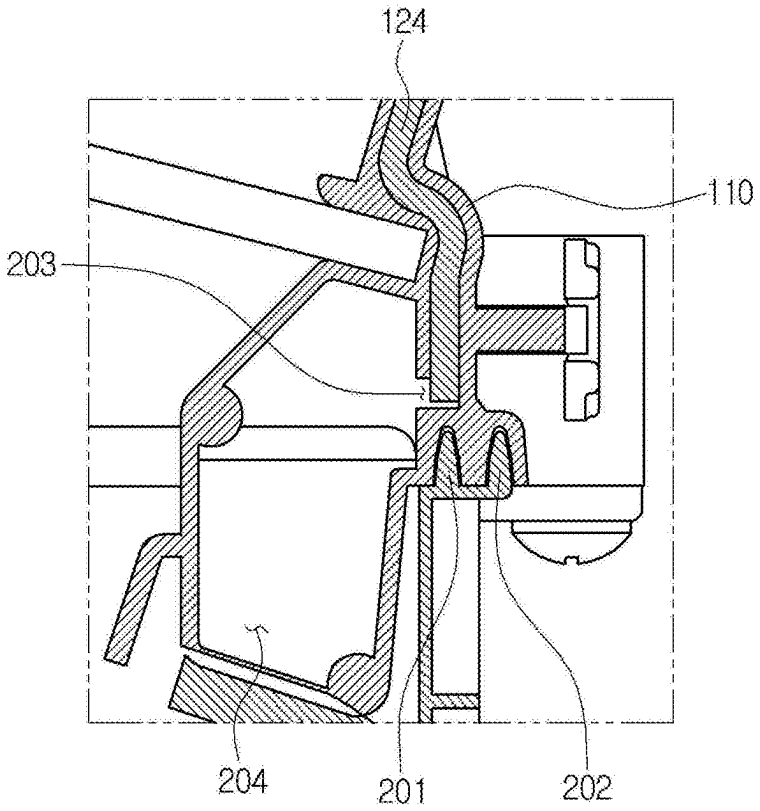


FIG. 7

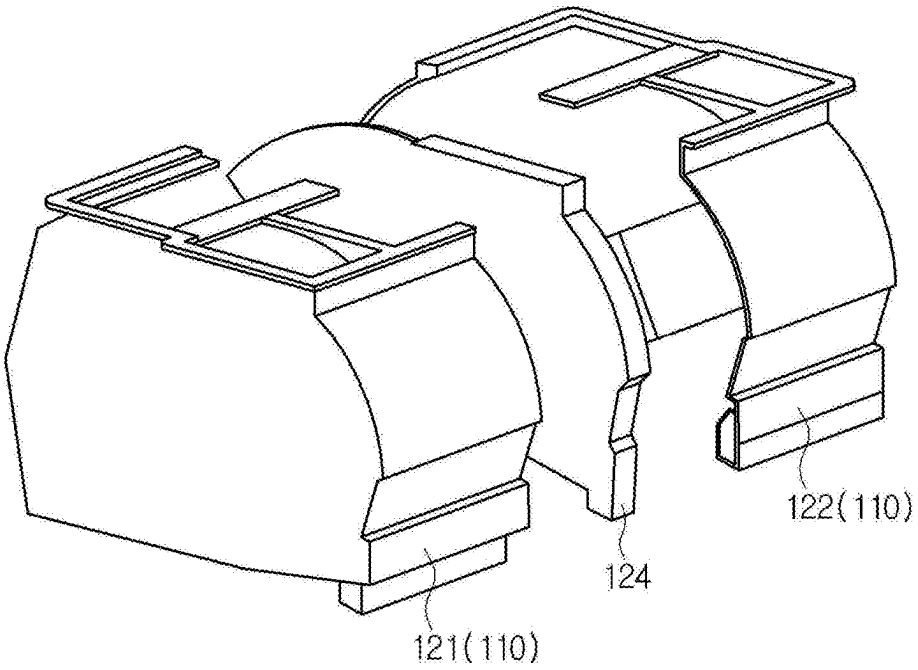


FIG. 8

