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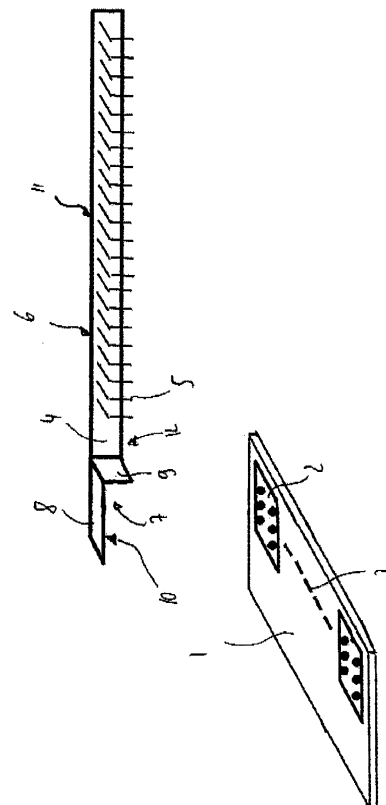
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(54) **Electric heater**

(57) The invention relates to an electric heater for an automobile vehicle, with at least one heating element and with at least one circuit board (1), whereby the circuit board (1) possesses at least one contact area (2) through which an electrical connection between a heating element and a power supply can be realized, whereas the heating element possesses at least one PTC-heating element, which is connected to at least one connecting sheet (6), whereby the heating element is bonded with a contact area (2) on the circuit board (1) through the connecting sheet (6).

Fig. 1



Description

Field of invention

[0001] The invention relates to an electric heater for an automobile vehicle, with at least one heating element and with at least one circuit board, whereby the circuit board possesses at least one contact area through which an electrical connection between a heating element and a power supply can be realized, whereas the heating element possesses at least one PTC-heating element, which is connected to at least one connecting sheet.

State of the art

[0002] Electric heaters usually consist of at least one heating element which can be heated by applying an electric current to the element. The heat is then transported via fins or other thermally conductive parts to a heat sink. The heat sink can thus be heated by the heating element. To control the electric current on the heating element electric heaters also possess a control unit.

[0003] Electric heaters known in the state of the art have a connection assembly between the heating elements and the control unit and/or the power supply. The connection assembly is usually built of a male connector and a female connector. Due to the nature of such a connection assembly the electric heater is exposed to mechanical stress while the connectors are being connected.

[0004] Furthermore the connection assembly can be exposed to corrosion, humidity or mechanical stress due to its location within the electric heater. Especially, if the individual heating elements are connected by a connection assembly to a common bussystem, which is connected to a power supply, the assembling of every heating element will cause mechanical stress to all the other already assembled heating elements. This can lead to damage within the connection assemblies or the heating elements.

[0005] Furthermore it is difficult to achieve a connection assembly that is sufficiently sealed off against water or more general humidity. Especially the area around the connector in or at a housing is critical, as water or humidity can leak through the joint-area between the connector and the housing.

[0006] An entry of water or humidity in general can lead to fretting corrosion and hence to failure of the electric heater. Due to the environment in which such electric heaters are usually used, the connector has to fulfill a high level of requirements over the full lifetime to prevent failure. Electric heaters of this kind are usually used within automobile vehicles to support the heating of the engine or the interior of the vehicle.

Object of the invention, solution, advantage

[0007] Therefore it is the object of the invention to provide an electric heater which has an improved connection between a power switch and an electric heating element, which can be obtained with a minimum of mechanical stress to the electric heater. Furthermore the electric heater should be easily producible.

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[0008] The object is achieved by the features of patent claim 1.

[0009] According to the invention an electric heater for an automobile vehicle is provided, with at least one heating element and with at least one circuit board, whereby the circuit board possesses at least one contact area through which an electrical connection between a heating element and a power supply can be realized, whereas the heating element possesses at least one PTC-heating element, which is connected to at least one connecting sheet, whereby the heating element is bonded with a contact area on the circuit board through the connecting sheet.

