A cooling and heating device for an electric vehicle includes a blower unit, which contains therein a blower in order to forcibly blow intake air. A temperature control unit is connected to the blower unit to receive air that is blown from the blower unit. A heat exchanger core having a thermoelectric element is disposed inside the temperature control unit. A heat pipe transfers heat. One end of the heat pipe is in contact with one surface of the thermoelectric element. Heat dissipation fins are disposed on the other end of the heat pipe. A cooling passage contains therein the heat dissipation fins of the heat pipe. Coolant fluid flows inside the cooling passage so that the coolant fluid performs heat exchange with the heat dissipation fins. The cooling and heating device can be used with electric vehicles and can increase cooling efficiency.
COOLING AND HEATING DEVICE FOR ELECTRIC VEHICLE

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Korean Patent Application Number 10-2010-0096458 filed on Oct. 4, 2010, the entire contents of which application is incorporated herein for all purposes by this reference.

BACKGROUND OF INVENTION

[0002] 1. Field of Invention
[0003] The present invention relates to a cooling and heating device for an electric vehicle, and more particularly, to a cooling and heating device for an electric vehicle, in which a heat exchanger core that is composed of thermoelectric elements is disposed in order to cool and heat the electric vehicle.

[0004] 2. Description of Related Art
[0005] In general, an air conditioner, also known as a Heating, Ventilation, and Air Conditioning (HVAC) system, is installed in a vehicle in order to provide a pleasant environment to a driver and passengers by performing a variety of air-conditioning functions, such as ventilation, cooling, and heating, in a cabin in response to operation by a driver. Such an HVAC system can be operated by the driver or the passenger using controls provided to the lower right of a steering wheel. The HVAC system can also be operated by adjusting a ventilation passage or running an air conditioner compressor by operating an automatic temperature control unit.

[0006] FIG. 1 is a status view schematically showing an air conditioner for a vehicle of the related art. In the air conditioner for a vehicle of the related art shown in the figure, the ventilation passage of air that passes through an air conditioner evaporator is described as follows. An air inlet door 100 determines whether inside air or outside air is the source of air to be blown. A blower 101 is configured to forcibly blow the air into a cabin of the vehicle through the air inlet door 100. The air conditioner evaporator 106 is provided such that the air that is introduced from the blower 101 passes through it. An air mix door 103 is configured such that it regulates the amount of the air that is blown toward a heater core 102. Air ducts 104 and air vents 105 are configured to supply the air that has passed through the air conditioner evaporator 106 and the heater core 102 to individual areas of the cabin of the vehicle.

[0007] Describing in greater detail the flow of the air that is supplied into the cabin of the vehicle through the ventilation passage as above, the blower 101 takes in the air from the source of air, which is selected using the air inlet door 100, and forcibly blows the air, so that the blown air is cooled while passing through the evaporator 106 of the air conditioner before being introduced into the cabin of the vehicle. After having passed through the evaporator 106 of the air conditioner, the air is introduced into the cabin of the vehicle through the air ducts 104 and the air vents 105, after selectively having passed through the heater core 102 depending on the state of the air mix door 103. The air that has passed through the heater core 102 and the air that has not passed through the heater core 102 are mixed in a mix zone 107 so that the mixed air is converted to a predetermined temperature. Afterwards, the resultant air is introduced into the cabin of the vehicle through the air ducts 104 and the air vents 105.

[0009] Therefore, when the amount of air that passes through the heater core 102 increases, the temperature of the air supplied into the cabin of the vehicle rises correspondingly. As described above, the air mix door 103 substantially serves to control the temperature of the air that is introduced into the cabin of the vehicle.

[0010] Of course, it is possible to supply air having a pre-determined temperature into the cabin of the vehicle or to regulate the supply of the air by controlling the degree to which the air vents are opened or closed and the degree to which the air conditioner compressor is operated while regulating the basic passageways of the air. The air vents 105 are generally configured to blow the air in three directions, that is, toward the feet, the chest, and the head of the driver or the passenger.

[0011] The air conditioner for a vehicle of the related art, which is configured to control the temperature of the cabin of the vehicle, actuates a cooler or a heater to cool or heat the cabin of the vehicle when controls, which are provided on a portion of a dashboard that is to the lower right of a steering wheel, are operated.

[0012] In such a combined air conditioner for a vehicle, engine coolant of the heater for a vehicle is heated, and the air taken in by the blower 101 obtains heat necessary for heating while passing through the heater core 102 which is provided in a coolant circulation path.