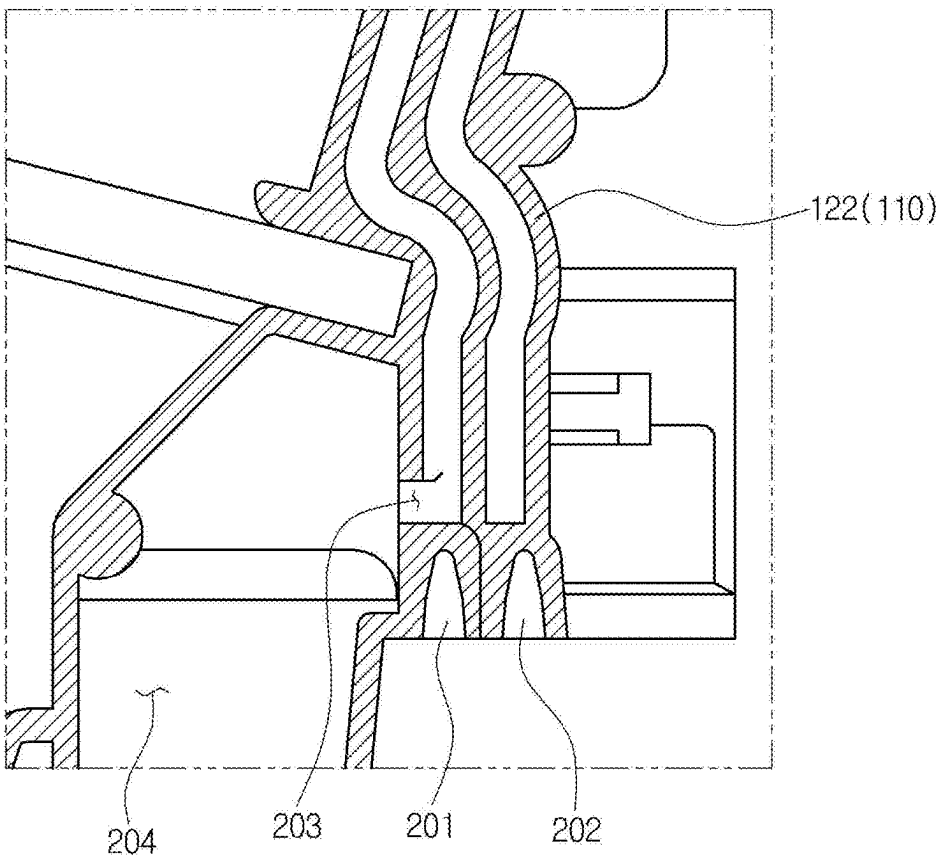


FIG. 9

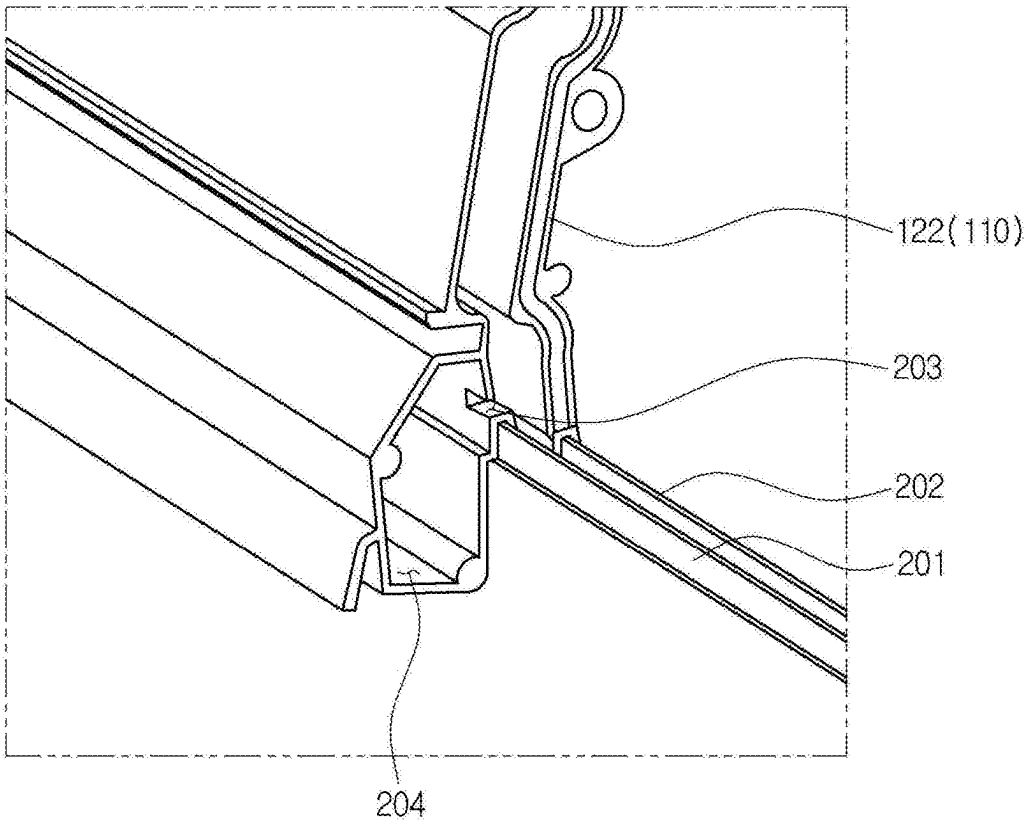


FIG. 10

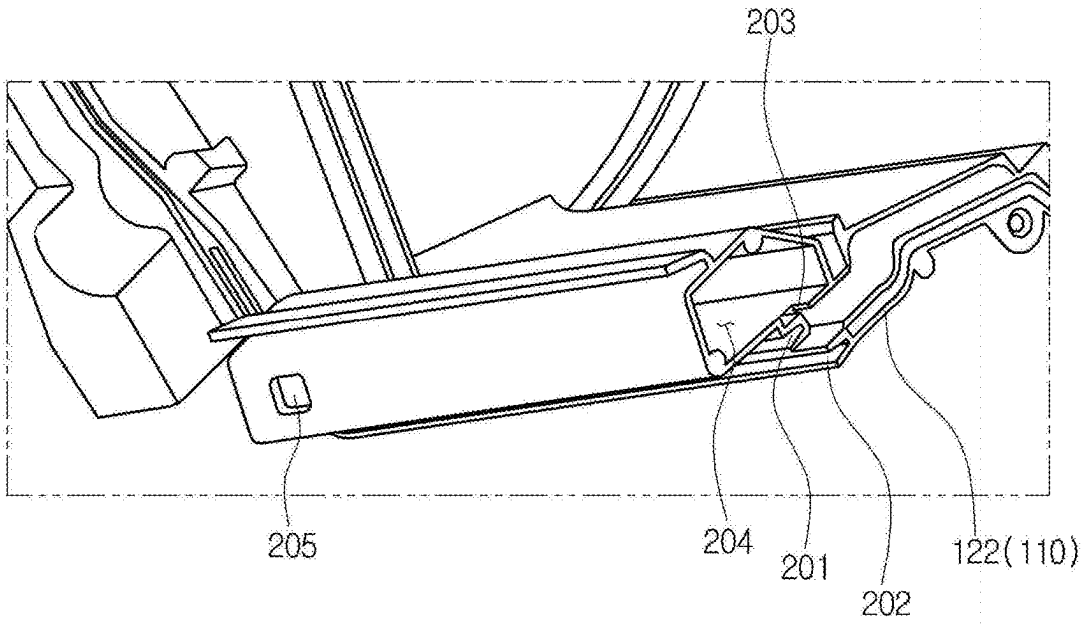


