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AIR CONDITIONER FOR VEHICLE

Abstract

Disclosed is an air conditioner for a vehicle which can include: 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, the air discharge ports include a defrost vent and a face vent, and a temperature channel is provided in an air passage inside the air conditioning case to guide cold air passing through the cooling heat exchanger to direct the discharge port of the defrost vent and guide warm air passing through the heating heat exchanger to direct the discharge port of the face vent.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of priority to Korean Patent Application No. KR 10-2024-0021880, filed Feb. 15, 2024, and Korean Patent Application No. KR 10-2024-0021967, filed Feb. 15, 2024, each of which are incorporated herein by reference in their 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 improves temperature performance in a structure where a defrost vent and a face vent face a warm air passage.

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 **13** 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] The conventional air conditioner for the vehicle have a structure in which the heat exchanger is arranged horizontally and the defrost vent **11** and face vent **12** face the warm air passage. Additionally, the discharge ports of the defrost vent **11** and the floor vent **13** are positioned to facilitate the flow of warm air, and the face vent **12** is located to facilitate the flow of cold air.
[0009] Therefore, in an air conditioning mode where air is discharged through the defrost vent **11** or the floor vent **13**, an unintended vertical temperature inversion that the air discharged through the defrost vent **11** is hotter than intended often occurs. Furthermore, in an air conditioning mode where air is discharged through the face vent **12** and the floor vent **13**, an excessive amount of cold air is discharged through the face vent **12** and an excessive amount of warm air is discharged through the floor vent **13**, increasing the vertical temperature difference.
[0010] Additionally, the vent door **52** may include a constant discharge hole for continuously discharging air. However, the conventional air conditioner for the vehicle is difficult to control the amount of cold air discharged through the constant discharge hole, so it is difficult to satisfy the left-right temperature difference performance at the discharge port of the face vent **12**.

SUMMARY OF THE INVENTION

[0011] 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 which can reduce the temperature of air discharged through the defrost vent and increase the temperature of air discharged through the face vent, thereby preventing the increase of vertical temperature differences and suppressing the direct discharge of cold air through the constant discharge hole.
[0012] 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 discharge ports include a defrost vent and a face vent, and a temperature channel is provided in an air passage inside the air conditioning case to guide cold air passing through the cooling heat exchanger to direct the discharge port of the defrost vent and guide warm air passing through the heating heat exchanger to direct the discharge port of the face vent.
[0013] The temperature channel includes: a cold air guide part which guides the cold air passing through the cooling heat exchanger toward the discharge port of the defrost vent; and a warm air guide part which guides the warm air passing through the heating heat exchanger toward the discharge port of the face vent.
[0014] The cold air guide part prevents the warm air passing through the heating heat exchanger from directly moving toward the defrost vent and guides the cold air passing through the cooling heat exchanger to move to the discharge port of the defrost vent.
[0015] The defrost vent and the face vent are formed above the heating heat exchanger and face a warm air passage, the face vent is positioned further rearward in the vehicle than the defrost vent, and a cold air passage passing through the cooling heat exchanger is positioned further rearward in the vehicle than the warm air passage passing through the heating heat exchanger. The temperature channel is separately formed and coupled directly below the discharge port of the face vent in the air conditioning case.
[0016] A vent door is formed to slide and adjust the opening degree of the face vent, and the temperature channel includes a plate-shaped body part corresponding to a sliding path of the vent door. The warm air guide part is formed to penetrate the body part in the thickness direction, and the cold air guide part is formed along the sliding path of the vent door on the body part.
[0017] The warm air guide part penetrates both sides of the body part in the thickness direction to connect the face vent with the warm air passage.
[0018] A plurality of vertical partition walls protruding in the thickness direction is formed on one surface of the body part, and the vertical partition walls are spaced apart in the vehicle width