[0010] The circuit board is preferably a so called printed-circuit-board that mechanically supports and electronically connects electrical components. The circuit board can be connected to a power supply by a direct connection or via alternative conducting means, e.g. a conductive bypass-bus or the like.

[0011] The PTC-heating elements are elements which are already well known in the state of the art. The PTC-heating elements are connected to a connecting sheet, which is then bonded to a designated contact area at the circuit board and thus creates an electronically conductive connection between the connecting sheet and the circuit board.

[0012] According to one advantageous refinement of the invention, the heating element respectively the connecting sheet is glued to the contact area of the circuit board.

[0013] A connection between the connecting sheet and the circuit board, which is created by the use of glue, is advantageous as it makes the usually used mechanical connection assemblies unnecessary. Mechanical connection assemblies usually consist of a male and a female connector which are put together through an external force that is brought on the connectors. This force can lead to permanent damage in the electric heater. Therefore the bonding by glue between the connecting sheet and the circuit board is very beneficial to assure a stress-free assembly.

[0014] In a further advantageous refinement, the connecting sheet is glued to the contact area with the same glue as the PTC-heating element is glued to the connecting sheet.

[0015] It is very advantageous if both the connection between the PTC-heating element and the connecting sheet and the connection between the connecting sheet and the circuit board are created with the same glue. This makes assembly much easier. Furthermore it helps to create connections which have the same characteristics regarding criteria such as temperature resistance or mechanical stress resistance.

[0016] It is preferable, if the glue used to bond the connecting sheet to the contact area is electrically conductive. Glue, which has electrically conductive characteristics, is advantageous to support the conductivity within the connection. The conductivity of the glue can especially be improved by enriching the glue with a conductive material.

[0017] Furthermore it is functional, if the contact area and/or the circuit board and/or the part of the connecting sheet, which is glued to the contact area, is covered by an electric cal insulation and/or an insulation against fluid leakage and/or an insulation against mechanical stress.

[0018] An insulation against short-circuits, fluid leakage or mechanical stress is advantageous to prevent failures due to influences like the before mentioned. Insulations of these kinds can for instance be realized by membranes or foils, which are spread over the specific area.

[0019] Furthermore it is beneficial, if the heating element possesses at least one PTC-heating element and multiple heat transmitting fins, whereby the PTC-heating element is electrically connected to the connecting sheet. A multitude of PTC-heating elements and/or fins can be advantageous to influence the maximum heat output of a specific electric heater.

[0020] Besides this it is preferable, if the circuit board and/or the contact area of the circuit board is electrically connected to at least one pole of a power supply. Via a connection between the circuit board and a pole of a power supply the power supply of the connecting sheets and thus the power supply of the PTC-heating elements can be realized. In an advantageous embodiment of the invention the PTC-heating elements are connected to at least one pole of a power supply by one connecting sheet and furthermore connected to a second pole of a power supply or to the ground by a second connecting sheet to create a closed circuit, which allows the PTC-heating elements to be heated.

[0021] Furthermore it is beneficial, if the circuit board and/or the contact area and/or the connecting sheet are coated with an electrically conductive material.

[0022] An electrically conductive material can be for instance tin, copper, brass, silver, an alloy of the afore mentioned or the like. A coating of the circuit board and/or the contact area and/or the connecting sheet with an identical electronically conductive coating is advantageous to reach a better material compatibility between the involved elements.

[0023] In an additional embodiment it is preferable, if the connecting sheet possesses a buckled section with which the connecting sheet is connectable to the contact area of the circuit board.

[0024] Through a buckled section the mechanical stress resistance and stability of the connecting sheet can be raised and thus the stability of the whole electric heater. Preferably the buckled section is close to the connection area of the circuit board. In a most preferred embodiment the buckled section is formed in a way that a

supporting effect between the circuit board and the connecting sheet can be obtained. Therefore the buckled section can be used as a brace against the circuit board.