FIG. 11

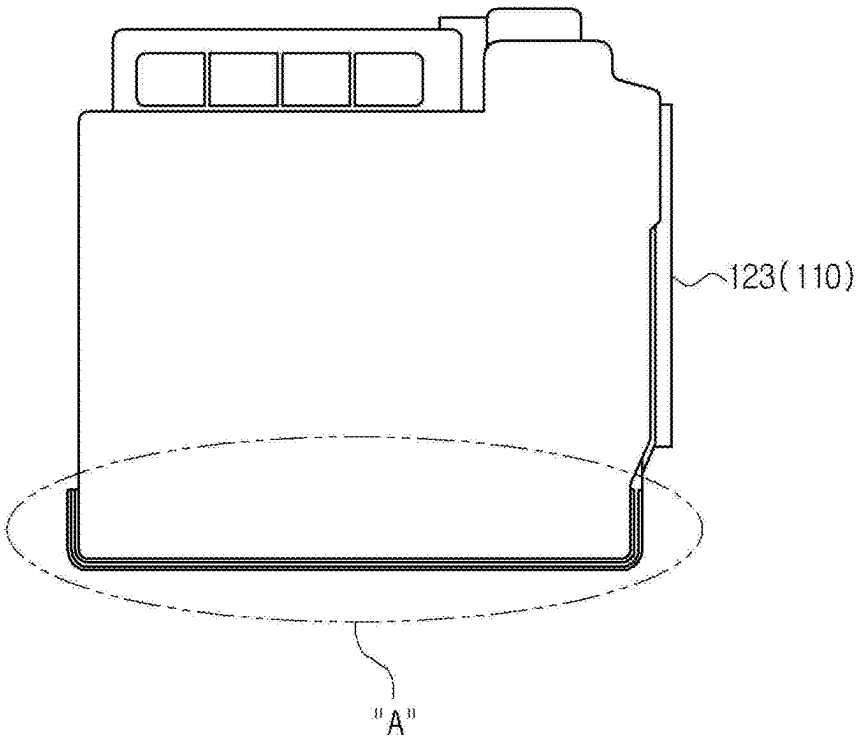
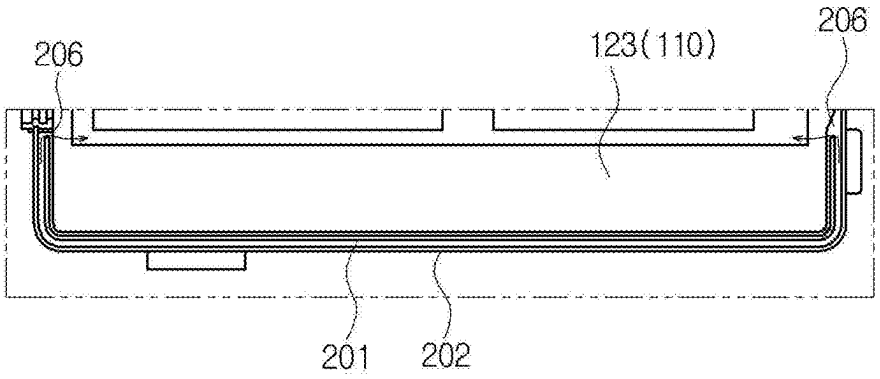