direction. The cold air guide part is formed in a space between the vertical partition walls, and the cold air guide part and the warm air guide part are partitioned by the vertical partition walls.
[0019] The warm air guide part, the cold air guide part, and another warm air guide part are sequentially arranged in the temperature channel in the vehicle width direction, so that the cold air guide part is positioned between the warm air guide parts.
[0020] The warm air guide part, the cold air guide part, another warm air guide part, and another cold air guide part are sequentially arranged in the temperature channel in the vehicle width direction, so that the cold air guide parts and the warm air guide parts are alternately arranged in the vehicle width direction.
[0021] The warm air guide part is positioned further toward the side than the cold air guide part in the vehicle width direction.
[0022] The face vent includes a center vent and a side vent in the vehicle width direction, and the center vent and the side vent are respectively arranged to correspond to at least one of the cold air guide part and the warm air guide part in the vehicle width direction.
[0023] The air discharge port includes a floor vent provided on the side of the air-conditioning case, and the temperature channel includes a floor air guide part which guides the warm air passing through the heating heat exchanger to the discharge port of the floor vent. The floor air guide part is formed on the outermost side of the temperature channel in the vehicle width direction.
[0024] A horizontal partition wall crosses a through hole of the warm air guide part in the vehicle width direction to partially block the warm air guide part, and the horizontal partition wall is positioned to correspond to the end of the vent door in the sliding direction of the vent door during a bi-level mode where air is discharged to the face vent and the floor vent.
[0025] The face vent includes a center vent and a side vent in the vehicle width direction, and a constant discharge hole which allows air to continuously flow to the side vent is formed in the vent door. During the air conditioning mode which closes the face vent, the constant discharge hole is positioned inside the warm air guide part to be exposed to the through-hole of the warm air guide part.
[0026] In another aspect of 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 discharge ports include a defrost vent and a face vent, a constant discharge hole is formed in a vent door adjusting the opening degree of the face vent to allow air to be continuously discharged to the face vent, and a temperature channel is provided in an air passage inside the air conditioning case to suppress cold air passing through the cooling heat exchanger from being discharged through the constant discharge hole.
[0027] The temperature channel guides the cold air passing through the cooling heat exchanger toward the discharge port of the defrost vent and guides the warm air passing through the heating heat exchanger toward the discharge port of the face vent. The temperature channel includes a warm air passage partition which blocks the cold air from being discharged to the constant discharge hole during a bi-level mode, where air is discharged to the face vent and the floor vent. The warm air passage partition crosses the through-hole of the warm air guide part in the vehicle width direction to partially block the warm air guide part.
[0028] The vent door is formed to slide and adjust the opening degree of the face vent, the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, the body part has a plurality of vertical partition walls protruding on one side of the body part in the thickness direction and spaced apart in the vehicle width direction, and the face vent includes a center vent and a side vent provided in the vehicle width direction. The warm air passage partition is formed on the body part at a position corresponding to the side vent to protrude from the vertical partition walls in the thickness direction of the vent door, thus blocking airflow

between the cold air passage and the constant discharge hole.
[0029] The temperature channel includes a cold air blocking baffle which reduces the amount of cold air discharged to the face vent during the bi-level mode where the air is discharged to the face vent and the floor vent. The vent door is formed to slide and adjust the opening degree of the face vent, the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, the body part has a plurality of vertical partition walls protruding on one side of the body part in the thickness direction and spaced apart in the vehicle width direction, and the face vent includes a center vent and a side vent provided in the vehicle width direction. The cold air blocking baffle is formed protruding from the body part in the thickness direction of the vent door, crossing the cold air guide part in the vehicle width direction.
[0030] The temperature channel includes a cold air guide baffle which induces the cold air passing through the cooling heat exchanger toward the downstream side of the heating heat exchanger, increasing static pressure downstream of the heating heat exchanger. The vent door is formed to slide and adjust the opening degree of the face vent, and the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, and the cold air guide baffle is formed within the warm air guide part and extends side by side with the sliding direction of the vent door on the body part to direct air from the cold air passage toward a downstream space of the heating heat exchanger.
[0031] The air discharge port includes a floor vent provided on the side of the air-conditioning case, and the temperature channel includes a floor cold air guide baffle which guides the cold air passing through the cooling heat exchanger toward the floor vent. The vent door is formed to slide and adjust the opening degree of the face vent, and the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door. The floor cold air guide baffle is formed within the warm air guide part and is inclined at a predetermined angle on the body part to guide the air from the cold air passage toward the floor vent.
[0032] The air conditioner for the vehicle according to the present invention can lower the temperature of air discharged through the defrost vent, thus preventing a passenger's head area from becoming hot during the air conditioning mode where air is discharged through the defrost vent and satisfying the temperature difference performance between the upper and lower discharge ports. Additionally, the air conditioner for the vehicle can increase the temperature of air discharged through the face vent, thus improving straightness of the air discharged through the face vent and satisfying the vertical temperature difference performance during the bi-level mode.
[0033] Furthermore, the air conditioner for the vehicle includes the temperature channel at a position where the discharge passages of the face vent, the floor vent, and the defrost vent overlap, thus maximizing the mixing effect in environments where a mixing zone space for cold air and warm air is insufficient.
[0034] Additionally, the air conditioner for the vehicle according to the present invention can suppress the direct discharge of cold air through the constant discharge hole. In addition, during the bi-level mode, the air conditioner for the vehicle can raise the temperature at the side vent discharge port and improve the left-right temperature difference performance. The air conditioner can reduce the amount of cold air flowing through the cold air guide part of the temperature channel, thereby increasing the discharge temperature. Moreover, the air conditioner for the vehicle can raise the static pressure in the downstream space of the electric heater, thus minimizing the influence of warm air crossing to the opposite side of the separator during the dual control for the driver's seat and the passenger's seat.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] FIG. **1** is a side sectional view illustrating a conventional air conditioner for a vehicle.