[0013] However, in the case in which the air conditioner of a vehicle of the related art is intended to be applied to an electric vehicle, which does not need engine coolant, it is difficult to perform heating using the existing HVAC structure. There are also problems in that it is difficult to install the heater core 102. In addition, in the case in which only a thermoelectric element is used, there are limitations on the ability to increase cooling efficiency.

[0014] The information disclosed in this Background of the Invention section is only for the enhancement of understanding of the background of the invention and should not be taken as an acknowledgment or any form of suggestion that this information forms the prior art that would already be known to a person skilled in the art.

[0015] The information disclosed in this Background section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgment or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

SUMMARY OF INVENTION

[0016] Various aspects of the present invention provide a cooling and heating device for an electric vehicle, which can be used with electric vehicles and can increase cooling efficiency.

[0017] Also provided is a cooling and heating device for an electric vehicle, which is intended to increase cooling and heating efficiency using a heating pipe.

[0018] In an aspect of the present invention, the cooling and heating device for an electric vehicle includes a blower unit, a temperature control unit, a heat pipe, and a cooling passage. The blower unit contains therein a blower in order to forcibly blow intake air. The temperature control unit is connected to the blower unit to receive air that is blown from the blower unit. A heat exchanger core having a thermoelectric element is disposed inside the temperature control unit. The heat pipe transfers heat. One end of the heat pipe is in contact with one
surface of the thermoelectric element. Heat dissipation fins are disposed on the other end of the heat pipe. The cooling passage contains therein the heat dissipation fins of the heat pipe. Coolant fluid flows inside the cooling passage so that it performs heat exchange with the heat dissipation fins.

0019 The cooling and heating device may include a plurality of the heat pipes.

0020 The heat exchanger core may be disposed on one end of the heat pipe. The heat exchanger core may include a plurality of the thermoelectric elements, wherein one surface of each of the thermoelectric elements is in contact with an outer surface of the heat pipe, heat exchanger fins in contact with the other surface of each of the thermoelectric elements, and an insulator disposed between the heat pipe and the heat dissipation fins to hold the thermoelectric elements.

0021 The cooling passage may include a circulation pump for circulating the coolant fluid, and a water-cooling blower fan for blowing outer air to the coolant fluid that is circulated by the circulation pump.

0022 A heat exchanger chamber may be provided between the circulation pump and the water-cooling blower fan, and the heat dissipation fins may be disposed in the heat exchanger chamber.

0023 The water-cooling blower fan may be disposed in a water-cooling heat exchanger, and the heat dissipation fins may be disposed inside a lower header of the water-cooling heat exchanger.

0024 The heat dissipation fins may be positioned higher than the heat exchanger core.

0025 The temperature control unit may further include a drain line. The drain line discharges moisture that is produced from the heat exchanger core to outside of the vehicle.

0026 According to various aspects of the present invention, the cooling and heating device for an electric vehicle can selectively perform cooling or heating in an electric vehicle using the heat exchanger core composed of thermoelectric elements.

0027 In addition, since the heat pipe is connected to the thermoelectric elements, heat is rapidly discharged from the temperature control unit when performing cooling, and cold air is rapidly discharged from the temperature control unit when performing heating, thereby improving cooling and heating efficiency.

0028 Furthermore, there is an advantage in that cooling and heating efficiency is improved, since heat exchange is actively performed on the heat exchanger fins, which are provided on the heat pipe, using the cooling passage through which the coolant fluid.

0029 The methods and apparatuses of the present invention have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

0030 FIG. 1 is a status view schematically showing an air conditioner for a vehicle of the related art.

0031 FIG. 2 is a status view showing an exemplary cooling and heating device of an electric vehicle according to the present invention.

0032 FIG. 3 is a cross-sectional view showing the heat exchanger core shown in FIG. 2.

0033 FIG. 4 is a status view showing another exemplary cooling and heating device of an electric vehicle according to the present invention.

DETAILED DESCRIPTION

0034 Reference will now be made in detail to various embodiments of the present invention(s), examples of which are illustrated in the accompanying drawings and described below. While the invention(s) will be described in conjunction with exemplary embodiments, it will be understood that present description is not intended to limit the invention(s) to those exemplary embodiments. On the contrary, the invention(s) is/are intended to cover not only the exemplary embodiments, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the invention as defined by the appended claims.