FIG. 12



AIR CONDITIONER FOR VEHICLE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of priority to Korean Patent Application No. KR 10-2024-0021987, filed Feb. 15, 2024, and is incorporated herein by reference in its entirety.

BACKGROUND OF THE PRESENT INVENTION

Field of the Present Invention

[0002] The present invention relates to an air conditioner for a vehicle, and more specifically, to an air conditioner for a vehicle which has an improved structure of joint parts of a case, guiding condensate to flow outward.

Background Art

[0003] In general, an air conditioner for a vehicle is a vehicle interior part that is installed for the purpose of cooling or heating the interior of the vehicle in the summer or winter or securing a driver's front and rear view by removing the frost from the windshield during the rainy or winter season. The air conditioner is usually equipped with a heating system and a cooling system to selectively introduce the indoor air or the outdoor air, heat or cool the air, and blow the heated or cooled air to the interior of the vehicle, thereby cooling, heating, or ventilating the interior of the vehicle.

[0004] Referring to FIG. **1**, a conventional air conditioner **1** for a vehicle includes an air conditioning case **10**, an evaporator **20** which is a cooling heat exchanger, an indoor condenser **30** which is a heating heat exchanger, and a temperature door **40**. The evaporator **20** and the indoor condenser **30** are sequentially arranged inside the air conditioning case **10** in an air flow direction. Downstream of the indoor condenser **30** in the air flow direction, an electric heater such as a PTC heater can be provided.

[0005] The temperature door **40** adjusts the opening degree of a warm air passage **15** passing through the indoor condenser **30** and a cold air passage **14** bypassing the indoor condenser **30**, thereby controlling the interior temperature of the vehicle. The air conditioning case **10** includes a plurality of air discharge ports. The air discharge ports include a defrost vent **11**, a face vent **12**, and a floor vent **13**. The defrost vent **11** discharges wind towards the vehicle window, the face vent **12** discharges wind towards passengers' faces, and the floor vent **13** discharges wind towards the passengers' feet.

[0006] Additionally, the air conditioning case **10** includes a plurality of mode doors to control the opening degree of the air discharge ports. That is, the air conditioning case **10** includes a defrost door **51** for controlling the opening degree of the defrost vent **11**, a vent door **52** for controlling the opening degree of the face vent **12**, and a floor door **53** for controlling the opening degree of the floor vent **13**. The temperature door **40** is designed in a sliding type, and has a rail-shaped guide groove **60** formed on the inner wall of the air conditioning case **10** to guide the temperature door **40**.

[0007] The temperature door **40** has a driven gear **43** that meshes with a driving gear **70**. The temperature door **40** slidably moves along the guide groove **60** by the rotation of the driving gear **70**. The guide groove **60** extends in a convex arc shape in the wind direction, and the temperature door **40** is correspondingly curved to fit the guide groove **60**. The driving gear **70** has a drive shaft **71** extending in the width direction of the door.

[0008] Referring further to FIG. **2**, the conventional air conditioner for the vehicle includes an air conditioning case **10**, which is assembled by joining a left case **21** and a right case **22** in a vehicle width direction and combining the left and right cases **21** and **22** with a lower case **23** in a vertical direction. The conventional air conditioner for the vehicle includes a joint part inevitably formed during the assembly of the cases, so condensate generated inside the air conditioning case **10** can be forced out through the joint part and drip into the cabin room.