[0036] FIG. **2** is a side sectional view illustrating an air conditioner for a vehicle according to a first embodiment of the present invention.

[0037] FIG. **3** is a perspective view illustrating the temperature channel of the air conditioner for the vehicle according to the first embodiment of the present invention.

[0038] FIG. **4** is a view illustrating an air flow within the temperature channel of the first embodiment of the present invention.

[0039] FIGS. **5** and **6** are perspective views illustrating a partial cutaway of the air conditioner for the vehicle according to the first embodiment of the present invention.

[0040] FIG. **7** is a perspective view illustrating the temperature channel and a separator according to the first embodiment of the present invention.

[0041] FIG. **8** is a plan view illustrating the air conditioner for the vehicle according to the first embodiment of the present invention.

[0042] FIG. **9** is a plan view illustrating a state where a face vent is closed in the air conditioner for the vehicle according to the first embodiment of the present invention.

[0043] FIG. **10** is an enlarged side sectional view illustrating a portion of the air conditioner for the vehicle according to the first embodiment of the present invention.

[0044] FIGS. **11** and **12** are views for depicting a cold air guide part and a warm air guide part of the temperature channel according to the first embodiment of the present invention.

[0045] FIGS. **13** and **14** are views for depicting a cold air guide part and a warm air guide part of the temperature channel according to a modification of FIG. **11**.

[0046] FIG. **15** is a perspective view illustrating a temperature channel of an air conditioner for a vehicle according to a second embodiment of the present invention.

[0047] FIG. **16** is a view illustrating an air flow within the temperature channel of the second embodiment of the present invention.

[0048] FIGS. **17** and **18** are bottom perspective views of the temperature channel of the air conditioner for the vehicle according to the second embodiment of the present invention.

[0049] FIG. **19** is an enlarged perspective view illustrating a face vent area where the temperature channel of the second embodiment of the present invention is installed.

[0050] FIG. **20** is a view for depicting the function of a warm air passage partition of the temperature channel according to the second embodiment of the present invention.

[0051] FIG. **21** is a view for depicting the function of a cold air blocking baffle of the temperature channel according to the second embodiment of the present invention.

[0052] FIG. **22** is a view illustrating a change in installation position of the cold air blocking baffle in FIG. **21**.

[0053] FIG. **23** is a view for depicting the function of a cold air guide baffle of the temperature channel according to the second embodiment of the present invention.

[0054] FIG. **24** is a view for depicting the function of a floor cold air guide baffle of the temperature channel according to the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0055] Hereinafter, referring to the drawings, the technical configuration of an air conditioner for a vehicle will be described in detail.

[0056] Referring to FIGS. **2** to **8**, 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. **2** corresponds to the vehicle's front-rear direction, while the left-right direction in FIG. **8**

corresponds to the vehicle's width direction.
[0057] 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**.
[0058] 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 **119**. 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 passengers' feet. The floor vent **119** is formed on the side of the air conditioning case **110** in the vehicle width direction to guide air toward the lower portion of the vehicle through a duct.
[0059] 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 to heat the air.
[0060] 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.
[0061] 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.
[0062] 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.
[0063] 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 **119**. In this case, the vent door **118** operates in a sliding type.
[0064] A separator **250** 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 **250** 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. The air passage inside the air conditioning case **110** is divided into a left passage and a right passage by the