[0025] Besides this it is preferable, if the connecting sheet is a planar body which extension in two of the three spatial directions is larger than the extension in the third spatial direction, whereby the PTC-heating element is connected to one side of the connecting sheet and one or more fins are connected to the opposed side of the connecting sheet.

[0026] Such a design of the connecting sheet is advantageous as it allows a multitude of PTC-heating elements to be placed alongside each connecting sheet. Due to its relatively short extension in the third spatial direction the temperature resistance along the third spatial direction is relatively low, which helps to improve the overall efficiency of the electric heater.

[0027] In another embodiment it is favorable, if the connecting sheet is built as a first L-shaped body, whereby the longer flank features the fins and/or the PTC-heating elements and the shorter flank features a plate-like appendix, which is arranged on the shorter flank in a way that the shorter flank and the appendix form a second L-shaped body, whereby the appendix builds the connecting area which can be glued to the contact area of the circuit board.

[0028] The L-shape of the first and second body is advantageous as it offers a higher amount of stability compared to a plate-like body. The shorter flank of the first body is built by the shorter flank of the second L-shaped body, which makes the shorter flanks identical. The longer flank of the second L-shaped body is preferably rotated by an angle of 90 degrees against the longer flank of the first L-shaped body.

[0029] In a preferred embodiment the Electric heater possesses a multitude of PTC-heating elements, whereby the PTC-heating elements have two opposed sides, whereby each of the sides is connected to a connecting sheet, whereby the side of the connecting sheet which is opposed to the side that is connected to the PTC-heating element is connected to a multitude of fins, whereby each connecting sheet is glued to a connecting area of a circuit board, whereby the connecting sheets are connected to either a positive pole of a power supply or a negative pole of a power supply or the ground.

[0030] Further preferable embodiments of the invention are described in the claims and the following description of the drawing.

50 Description of the drawing

[0031] The invention is explained in detail below by means of an exemplary embodiment and with reference to the drawing, in which:

Fig. 1 shows a schematic view of a connecting sheet with a multitude of fins and a buckled section, which is located above a contact area of a circuit

board to which it can be glued to realize an electrically conductive connection.

Preferred embodiments of the invention

[0032] Figure 1 shows a schematic view of a circuit board 1 which possesses two contact areas 2 on the upper side of the circuit board 1. Within the contact area 2 a plurality of electronic contacts is shown. These can be connected to a power supply or a control unit or the like. The circuit board 1 furthermore shows an electric circuit 3 which is printed on the upper side of the circuit board 1.

[0033] The circuit board 1 is preferably built from a material that can give a structural support to the electric heater (not shown in Fig. 1) which the circuit board 1 is a component of. Therefore it is preferably stiff enough to absorb mechanical stress up to a certain level without the occurrence of structural damage of the circuit board 1.

[0034] The electric circuit 3 on the circuit board 1 is exemplary. In other embodiments a plurality of electric circuits can be printed on the circuit board.

[0035] Above the circuit board 1 a connecting sheet 6 is shown. The connecting sheet 6 preferably consists of a highly conductive material, which poses a minimal resistance to heat transport and to an electric current. The shown embodiment of the connecting sheet 6 is built by a first L-shaped body 12 consisting of a longer flank 4 and a shorter flank 9, which are arranged in a 90 degree angle to each other. The side of the longer flank 4, which points to the observer, shows a multitude of fins 5. These fins 5 are used to improve the heat dissipation from the PTC-heating element (not shown in Fig. 1) to a fluid that streams around the electric heater or more specifically around the fins 5.

[0036] In Figure 1 the design of the fins 5 is only indicated with L-shaped outlines. In alternative embodiments a wide variety of different fin-designs can be used. Preferred fin-designs are for instance wave-shaped fins, zig-zag-shaped fins, corrugated fins or fins in a meandering shape.

[0037] The larger flank 8 of the second L-shaped body 7 is built by an appendix 8. The appendix 8 is shaped as a plate-like body. The Appendix 8 acts as bonding partner for the contact area 2 of the circuit board 1. Between the downward oriented side 10 of the appendix 8 and the upward oriented side of the contact area 2 a connection can be created by using glue. The glue is either highly conductive itself or is enriched with an electrically conductive material to improve the conductivity of the glue.