[0009] Specifically, condensate leakage may occur at the joint part of the air conditioning case **10** which faces the air passing through the evaporator **20**. During a cooling mode, the condensate and the air passing through the evaporator **20** can move together, and in this case, the condensate is more likely to leak through the joint part of the air conditioning case **10**. That is, the condensate generated inside the air conditioning case **10** may leak out through the joint part of the cases to unintended locations instead of being drained properly through a drain hole, causing potential problems.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior arts, and it is an objective of the present invention to provide an air conditioner for a vehicle with an improved structure, which prevents condensate generated inside an air conditioning case from leaking through a joint part of cases and ensures smooth drainage of the condensate to a desired location.

[0011] To accomplish the above object, according to the present invention, there is provided an air conditioner for a vehicle including: an air conditioning case in which an air passage and a plurality of air discharge ports are formed; and a cooling heat exchanger and a heating heat exchanger sequentially arranged in the air passage of the air conditioning case in an airflow direction, wherein the air conditioning case is formed by assembling a plurality of cases, and includes a condensate guide part provided at a joint part of the cases to guide the condensate generated inside the air conditioning case toward the interior of the air conditioning case.

[0012] The condensate guide part includes a drainage hole formed at the bottom of the joint part to communicate with the interior of the air conditioning case.

[0013] The joint part overlap in multiple layers.

[0014] The joint part includes an inner joint part and an outer joint part, and the inner joint part is separated from the outer joint part.

[0015] The inner joint part and the outer joint part are separated in the thickness direction of the air conditioning case.

[0016] The condensate guide part includes an internal channel through which condensate running down along the joint part flows.

[0017] The drainage hole connects the internal channel to the interior of the air conditioning case.

[0018] The outer joint part prevents the condensate generated inside the air conditioning case from being discharged

to the exterior, and the drainage hole is formed in the inner joint part and guides the condensate into the interior of the air conditioning case.

[0019] The condensate guide part includes an internal channel through which the condensate running down along the joint part flows, and the drainage hole includes a side hole connecting the joint part to the internal channel and a bottom hole connecting the internal channel to the interior of the air conditioning case.

[0020] The air conditioning case includes a left case and a right case, and a separator is interposed between the left case and the right case to divide the internal air passage of the air conditioning case into the left and right.

[0021] The Joint part is formed between the left case and the separator and between the right case and the separator.

[0022] A lower case is provided beneath the left case, the separator, and the right case, and the joint part is formed between the lower case and the bottoms of the left case, the separator, and the right case.

[0023] The lower case includes a lower drainage hole which guides the condensate, guided between the inner joint part and the outer joint part, toward the interior of the air conditioning case.

[0024] The drainage holes are respectively formed in the left case and the right case.

[0025] The condensate guide part is formed at a joint part section of the air conditioning case facing the cooling heat exchanger.

[0026] The inner joint part and the outer joint part are each configured with a tongue-and-groove structure.

[0027] The outer joint part is positioned further outward than the inner joint part **201** and forms a double-sealing structure.

[0028] The drainage hole prevents the condensate from leaking through the joint part to the exterior of the air conditioning case and guides the condensate to flow into the interior of the air conditioning case.

[0029] The air conditioner for the vehicle according to the present invention can prevent condensate generated inside an air conditioning case from unintentionally leaking through the joint part of cases and ensure smooth drainage of the condensate to a desired location, thus effectively preventing the condensate from dripping into the cabin room.

[0030] Additionally, the air conditioner for the vehicle according to the present invention can optimize the location of the condensate guide part, thus effectively preventing leakage of condensate through the joint part of the air conditioning case, even when the condensate and the air passing through the evaporator move together.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] FIG. **1** is a side cross-sectional view of a conventional air conditioner for a vehicle.

[0032] FIG. **2** is a front view of the conventional air conditioner for the vehicle.

[0033] FIG. **3** is a side cross-sectional view of an air conditioner for a vehicle according to an embodiment of the present invention.

[0034] FIG. **4** is a front view of the air conditioner for the vehicle according to an embodiment of the present invention.

[0035] FIG. **5** is a cross-sectional view taken along line A-A of FIG. **4**.

[0036] FIG. **6** is a cross-sectional view taken along line B-B of FIG. **4**.

[0037] FIG. **7** is an exploded perspective view illustrating a left case, a separator, and a right case according to an embodiment of the present invention.

[0038] FIG. **8** is a side view of the right case according to an embodiment of the present invention.