separator **250**.
[0065] Meanwhile, the face vent **116** includes a center vent **162** and side vents **161** arranged in the vehicle width direction. Specifically, the left passage divided by the separator **250** is partitioned into the center vent **162** and the side vent **161** by a partition wall, and the right passage is also divided into the center vent **162** and the side vent **161** by a partition wall. Consequently, the center vent **162** is formed at the central portion in the vehicle width direction, and the side vents **161** are positioned on both sides.
[0066] The air conditioner for the vehicle according to a first embodiment of the present invention includes a temperature channel **200**. The temperature channel **200** is provided in the air passage inside the air conditioning case **110**, and guides the cold air passing through the cooling heat exchanger toward the discharge port of the defrost vent **115** and the warm air passing through the heating heat exchanger toward the discharge port of the face vent **116**.
[0067] The temperature channel **200** includes a cold air guide part **220**, a warm air guide part **230**, and a floor air guide part **240**. The cold air guide part **220** guides the cold air passing through the cooling heat exchanger toward the defrost vent **115**. The warm air guide part **230** guides the warm air passing through the heating heat exchanger toward the face vent **116**. The floor air guide part **240** guides the warm air passing through the heating heat exchanger toward the floor vent **119**.
[0068] Meanwhile, the defrost vent **115** and the face vent **116** are positioned above the heating heat exchanger and face the warm air passage. Additionally, the face vent **116** is located rearward of the defrost vent **115** in the vehicle. The cold air passage passing through the cooling heat exchanger is arranged rearward of the warm air passage passing through the heating heat exchanger. Furthermore, the vent door **118** is configured to slide, adjusting the opening degree of the face vent **116**. As described above, the cold air passing through the evaporator **111** flows along the cold air passage and passes the face vent **116** before reaching the defrost vent **115**. In contrast, the warm air passing through the indoor condenser **113** and the electric heater **114** flows along the warm air passage and is easily discharged through the defrost vent **115**.
[0069] The temperature channel **200** suppresses the warm air from directly flowing toward the discharge port of the defrost vent **115**, and guides the cold air to flow to the discharge port of the defrost vent **115**. In other words, the temperature channel **200** guides the cold air passing through the evaporator **111** to flow toward the discharge port of the defrost vent **115**, and guides the warm air passing through the indoor condenser **113** and the electric heater **114** to direct toward the discharge port of the face vent **116**. Additionally, the temperature channel **200** adjusts the amount of warm air and the amount of cold air directing toward the discharge port of the floor vent **119**.
[0070] Therefore, the temperature of the air discharged through the defrost vent **115** is lowered, preventing a passenger's head area from becoming hot during air conditioning modes such as a defrost mode, a mixing mode, and a floor mode, and satisfying the temperature difference performance between the upper and lower discharge ports. Furthermore, the temperature channel **200** can increase the temperature of the air discharged through the face vent **116**, thus enhancing the straightness of the air discharged to the face vent **116** and improving the vertical temperature difference performance during a bi-level mode.
[0071] The temperature channel **200** is separately formed and coupled to the air conditioning case **110** directly below the discharge port of the face vent **116**. More specifically, the temperature channel **200** includes a body part **210**, vertical partition walls **225**, and horizontal partition walls **235**. The body part **210** is slightly curved and shaped to correspond to a sliding path of the vent door **118**. If the vent door **118** slides in a straight line, the body part **210** is straight to correspond to the sliding path of the vent door **118**. Alternatively, as in this embodiment, if the vent door **118** slides in a streamlined manner, the body part **210** is also streamlined to match the sliding path of the vent door **118**.
[0072] The warm air guide part **230** is formed to penetrate the body part **210** in the thickness direction. When the temperature channel **200** is installed in the air conditioning case **110**, the warm

air guide part **230** is formed to penetrate in the vertical direction. That is, the warm air guide part **230** penetrates both sides of the body part **210** in the thickness direction to connect the warm air passage and the face vent **116**. The warm air passing through the indoor condenser **113** and the electric heater **114** is discharged upward toward the face vent **116** directly above through a through-hole of the warm air guide part **230**.

[0073] The cold air guide part **220** prevents the warm air passing through the heating heat exchanger from directly moving toward the defrost vent **115** and guides the cold air passing through the cooling heat exchanger to move to the discharge port of the defrost vent **115**. The cold air guide part **220** is formed on the body part **210** along the sliding path of the vent door **118**. The cold air guide part **220** is located on the upper surface of the body part **210**. The vent door **118** slides directly above the temperature channel **200**. In other words, the cold air guide part **220** is formed in a space between the body part **210** and the vent door **118** in the vertical direction.

[0074] The plurality of vertical partition walls **225** are formed on one surface of the body part **210** to protrude in the thickness direction. The vertical partition walls **225** are spaced apart from each other in the vehicle width direction. The cold air guide part **220** is defined by a space between the vertical partition walls **225**. That is, the cold air guide part **220** is formed in the space between the vertical partition walls **225**. Additionally, the vertical partition walls **225** act as bulkheads to partition the cold air guide part **220** from the warm air guide part **230**. When the spacing between the vertical partition walls **225** is adjusted, the width of the cold air guide part **220** can be varied.

[0075] Since the temperature channel **200** is separately manufactured and assembled into the air conditioning case **110**, the vertical partition walls **225** can be molded to have different spacings according to the specifications of the air conditioner installed in the vehicle. Thus, the temperature channel **200** can be easily applied to various specifications by varying shape of the temperature channel **200**, the position of its through-holes, and the spacing and alignment of partition walls including the vertical partition walls **225**, without requiring a change in the entire design of the air conditioning case **110**.