[0038] The L-shaped design of the second body 7 is created through the buckle between the two flanks 8, 9. The buckle contributes to a higher stability of the second L-shaped body 7 and thus to the stability of the whole connecting sheet 6. The shorter flank 9 can additionally be brought in direct contact with the outer edge of the circuit board 1. By means of this the connecting sheet 6 can be braced by the circuit board 1 and the overall sta-

bility of the connection can be improved.

[0039] On the backside 11 of the longer flank 4 of the first L-shaped body 12 a plural of PTC-heating elements (not shown in Fig. 1) can be arranged. These PTC-heating elements are preferably glued to the connecting sheet 6 by the same glue that is used for the connection between the connecting sheet 6 and the contact area 2 of the circuit board 1.

[0040] The contact area 2 and the appendix 8 can be covered by an insulation (not shown in Fig. 1) which protects the electric heater against short-circuiting, damage due to fluid leakage or due to mechanical stress.

[0041] A preferred embodiment of an electric heater possesses a plurality of circuit boards, which can be arranged in a stacked formation. The individual circuit boards can feature a plurality of contact areas for respectively one connecting sheet. The electric heater also comprises a plurality of connecting sheets which respectively have a plurality of fins and PTC-heating elements attached to them. The connecting sheets are respectively connected to either the positive pole or the negative pole of a power supply so that the PTC-heating elements are placed within a closed electric circuit. The circuit boards and/or the connecting sheets can be arranged within a housing or a frame that gives additional support.

[0042] While the invention has been shown in Figure 1 in one preferred embodiment, it will be clear to those skilled in the arts to which it pertains that a variety of modifications and changes can be made thereto without departing from the scope of the invention.