0035 FIG. 2 is a status view showing a cooling and heating device of an electric vehicle according to various embodiments of the invention, and FIG. 3 is a cross-sectional view showing the heat exchanger core shown in FIG. 2. As shown in FIGS. 2 and 3, the cooling and heating device for an electric vehicle of various embodiments may include a blower unit 10, a temperature control unit 20, a heat pipe 40, and a cooling passage 50. A blower 11 is disposed inside the blower unit 10. The temperature control unit 20 communicates with the blower unit 10. Heat exchanger cores 30 are disposed inside the temperature control unit 20. One end of the heat pipe 40 is in contact with the heat exchanger cores 30. Heat dissipation fins 41 are provided on the other end of the heat pipe 40. The heat dissipation fins 41 are contained inside the cooling passage 50, through which coolant fluid flows.

0036 The blower unit 10 also includes an air inlet door 12, which determines whether inside air or outside air is the source of air to be blown. The blower 11 forcibly blows the air that is introduced through the inlet door 12 to the temperature control unit 20.

0037 One portion of the temperature control unit 20 communicates with the blower unit 10 such that it receives the air that is forcibly blown from the blower unit 10, and the heat exchanger cores 30 are disposed inside the temperature control unit 20. The temperature control unit 20 is also connected to an air duct 21 or an air vent 22 such that the air that has passed through the heat exchanger cores 30 can be supplied to individual parts of the vehicle. In addition, a drain line 23, which discharges moisture produced by the heat exchanger cores 30 out of the vehicle, is provided in the lower portion of the temperature control unit 20.

0038 Each of the heat exchanger cores 30 includes thermoelectric elements 31, which are attached to the heat pipe 40 such that each first surface 31a thereof is in contact with the outer circumference of the heat pipe 40. Heat exchanger fins 32 are in contact with second surfaces 31b of the thermoelectric elements 31, which are opposite the first surfaces 31a. An insulator 33 is disposed between the heat pipe 40 and the heat exchanger fins 32 such that it holds the thermoelectric elements 31.

0039 The heat pipe 40 is a conductor that is generally used to transfer heat. In various embodiments, it may be preferred that a plurality of heat pipes be arranged in pairs. The heat pipe 40 generally has the form of a pipe with a circular cross section.

0040 The cooling passage 50 is configured such that coolant fluid circulates through the inside thereof. In the cooling
passage 50, a circulation pump 51 circulates coolant fluid, and a heat exchanger 53 is provided in the portion in which a water-cooling blower fan 52, which blows outside air to the circulating cooling fluid, is disposed. In addition, a heat exchanger chamber 54 is disposed between the circulation pump 51 and the heat exchanger 53. The heat exchanger chamber 54 contains therein the other end of the heat pipe 40, on which the heat dissipation fins 41 are mounted. In various embodiments, it may be preferred that the heat dissipation fins 41 be positioned higher than the heat exchanger cores 30 such that heat can be actively transferred. The heat exchanger 53 has a typical structure in which a plurality of heat dissipation fins 53c is provided in a passage, which connects an upper header 53a to a lower header 53b such that coolant fluid can flow therethrough.

[0041] In the cooling and heating device for an electric vehicle of various embodiments having the above-described configuration, when it is desired to cool the cabin of the vehicle, the direction of current flowing through the thermoelectric elements 31 is controlled so that the second surfaces 31b become cold but the first surfaces 31a become hot. The low-temperature state of the second surfaces 31b is transferred to the heat exchanger fins 32, which in turn maintain the inside of the temperature control unit 20 in a low-temperature state. Heat that has been produced from the first surfaces 31 is transferred to the heat pipe 40. Heat that has been transferred to one portion of the heat pipe 40 is transferred to the heat dissipation fins 41, which are disposed on the other end of the heat pipe 40, and is subjected to heat exchange with coolant fluid that circulates inside the cooling passage 50. The coolant fluid is forced by the circulation pump 51 so that it circulates through the inside of the cooling passage 50. While the coolant fluid is passing through the heat exchanger 53, heat transferred from the heat dissipation fins 41 is dissipated to the outside by the outside air that is forcibly blown by the water cooling blower fan 52. Since the cooling and heating device can dissipate heat from the heat dissipation fins 41, which are disposed on a plurality of heat pipes 40, by repeating the above-described process, the heat exchanger cores 30, which is disposed inside the temperature control unit 20, can have improved cooling and heating performance.

[0042] When the blower unit 10 is operated in this state, air that has been forcibly blown is cooled while passing through the heat exchanger cores 30. The cooled air is consequently discharged to the individual areas of the cabin through the air duct 21 or the air vent 22.