[0076] The cold air guide part **220** and the warm air guide part **230** are partitioned by the vertical partition walls **225**. Therefore, the air conditioner for the vehicle according to the present invention can enhance the left-right temperature difference performance in the vehicle width direction by adjusting the widths of the cold air guide part **220** and the warm air guide part **230**.

[0077] The warm air guide part **230** is positioned toward the side relative to the cold air guide part **220** in the vehicle width direction. Consequently, relatively warm air is discharged through the side vents **161**, and relatively cold air is discharged through the center vents **162**, thus improving air conditioning performance and enhancing passenger satisfaction with the air conditioner. Additionally, the floor air guide part **240** is formed on the outermost side of the temperature channel **200** in the vehicle width direction. Since the floor vent **119** is located on the side of the air conditioning case **110** and serves as a heating discharge port, the air discharged through the floor vent **119** can adequately meet the demand for warm air, which is more required than cold air.

[0078] As illustrated in FIG. **6**, a constant discharge hole **163** is formed on the vent door **118**. The constant discharge hole **163** penetrates the vent door **118** in the thickness direction (vertical direction), allowing air to be continuously discharged to the side vent **161**. Referring further to FIG. **9**, in the air conditioning mode where the vent door **118** closes the face vent **116**, the constant discharge hole **163** is positioned inside the warm air guide part **230** to be exposed to the through-hole of the warm air guide part **230**. In this case, the air conditioning mode where the vent door **118** closes the face vent **116** may include the floor mode, the mixing mode, and the defrost mode. Accordingly, air, primarily warm air, is discharged through the constant discharge hole **163**, enabling efficient temperature control.

[0079] The horizontal partition wall **235** is formed across the through-hole of the warm air guide part **230** in the vehicle width direction. The horizontal partition wall **235** partially covers the through-hole of the warm air guide part **230**. Additionally, referring to FIG. **10**, the horizontal

partition wall **235** is positioned to correspond to the end of the vent door **118** in a sliding direction of the vent door **118** during the bi-level mode. The bi-level mode is an air conditioning mode that discharges air to the face vent **116** and the floor vent **119**.

[0080] As described above, the position of the horizontal partition wall **235** is related to the position of the sliding-type vent door **118**. During the bi-level mode, the vent door **118** partially opens the face vent **116** to an intermediate degree. During the bi-level mode, the position of the horizontal partition wall **235** at the position of the vent door **118** can be selected to coincide with the end of the vent door **118** or be exposed. Preferably, during the bi-level mode, the horizontal partition wall **235** is positioned within approximately 10 mm forward or backward of the end of the vent door **118**. As described above, each area of the temperature channel **200** influences the temperature at the discharge port of the face vent **116**.

[0081] Referring to FIGS. **11** and **12**, the warm air guide part **230**, the cold air guide part **220**, and another warm air guide part **230** are sequentially arranged in the temperature channel **200** in the vehicle width direction. That is, the cold air guide part **220** is located between the warm air guide parts **230** in the vehicle width direction. The temperature channel **200** is assembled in pairs on both sides of the air conditioning case **110** based on the separator **250**. Thus, the cold air guide part **220** and the warm air guide part **230** are respectively arranged on the side vent **161** and center vent **162** at the left side based on the separator **250**, and the cold air guide part **220** and the warm air guide part **230** are also arranged on the side vent **161** and center vent **162** at the right side.

[0082] Referring further to FIGS. **13** and **14**, the warm air guide part **230**, the cold air guide part **220**, another warm air guide part **230**, and another cold air guide part **220** are sequentially arranged in the temperature channel **200** in the vehicle width direction. That is, the cold air guide part **220** and the warm air guide part **230** are alternately arranged in the vehicle width direction. Thus, the cold air guide part **220** and the warm air guide part **230** are respectively arranged on the side vent **161** and center vent **162** at the left side based on the separator **250**, and the cold air guide part **220** and the warm air guide part **230** are also arranged on the side vent **161** and center vent **162** at the right side.

[0083] As described above, the center vent **162** and the side vent **161** are arranged such that at least one cold air guide part **220** and at least one warm air guide part **230** correspond to each other in the vehicle width direction. Therefore, the air conditioner for the vehicle according to the present invention can effectively meet the desired air conditioning performance and temperature by adjusting the ratio of the cold air guide part **220** to the warm air guide part **230**.

[0084] The present invention includes the temperature channel **200** provided at a position where the discharge passages of the face vent **116**, floor vent **119**, and defrost vent **115** overlap, thereby maximizing the mixing effect of cold and warm air in environments with limited mixing zone space by incorporating the temperature channel **200** at positions where the mixing zone space for cold air and warm air is insufficient.