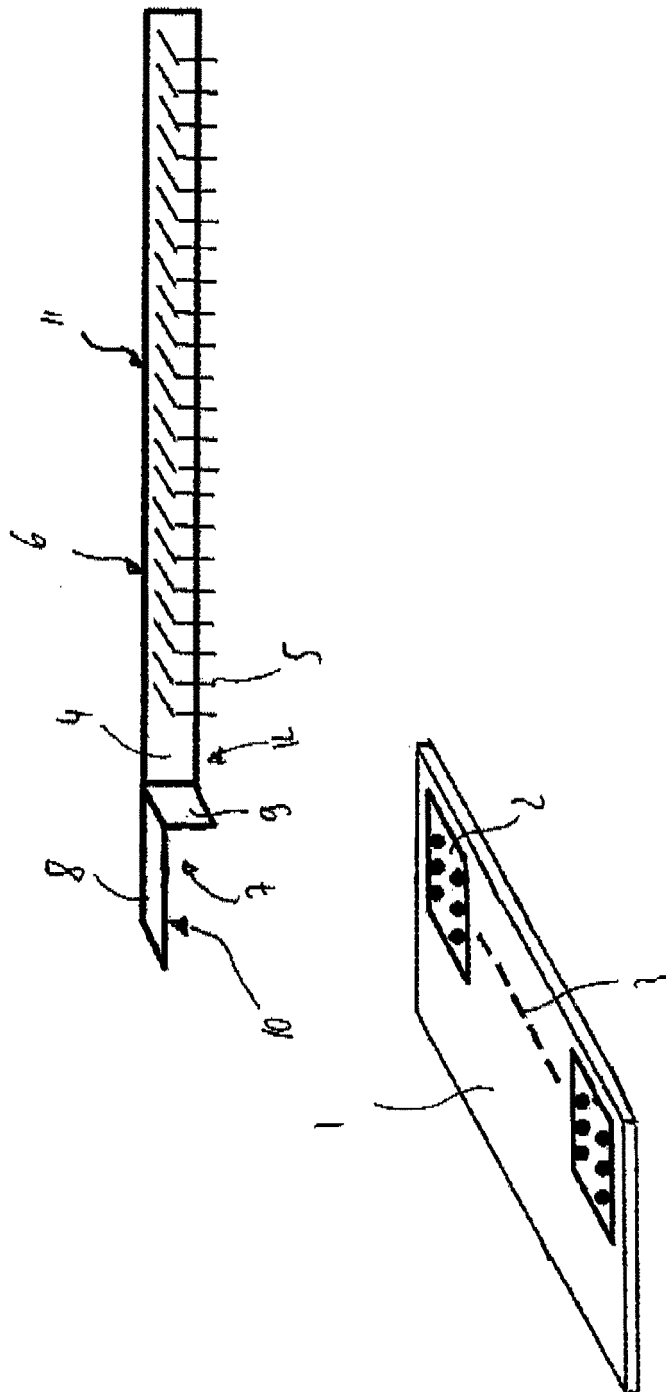
Claims

1. Electric heater for an automobile vehicle, with at least one heating element and with at least one circuit board (1), whereby the circuit board (1) possesses at least one contact area (2) through which an electrical connection between a heating element and a power supply can be realized, whereas the heating element possesses at least one PTC-heating element, which is connected to at least one connecting sheet (6), **characterized in that** the heating element is bonded with a contact area (2) on the circuit board (1) through the connecting sheet (6).
2. Electric heater as claimed in claim 1, **characterized in that** the heating element respectively the connecting sheet (6) is glued to the contact area (2) of the circuit board (3).
3. Electric heater as claimed in one or more of the previous claims, **characterized in that** the connecting sheet (6) is glued to the contact area (2) with the same glue as the PTC-heating element is glued to the connecting sheet (6).
4. Electric heater as claimed in one or more of the pre-

vious claims, **characterized in that** the glue used to bond the connecting sheet (6) to the contact area (2) is electrically conductive.

5. Electric heater as claimed in one or more of the previous claims, **characterized in that** the contact area (2) and/or the circuit board (1) and/or the part of the connecting sheet (6), which is glued to the contact area (2), is covered by an electrical insulation and/or an insulation against fluid leakage and/or an insulation against mechanical stress. 5
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6. Electric heater as claimed in one or more of the previous claims, **characterized in that** the heating element possesses at least one PTC-heating element and multiple heat transmitting fins (5), whereby the PTC-heating element is electrically connected to the connecting sheet (6). 15
7. Electric heater as claimed in one or more of the previous claims, **characterized in that** the circuit board (1) and/or the contact area (2) of the circuit board (1) is electrically connected to at least one pole of a power supply. 20
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8. Electric heater as claimed in one or more of the previous claims, **characterized in that** the circuit board (1) and/or the contact area (2) and/or the connecting sheet (6) are coated with an electrically conductive material. 30
9. Electric heater as claimed in one or more of the previous claims, **characterized in that** the connecting sheet (6) possesses a buckled section (7) with which the connecting sheet (6) is connectable to the contact area (2) of the circuit board (1). 35
10. Electric heater as claimed in one or more of the previous claims, **characterized in that** the connecting sheet (6) is a planar body which extension in two of the three spatial directions is larger than the extension in the third spatial direction, whereby the PTC-heating element is connected to one side (11) of the connecting sheet (6) and one or more fins (5) are connected to the opposed side of the connecting sheet (6). 40
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11. Electric heater as claimed in one or more of the previous claims, **characterized in that** the connecting sheet (6) is built as a first L-shaped body (12), whereby the longer flank (4) features the fins (5) and/or the PTC-heating elements and the shorter flank (9) features a plate-like appendix (8), which is arranged on the shorter flank (9) in a way that the shorter flank (9) and the appendix (8) form a second L-shaped body (7), whereby the appendix (8) builds the connecting area (10) which can be glued to the contact area (2) of the circuit board (1). 50
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Fig. 1





EUROPEAN SEARCH REPORT

 Application Number
 EP 13 29 0230

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 December 2013	Examiner Schwaiger, Bernd
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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