[0043] In addition, when it is desired to warm the cabin of the vehicle, the direction of current flowing through the thermoelectric elements 31 is controlled so that it becomes opposite to the direction of current flowing through the thermoelectric elements 31 when cooling the cabin of the vehicle, so that the second surfaces 31b become hot but the first surfaces 31a become cold. The high-temperature state of the second surfaces 31b is transferred to the heat exchanger fins 32, which in turn maintain the inside of the temperature control unit 20 in a high-temperature state. The low-temperature state of the first surfaces 31b absorbs heat from the heat pipe 40, which in turn lowers the temperature of the heat dissipation fins 41 on the other end of the heat pipe 40. Consequently, the heat dissipation fins 41 are subjected to heat exchange with coolant fluid that circulates inside the cooling passage 50. The coolant fluid performs heat exchange with the heat dissipation fins 41 while being circulated through the cooling passage 50 by the circulation pump 51.

Since the cooling and heating device of various embodiments can produce cold air from the heat dissipation fins 41, which are provided on a plurality of heat pipes 40, by repeating the above-described process, the heat exchanger cores 30, which are disposed inside the temperature control unit 20, can have improved heating performance.

[0044] When the blower fan 52 is operated in this state, the air that has been forcibly blown is heated while passing through the heat exchanger cores 30. The heated air is consequently discharged to individual areas of the cabin through the air duct 21 or the air vent 22.

[0045] Likewise, as shown in FIG. 4, a cooling and heating device for an electric vehicle according to other embodiments of the invention is configured such that the other end of the heat pipe 40 is disposed inside the lower header 53b of the heat exchanger 53, and the heat dissipation fins 41 are provided on the other end of the heat pipe 40. Excepting that the other end of the heat pipe 40 is provided in the lower header 53b instead of inside the heat exchanger chamber 54, the embodiment illustrated in FIG. 4 has the same structure and operation as the foregoing exemplary embodiments of the invention. In the illustrated embodiment, the heat exchanger chamber 54 is omitted.

[0046] As described above, the cooling and heating device for an electric vehicle of various embodiments is characterized in that heat is actively dissipated through the heat dissipation fins 41, which are provided on the heat pipe, so that cooling efficiency can be improved by the heat exchanger cores 30.

[0047] In addition, since the heat dissipation fins 41 are positioned higher than the heat exchanger cores 30, high-temperature heat can be easily transferred toward and dissipated from the heat dissipation fins 41.

[0048] For convenience in explanation and accurate definition in the appended claims, the terms upper or lower, inside, and etc. are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures.

[0049] The foregoing descriptions of specific exemplary embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teachings. The exemplary embodiments were chosen and described in order to explain certain principles of the invention and their practical application, to thereby enable others skilled in the art to make and use various exemplary embodiments of the present invention, as well as various alternatives and modifications thereof. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.

What is claimed is:
1. A cooling and heating device for an electric vehicle, the device comprising:
a blower unit including therein a blower to forcibly blow intake air;
a temperature control unit connected to the blower unit to receive air blown from the blower unit, wherein a heat exchanger core having a thermoelectric element is disposed inside the temperature control unit;
a heat pipe for transferring heat, wherein one end of the heat pipe is in contact with one surface of the thermo-
electric element, and heat dissipation fins are disposed on an other end of the heat pipe; and
a cooling passage containing therein the heat dissipation fins of the heat pipe, wherein coolant fluid flows inside the cooling passage so that the coolant fluid performs heat exchange with the heat dissipation fins.

2. The cooling and heating device of claim 1, comprising a plurality of heat pipes for transferring heat.

3. The cooling and heating device of claim 1, wherein the heat exchanger core is disposed on one end of the heat pipe, and includes:
   a plurality of thermoelectric elements, wherein one surface of each of the thermoelectric elements is in contact with an outer surface of the heat pipe;
   heat exchanger fins in contact with the other surface of each of the thermoelectric elements; and
   an insulator disposed between the heat pipe and the heat dissipation fins to hold the thermoelectric elements.

4. The cooling and heating device of claim 1, wherein the cooling passage includes:
   a circulation pump for circulating the coolant fluid; and
   a water-cooling blower fan for blowing outer air to the coolant fluid that is circulated by the circulation pump.

5. The cooling and heating device of claim 4, wherein a heat exchanger chamber is provided between the circulation pump and the water-cooling blower fan, and the heat dissipation fins are disposed in the heat exchanger chamber.

6. The cooling and heating device of claim 4, wherein the water-cooling blower fan is disposed in a water-cooling heat exchanger, and the heat dissipation fins are disposed inside a lower header of the water-cooling heat exchanger.

7. The cooling and heating device of claim 1, wherein the heat dissipation fins are positioned higher than the heat exchanger core.

8. The cooling and heating device of claim 1, wherein the temperature control unit further includes a drain line, wherein the drain line discharges moisture that is produced from the heat exchanger core out of the vehicle.

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