[0085] Referring to FIGS. **15** to **24**, an air conditioner for a vehicle according to a second embodiment of the present invention includes a temperature channel **200**. The second embodiment will be described only for the configurations differing from the first embodiment. The temperature channel **200** is formed within the air passage of the air conditioning case **110** and functions to prevent cold air passing through the cooling heat exchanger from being discharged through the constant discharge hole **163** of the vent door **118**. The temperature channel **200** includes a cold air guide part **220**, a warm air guide part **230**, and a floor air guide part **240**.

[0086] The temperature channel **200** is separately formed and coupled to the air conditioning case **110** directly below the discharge port of the face vent **116**. More specifically, the temperature channel **200** includes a body part **210** and vertical partition walls **225**. The body part **210** is slightly curved and shaped to correspond to a sliding path of the vent door **118**. If the vent door **118** slides in a straight line, the body part **210** is straight to correspond to the sliding path of the vent door **118**. Alternatively, as in this embodiment, if the vent door **118** slides in a streamlined manner, the body

part **210** is also streamlined to match the sliding path of the vent door **118**.
[0087] The floor air guide part **240** is positioned at the outermost side of the temperature channel **200** in the vehicle width direction. Since the floor vent **119** is located on the side of the air conditioning case **110** and serves as a heating discharge port, the air discharged through the floor vent **119** can adequately meet the demand for warm air, which is more required than cold air.
[0088] Additionally, the warm air guide part **230**, the cold air guide part **220**, another warm air guide part **230**, and another cold air guide part **220** are sequentially arranged within the temperature channel **200** in the vehicle width direction. That is, the cold air guide part **220** and the warm air guide part **230** are alternately arranged in the vehicle width direction. Accordingly, the cold air guide part **220** and the warm air guide part **230** are respectively arranged on the side vent **161** and center vent **162** at the left side based on the separator **250**, and the cold air guide part **220** and the warm air guide part **230** are also arranged on the side vent **161** and center vent **162** at the right side.
[0089] As described above, the center vent **162** and the side vent **161** are arranged such that at least one cold air guide part **220** and at least one warm air guide part **230** correspond to each other in the vehicle width direction. Therefore, the air conditioner for the vehicle according to the present invention can effectively meet the desired air conditioning performance and temperature by adjusting the ratio of the cold air guide part **220** to the warm air guide part **230**. The present invention includes the temperature channel **200** provided at a position where the discharge passages of the face vent **116**, floor vent **119**, and defrost vent **115** overlap, thereby maximizing the mixing effect of cold and warm air in environments with limited mixing zone space by incorporating the temperature channel **200** at positions where the mixing zone space for cold air and warm air is insufficient.
[0090] Meanwhile, the temperature channel **200** also includes a warm air passage partition **260**, a cold air blocking baffle **270**, a cold air guide baffle **280**, and a floor cold air guide baffle **290**.
[0091] The warm air passage partition **260** prevents cold air from being discharged to the constant discharge hole **163** during the bi-level mode. The bi-level mode is an air conditioning mode that discharges air through both the face vent **116** and the floor vent **119**. The warm air passage partition **260** partially blocks the through-hole of the warm air guide part **230** in the vehicle width direction. The warm air passage partition **260** is positioned to block the constant discharge hole **163** at the position of the vent door **118** during the bi-level mode.
[0092] That is, the warm air passage partition **260** is formed at the location corresponding to the side vent **161** to protrude from the vertical partition walls **225** in the thickness direction of the vent door **118**, blocking the airflow between the cold air passage and the constant discharge hole **163**. As illustrated in FIG. **20**, the warm air passage partition **260** extends to cover the constant discharge hole **163**, preventing cold air from being discharged to the constant discharge hole **163** formed in the vent door **118** during the bi-level mode. The warm air passage partition **260** is further extended from the top of the vertical partition walls **225** to form a step with the vertical partition walls **225**.
[0093] The cold air blocking baffle **270** reduces the amount of cold air discharged to the face vent **116** during the bi-level mode. The cold air blocking baffle **270** is formed protruding from the body part **210** in the thickness direction of the vent door **118**, crossing the cold air guide part **220** in the vehicle width direction. That is, as illustrated in FIG. **21**, the cold air blocking baffle **270** protrudes upward from the upper surface of the body part **210** corresponding to the cold air guide part **220**, blocking a portion of the air flowing through the cold air guide part **220** to reduce the amount of cold air.
[0094] As illustrated in FIG. **22**, it is necessary to optimize the position of the cold air blocking baffle **270**. If the cold air blocking baffle **270** is positioned at the dotted lines illustrated in the drawing, the cold air blocking baffle **270** may excessively restrict airflow during the vent mode, resulting in airflow loss. Therefore, it is preferable to position the cold air blocking baffle **270** downstream in the cold air flow direction rather than a starting point of the cold air guide part **220** of the temperature channel **200**.