[0039] FIG. **9** is a perspective view of the right case according to an embodiment of the present invention.

[0040] FIG. **10** is a rear perspective view of the right case according to an embodiment of the present invention.

[0041] FIG. **11** is a plan view of a lower case according to an embodiment of the present invention.

[0042] FIG. **12** is an enlarged plan view of an area "A" in FIG. **11**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0043] Hereinafter, referring to the drawings, the technical configuration of an air conditioner for a vehicle will be described in detail.

[0044] Referring to FIGS. **3** to **12**, the air conditioner for a vehicle according to an embodiment of the present invention is a slim-type air conditioner with a horizontally arranged heat exchanger type, and has a relatively thin vertical width. The air conditioner for a vehicle according to an embodiment of the present invention includes an air conditioning case **110**, a cooling heat exchanger, a heating heat exchanger, and a door. In the description below, the left-right direction in FIG. **3** corresponds to the vehicle's front-rear direction, while the left-right direction in FIG. **4** corresponds to the vehicle's width direction.

[0045] The air conditioning case **110** includes an air passage and is a slim type with a narrow vertical width. The air conditioning case **110** includes an air inflow port **127** and a plurality of air discharge ports. An air blower for blowing air into the air conditioning case **110** is connected to the air inflow port **127**. The air blower selectively introduces inside air or outside air and blows the air into the air conditioning case **110**.

[0046] Moreover, the air inflow port **127** is located below the cooling heat exchanger so that air flows from the bottom to the top. The air discharge ports of the air conditioning case **110** includes a defrost vent **115**, a face vent **116**, and a floor vent. The defrost vent **115** is formed to direct air toward the vehicle windows, the face vent **116** is formed to direct air toward the front seat passengers' faces, and the floor vent is formed to direct air toward the front seat passengers' feet. The floor vent (not shown) is formed on the side of the air conditioning case **110** to guide air toward the lower portion of the vehicle through a duct.

[0047] The cooling heat exchanger is an evaporator **111**, and the heating heat exchanger is an indoor condenser **113**. An electric heater **114** such as a PTC heater is provided downstream of the indoor condenser **113** in the airflow direction. The evaporator **111** and the indoor condenser **113** are connected in a refrigerant circulation line connecting a compressor, an expansion valve, etc., to act as a cooling means or a heating means depending on the refrigerant state. That is, the refrigerant passing through the evaporator **111** exchanges heat with air to cool the air, and the refrigerant passing through the indoor condenser **113** exchanges heat with air to heat the air.

[0048] The evaporator **111** and the indoor condenser **113** are sequentially arranged in the air passage of the air conditioning case **110** in the airflow direction. The evaporator **111**, the indoor condenser **113**, and the electric heater **114** are all arranged horizontally. That is, the internal passage of the air conditioning case **110** is vertically oriented relative to the ground, directing the airflow route from the lower part to the upper part in the direction of gravity. In addition, the cooling heat exchanger and the heating heat exchanger on the internal passage are arranged sequentially from the bottom to the top in the direction of gravity corresponding to the air flow route.

[0049] As described above, the heat exchangers are arranged horizontally relative to the ground surface or inclined at a predetermined angle to be close to the horizontal. That is, air is introduced into the air inflow port **127** at the lower side of the air conditioning case **110** and flows upwards. From below, the evaporator **111**, the indoor condenser **113**, and the electric heater **114** are arranged in sequence.

[0050] The air conditioner for a vehicle includes a temperature door **112** and a plurality of mode doors. The temperature door **112** is placed between the evaporator **111** and the indoor condenser **113**. The temperature door **112** controls the opening degree between the warm air passage passing through the indoor condenser **113** and the cold air passage bypassing the indoor condenser **113** to adjust the interior temperature of the vehicle. That is, the temperature door **112** adjusts the amount of air passing through or the amount of air bypassing the indoor condenser **113** and the electric heater **114** according to the position thereof.

[0051] The temperature door **112** is a plate door that slides horizontally within the air conditioning case **110**, adjusting the opening degree between the cold air passage and the warm air passage. The sliding-type temperature door **112** helps reduce the height of the air conditioning case **110**. The mode doors include a defrost door **117** for adjusting the opening degree of the defrost vent **115**, a vent door **118** for adjusting the opening degree of the face vent **116**, and a floor door for adjusting the opening degree of the floor vent.