[0095] The cold air guide baffle **280** acts to induce the cold air passing through the cooling heat exchanger toward the downstream side of the heating heat exchanger, increasing static pressure downstream of the heating heat exchanger. The cold air guide baffle **280** is formed within the warm air guide part **230** and extends side by side with the sliding direction of the vent door **118** on the body part **210** to direct air from the cold air passage toward a downstream space of the heating heat exchanger. That is, through the configuration of the cold air guide baffle **280**, cold air is guided downstream of the electric heater **114** via the warm air guide part **230**, raising the static pressure in the downstream space of the electric heater **114**.
[0096] As illustrated in FIG. **23**, during the vent mode or the bi-level mode, where the face vent **116** is open, the cold air is directed downstream of the electric heater **114**, increasing the static pressure downstream of the electric heater **114**. So, when the internal static pressure differs between the driver's seat and the passenger's seat (left and right sides in the vehicle width direction), the cold air guide baffle **280** can minimize the effects of air backflow from the opposite side of the separator, which could influence the fixed side of the temperature door **112**.
[0097] The floor cold air guide baffle **290** guides the cold air passing through the cooling heat exchanger toward the floor vent **119**. The floor cold air guide baffle **290** is formed within the warm air guide part **230** and is inclined at a predetermined angle on the body part **210** to guide the air from the cold air passage toward the floor vent **119**. As illustrated in FIG. **24**, the inclination angle of the floor cold air guide baffle **290** is formed to direct air toward the discharge port of the floor vent **119**.
[0098] Such a configuration allows the temperature at the discharge port of the side vent **161** to be increased during the bi-level mode, thereby improving the right-left temperature difference performance. Additionally, the configuration can reduce the amount of the cold air flowing through the cold air guide part **220** of the temperature channel **200**, thus increasing the discharge temperature. In addition, the air conditioner for the vehicle can raise the static pressure in the downstream space of the electric heater, thus minimizing the influence of warm air crossing to the opposite side of the separator during the dual control for the driver's seat and the passenger's seat.
[0099] 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.

Claims

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 discharge ports include a defrost vent and a face vent, and wherein a temperature channel is provided in an air passage inside the air conditioning case to guide cold air passing through the cooling heat exchanger to direct the discharge port of the defrost vent and guide warm air passing through the heating heat exchanger to direct the discharge port of the face vent.
2. The air conditioner according to claim 1, wherein the temperature channel includes: a cold air guide part which guides the cold air passing through the cooling heat exchanger toward the discharge port of the defrost vent; and a warm air guide part which guides the warm air passing through the heating heat exchanger toward the discharge port of the face vent.
3. The air conditioner according to claim 2, wherein the cold air guide part prevents the warm air passing through the heating heat exchanger from directly moving toward the defrost vent and guides the cold air passing through the cooling heat exchanger to move to the discharge port of the

defrost vent.

4. The air conditioner according to claim 2, wherein the defrost vent and the face vent are formed above the heating heat exchanger and face a warm air passage, the face vent is positioned further rearward in the vehicle than the defrost vent, and a cold air passage passing through the cooling heat exchanger is positioned further rearward in the vehicle than the warm air passage passing through the heating heat exchanger, and wherein the temperature channel is separately formed and coupled directly below the discharge port of the face vent in the air conditioning case.

5. The air conditioner according to claim 2, wherein a vent door is formed to slide and adjust the opening degree of the face vent, wherein the temperature channel includes a plate-shaped body part corresponding to a sliding path of the vent door, wherein the warm air guide part is formed to penetrate the body part in the thickness direction, and wherein the cold air guide part is formed along the sliding path of the vent door on the body part.

6. The air conditioner according to claim 5, wherein the warm air guide part penetrates both sides of the body part in the thickness direction to connect the face vent with the warm air passage.

7. The air conditioner according to claim 5, wherein a plurality of vertical partition walls protruding in the thickness direction is formed on one surface of the body part, wherein the vertical partition walls are spaced apart in the vehicle width direction, wherein the cold air guide part is formed in a space between the vertical partition walls, and wherein the cold air guide part and the warm air guide part are partitioned by the vertical partition walls.

8. The air conditioner according to claim 7, wherein the warm air guide part, the cold air guide part, and another warm air guide part are sequentially arranged in the temperature channel in the vehicle width direction, so that the cold air guide part is positioned between the warm air guide parts.

9. The air conditioner according to claim 7, wherein the warm air guide part, the cold air guide part, another warm air guide part, and another cold air guide part are sequentially arranged in the temperature channel in the vehicle width direction, so that the cold air guide parts and the warm air guide parts are alternately arranged in the vehicle width direction.

10. The air conditioner according to claim 7, wherein the warm air guide part is positioned further toward the side than the cold air guide part in the vehicle width direction.

11. The air conditioner according to claim 7, wherein the face vent includes a center vent and a side vent in the vehicle width direction, and wherein the center vent and the side vent are respectively arranged to correspond to at least one of the cold air guide part and the warm air guide part in the vehicle width direction.

12. The air conditioner according to claim 1, wherein the air discharge port includes a floor vent provided on the side of the air conditioning case, wherein the temperature channel includes a floor air guide part which guides the warm air passing through the heating heat exchanger to the discharge port of the floor vent, and wherein the floor air guide part is formed on the outermost side of the temperature channel in the vehicle width direction.

13. The air conditioner according to claim 5, wherein a horizontal partition wall crosses a through hole of the warm air guide part in the vehicle width direction to partially block the warm air guide part, and wherein the horizontal partition wall is positioned to correspond to the end of the vent door in the sliding direction of the vent door during a bi-level mode where air is discharged to the face vent and the floor vent.

14. The air conditioner according to claim 7, wherein the face vent includes a center vent and a side vent in the vehicle width direction, wherein a constant discharge hole which allows air to continuously flow to the side vent is formed in the vent door, and wherein during the air conditioning mode which closes the face vent, the constant discharge hole is positioned inside the warm air guide part to be exposed to the through-hole of the warm air guide part.

15. 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 discharge ports include a defrost vent and a face vent, wherein a constant discharge hole is formed in a vent door adjusting the opening degree of the face vent to allow air to be continuously discharged to the face vent, and wherein a temperature channel is provided in an air passage inside the air conditioning case to suppress cold air passing through the cooling heat exchanger from being discharged through the constant discharge hole.

16. The air conditioner according to claim 15, wherein the temperature channel guides the cold air passing through the cooling heat exchanger toward the discharge port of the defrost vent and guides the warm air passing through the heating heat exchanger toward the discharge port of the face vent, wherein the temperature channel includes a warm air passage partition which blocks the cold air from being discharged to the constant discharge hole during a bi-level mode, where air is discharged to the face vent and a floor vent, and wherein the warm air passage partition crosses the through-hole of a warm air guide part in the vehicle width direction to partially block the warm air guide part.

17. The air conditioner according to claim 16, wherein the vent door is formed to slide and adjust the opening degree of the face vent, the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, the body part has a plurality of vertical partition walls protruding on one side of the body part in the thickness direction and spaced apart in the vehicle width direction, and the face vent includes a center vent and a side vent provided in the vehicle width direction, and wherein the warm air passage partition is formed on the body part at a position corresponding to the side vent to protrude from the vertical partition walls in the thickness direction of the vent door, thus blocking airflow between the cold air passage and the constant discharge hole.

18. The air conditioner according to claim 15, wherein the temperature channel includes a cold air blocking baffle which reduces the amount of cold air discharged to the face vent during the bi-level mode where the air is discharged to the face vent and the floor vent, wherein the vent door is formed to slide and adjust the opening degree of the face vent, the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, the body part has a plurality of vertical partition walls protruding on one side of the body part in the thickness direction and spaced apart in the vehicle width direction, and the face vent includes a center vent and a side vent provided in the vehicle width direction, and wherein the cold air blocking baffle is formed protruding from the body part in the thickness direction of the vent door, crossing the cold air guide part in the vehicle width direction.

19. The air conditioner according to claim 15, wherein the temperature channel includes a cold air guide baffle which induces the cold air passing through the cooling heat exchanger toward the downstream side of the heating heat exchanger, increasing static pressure downstream of the heating heat exchanger, wherein the vent door is formed to slide and adjust the opening degree of the face vent, and the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, and wherein the cold air guide baffle is formed within the warm air guide part and extends side by side with the sliding direction of the vent door on the body part to direct air from the cold air passage toward a downstream space of the heating heat exchanger.

20. The air conditioner according to claim 15, wherein the air discharge port includes a floor vent provided on the side of the air conditioning case, wherein the temperature channel includes a floor cold air guide baffle which guides the cold air passing through the cooling heat exchanger toward the floor vent, wherein the vent door is formed to slide and adjust the opening degree of the face vent, and the temperature channel includes a plate-shaped body part corresponding to the sliding path of the vent door, and wherein the floor cold air guide baffle is formed within the warm air guide part and is inclined at a predetermined angle on the body part to guide the air from the cold air passage toward the floor vent.