[0052] A separator **124** which divides the inside of the air conditioning case **110** into the left and right in a vehicle width direction is provided within the air conditioning case **110**. The separator **124** divides the air passage of the air conditioning case **110** into the left and right, enabling right and left independent air conditioning for the driver's seat and the front passenger's seat. Furthermore, the air conditioning case **110** is formed by assembling a plurality of cases. That is, the air conditioning case **110** is formed by assembling a left case **121**, a right case **122**, and a lower case **123**. A separator **124** is interposed between the left case **121** and the right case **122**.

[0053] The air conditioner for the vehicle according to an embodiment of the present invention includes a condensate guide part. The condensate guide part is provided at a joint part of the case to guide the condensate generated inside the air conditioning case **110** toward the interior of the air conditioning case rather than the exterior. In this case, the joint parts overlap in multiple layers. That is, the joint parts include an inner joint part **201** and an outer joint part **202**, and the inner joint part **201** is configured to be separated from the outer joint part **202** in the thickness direction of the air conditioning case.

[0054] As described above, a double-layer joint parts are formed on the air conditioning case **110** and the separator **124**, and the condensate guide part includes a drainage hole and an internal channel **204**. The internal channel **204** is located at the bottom of the joint part of the air conditioning case **110** and serves as a passage through which condensate running down along the joint parts flows. The internal channel **204** connects to the interior of the air conditioning case **110**, preventing the condensate from flowing outside the air conditioning case **110** and ensuring the condensate to flow inward.

[0055] The joint parts, which serve as coupling surfaces, are formed between the cases. That is, the joint parts are formed between the left case **121** and the separator **124** and between the right case **122** and the separator **124**. Additionally, the lower case **123** is assembled at the bottoms of the left case **121**, the separator **124**, and the right case **122**. Joint parts are also formed between the bottoms of the left case **121**, the separator **124**, and the right case **122** and the lower case **123**. The joint parts adopt a tongue-and-groove structure that combines protrusions and recesses.

[0056] The drainage hole is formed at the bottom of the joint part and communicates with the interior of the air conditioning case **110**. That is, the drainage hole connects the internal channel **204** to the interior of the air conditioning case **110**, thereby preventing the condensate from leaking through the joint parts to the exterior of the air conditioning case and guiding the condensate to flow into the interior of the air conditioning case. The internal channel **204** serves as a passage through which the condensate running down along the joint parts flows.

[0057] The inner joint part **201** and the outer joint part **202** are formed by the tongue-and-groove structure, and the outer joint part **202** is positioned further outward than the inner joint part **201** and forms a double-sealing structure. The outer joint part **202** functions as a dam that prevents the condensate generated inside the air conditioning case from leaking to the outside. The condensate flowing down along the joint part is directed inward.

[0058] The drainage hole is formed in the inner joint part **201** and guides the condensate into the interior of the air conditioning case **110**. The drainage hole includes a side hole **203** and a bottom hole **205**. The side hole **203** laterally penetrates the side of the air conditioning case **110** to connect the joint part with the internal channel **204**. The condensate flowing down along the joint part is guided through the side hole **203** into the internal channel **204**. Additionally, the drainage holes are respectively formed in the left case **121** and the right case **122**.

[0059] The bottom hole **205** penetrates the bottom surface of the air conditioning case **110** in a vertical direction to connect the internal channel **204** with the interior of the air conditioning case **110**. The condensate flowing along the internal channel **204** falls into the interior of the air conditioning case **110** through the bottom hole **205**. Within the air conditioning case **110**, condensate is inevitably generated during the refrigerant evaporation process in the evaporator. The condensate is typically discharged to the exterior through a drain hole formed at the bottom surface of the air conditioning case **110**.

[0060] However, a portion of the condensate generated inside the air conditioning case **110** may be forced out through tiny gaps between the joint parts of the cases due to strong wind blowing from a blower, unintentionally dripping

into the cabin room. The unintended leakage of condensate into the cabin room can cause various problems. Therefore, it is necessary to fundamentally prevent the condensate inside the air conditioning case **110** from getting out of the air conditioning case **110**.

[0061] Accordingly, the joint parts are configured to overlap in multiple layers, either double or triple. The multi-layered joint parts significantly contribute to preventing the condensate inside the air conditioning case **110** from getting out of the air conditioning case **110**. In this case, merely forming multi-layered joint parts is not sufficient to perfectly block the condensate inside the air conditioning case **110**. The reason is why it is possible for the condensate to get out of the air conditioning case **110** through very small gaps by high pressure wind using a blower.

[0062] Finally, the condensate guide part including the internal channel **204**, the side hole **203**, and the bottom hole **205** guides the condensate to direct the interior of the air conditioning case **110** and to be discharged through the drain hole. This minimizes the possibility of condensate unintentionally escaping to the exterior of the air conditioning case **110**, reducing it to nearly zero.

[0063] Additionally, the condensate guide part is formed at the joint part of the air conditioning case **110** that faces air passing through the evaporator **111**. Specifically, as shown in FIG. **3**, the condensate guide part is located at the joint part section (S) of the air conditioning case facing the evaporator **111**. By optimizing the location of the condensate guide part, the system effectively prevents condensate from leaking through the joint parts of the air conditioning case **110**, even when air passing through the evaporator **111** and condensate move together.

[0064] Meanwhile, a lower drainage hole **206** is formed in the lower case **123**. The lower drainage hole **206** guides the condensate, guided between the inner joint part **201** and the outer joint part **202**, toward the interior of the air conditioning case **110**. Accordingly, the condensate that could be discharged through the joint parts among the left case **121**, the separator **124**, and the right case **122** is guided to the interior of the air conditioning case **110** through the internal channel **204**, the side hole **203**, and the bottom hole **205**. Moreover, the condensate that could be discharged through the joint parts between the upper cases (left and right cases) and the lower case is guided to the interior of the air conditioning case **110** through the lower drainage hole **206**.

[0065] The air conditioner for a vehicle according to the present invention has been described with reference to the embodiments shown in the drawings, but the embodiments are merely examples. It should be apparent that modifications and variations can be made by persons skilled without deviating from the spirit or scope of the present invention. Therefore, the true scope of technical protection should be defined by the spirit of the appended claims.

What is claimed is:

1. An air conditioner for a vehicle comprising:

an air conditioning case in which an air passage and a plurality of air discharge ports are formed; and

a cooling heat exchanger and a heating heat exchanger sequentially arranged in the air passage of the air conditioning case in an airflow direction,

wherein the air conditioning case is formed by assembling a plurality of cases, and includes a condensate guide part provided at a joint part of the cases to guide the condensate generated inside the air conditioning case toward the interior of the air conditioning case.

2. The air conditioner according to claim **1**, wherein the condensate guide part includes a drainage hole formed at the bottom of the joint part to communicate with the interior of the air conditioning case.

3. The air conditioner according to claim **2**, wherein the joint part overlap in multiple layers.

4. The air conditioner according to claim **3**, wherein the joint part includes an inner joint part and an outer joint part, and

wherein the inner joint part is separated from the outer joint part.

5. The air conditioner according to claim **4**, wherein the inner joint part and the outer joint part are separated in the thickness direction of the air conditioning case.

6. The air conditioner according to claim **3**, wherein the condensate guide part includes an internal channel through which condensate running down along the joint part flows.

7. The air conditioner according to claim **6**, wherein the drainage hole connects the internal channel to the interior of the air conditioning case.

8. The air conditioner according to claim **4**, wherein the outer joint part prevents the condensate generated inside the air conditioning case from being discharged to the exterior, and

wherein the drainage hole is formed in the inner joint part and guides the condensate into the interior of the air conditioning case.

9. The air conditioner according to claim **2**, wherein the condensate guide part includes an internal channel through which the condensate running down along the joint part flows, and

wherein the drainage hole includes a side hole connecting the joint part to the internal channel and a bottom hole connecting the internal channel to the interior of the air conditioning case.

10. The air conditioner according to claim **4**, wherein the air conditioning case includes a left case and a right case, and

wherein a separator is interposed between the left case and the right case to divide the internal air passage of the air conditioning case into the left and right.

11. The air conditioner according to claim **10**, wherein the joint part is formed between the left case and the separator and between the right case and the separator.

12. The air conditioner according to claim **11**, wherein a lower case is provided beneath the left case, the separator, and the right case, and the joint part is formed between the lower case and the bottoms of the left case, the separator, and the right case.

13. The air conditioner according to claim **12**, wherein the lower case includes a lower drainage hole which guides the condensate, guided between the inner joint part and the outer joint part, toward the interior of the air conditioning case.

14. The air conditioner according to claim **12**, wherein the drainage holes are respectively formed in the left case and the right case.

15. The air conditioner according to claim **4**, wherein the condensate guide part is formed at a joint part section of the air conditioning case facing the cooling heat exchanger.

16. The air conditioner according to claim **4**, wherein the inner joint part and the outer joint part are each configured with a tongue-and-groove structure.

17. The air conditioner according to claim **16**, wherein the outer joint part is positioned further outward than the inner joint part and forms a double-sealing structure.

18. The air conditioner according to claim **7**, wherein the drainage hole prevents the condensate from leaking through the joint part to the exterior of the air conditioning case and guides the condensate to flow into the interior of the air conditioning case.

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