Claims

1. A device for contacting electrical energy storage cells (1-i) of an energy store (11), which are each connected at their poles (2-i, 3-i) to a printed circuit board (7, 8) via an electrically and thermally conductive contact element (4-i, 5-i), said printed circuit board being provided to separate an electrical current (I), flowing from the respective energy storage cell (1-i) via the contact element (2-i, 3-i), from a heat flow ($\dot{Q}_s$) received via the contact element (2-i, 3-i), wherein the contact element (4-i, 5-i) draws its elastic deformation from the change in a longitudinal extension in a direction perpendicular to the contact surfaces of the poles.

2. The device as claimed in claim 1, wherein, provided on both poles (2-i, 3-i) of the electrical energy storage cell (1-i) are in each case flat contact elements (4-i, 5-i) consisting of an elastic material between the respective pole (2-i, 3-i) of the electrical energy storage cell (1-i) and the respective printed circuit board (7, 8).

3. The device as claimed in claim 2, wherein the elastic material is an elastic contacting material which consists of a mixture of elastomer and metal particles and electrically and thermally connects two electrical conductors consisting of different materials, without these electrical conductors touching, wherein the surface of the pole or of one electrical conductor is completely or partially protected against being contacted by moisture.

4. The device as claimed in any one of the preceding claims 1 to 3, wherein the electrical energy storage cells (1-i) are clamped at their two poles (2-i, 3-i) between two printed circuit boards (7, 8).

5. The device as claimed in any one of the preceding claims 1 to 4, wherein the printed circuit boards (7, 8) comprise in each case an electrically conductive and heat-conducting first layer (7-1, 8-1) which lies against the contact element (4-i, 5-i), wherein the first layer (7-1, 8-1) of the printed circuit board (7, 8) laterally discharges the electrical current (I) flowing via the contact element (4-i, 5-i) and transfers the heat flow ($Q^{\bullet}_{s}$) flowing via the contact element (4-i, 5-i) to a second heat-conducting layer (7-2, 8-2) of the printed circuit board (7, 8) which outputs the heat flow ($Q^{\bullet}_{s}$) received by the first layer (7-1, 8-1) of the printed circuit board (7, 8) to a surrounding area or to a cooling medium.

6. The device as claimed in any one of the preceding claims 1 to 5, wherein the electrically and thermally conductive first layer (7-1, 8-1) also permits lateral heat dissipation owing to a suitable pole arrangement.

7. The device as claimed in any one of the preceding claims 1 to 5, wherein the second layer (7-2, 8-2) of the printed circuit board (7, 8) is electrically conductive and is separated from the electrically conductive first layer (7-1, 8-1) of the printed circuit board (7, 8) by an electrically insulating intermediate layer (7-3, 8-3) of the printed circuit board (7, 8), wherein the electrically insulating intermediate layer (7-3, 8-3) of

the printed circuit board (7, 8) consists of a thermally conductive material.

8. The device as claimed in any one of the preceding claims 1 to 7, wherein electrical safety elements (9-i) or tapered sections for overload protection are provided in or on the electrically and thermally conductive first layer (7-1, 8-1) of the printed circuit board (7, 8).

9. The device as claimed in any one of the preceding claims 1 to 8, wherein the electrical energy store (11) comprises a plurality of energy storage cells (1-i) which are connected in parallel in an energy storage cell group (12A, 12B), wherein a plurality of energy storage cell groups (12A, 12B) each comprising energy storage cells (1-i) connected in parallel are series-connected in the energy store (11), and wherein the energy storage cells (1-i) include chemical or physical storage systems.

10. The device as claimed in claim 9, wherein the series-connected energy storage cell groups (12A, 12B) of the energy store (11) are connected to an electronic monitoring unit (13) in each case via sense lines (14-i) which are provided in the printed circuit boards (7, 8), which monitoring unit monitors an electrical voltage applied in each case at the energy storage cell group (12A, 12B) of the energy store (11).

11. The device as claimed in any one of the preceding claims 1 to 10, wherein an electrical safety element (9-i) for current limitation is provided in or on the first layer (7-1, 8-1) of the printed circuit board (7, 8) for each energy storage cell group (12A, 12B) or for each individual energy storage cell (1-i) of an energy storage

cell group (12A, 12B).

12. The device as claimed in claim 10 or 11, wherein the heat output by an energy storage cell (1-i) or by an energy storage cell group (12A, 12B) of the energy store (11) is detected by at least one associated temperature sensor which is provided on one of the printed circuit boards (7, 8) and signals the detected temperature to the electronic monitoring unit (13) of the energy store (11) via sensor lines on the printed circuit board (7, 8).

13. the device as claimed in any one of the preceding claims 10 to 12, wherein the lines for the active current, the sensor lines and the sense lines (14-i) are guided in one and the same printed circuit board (7, 8).

14. The device as claimed in any one of the preceding claims 1 to 13, wherein compensation resistors are provided for converting excess charge from energy storage cells (1-i) of the energy store (11) into heat and the heat produced thereby is output to the printed circuit boards (7, 8) via the electrically and thermally conductive contact elements (4-i, 5-i), wherein the heat output by the compensation resistors is uniformly distributed via the printed circuit boards (7, 8), consisting of thermally conductive layers, in order to pre-heat the energy store (11), in particular in the case of low ambient temperatures.

15. An energy storage device (10) for a vehicle having an energy store (11) which comprises a plurality of series-connected energy storage cell groups (12A, 12B) which consist of energy storage cells (1-i) connected in parallel, wherein the poles (2-i, 3-i) of an energy

storage cell (1-i) are connected to a printed circuit board (7, 8) in each case via an electrically and thermally conductive contact element (4-i, 5-i), said printed circuit board being provided to separate an electrical current (I), flowing from the respective energy storage cell (1-i) via the contact element (4-i, 5-i), from a heat flow ($\dot{Q}_s$) received via the contact element (4-i, 5-i).

Claims

1. A device for contacting one or more electrical energy storage cells of an energy store, each storage cells including a pair of poles for connection to a printed circuit board, comprising:

an electrically and thermally conductive contact element provided on the contact surfaces of each of said pair poles of each of the one or more electrical energy storage cells,

one or more printed circuit boards connected to each of said pair of poles of each of the one or more electrical energy storage cells and provided to separate an electrical current, flowing from the respective energy storage cell via the contact element, from a heat flow received via the contact element,

wherein the contact element is elastically deformable from a change in a longitudinal extension in a direction perpendicular to the contact surfaces of the poles,

wherein the contact element for each pole is a flat contact element including an elastic material between the respective pole of the electrical energy storage cell and the one or more printed circuit boards, and

further wherein the elastic material is an elastic contacting material which includes a mixture of elastomer and metal particles configured to electrically and thermally connect two electrical conductors consisting of different materials without these electrical conductors touching, wherein the contact surface of the pole is completely or partially protected against being contacted by moisture.

2. The device as claimed in claim 1, wherein the electrical energy storage cells are clamped at their two poles between two printed circuit boards.

3. The device as claimed in claim 1, wherein the one or more printed circuit boards each include an electrically conductive and heat-conducting first layer which lies against a corresponding contact element, wherein the first layer laterally discharges the electrical current flowing via the contact element and transfers the heat flow flowing via the contact element to a second heat-conducting layer of the one or more printed circuit boards which outputs the heat flow received by the first layer to a surrounding area or to a cooling medium.

4. The device as claimed in claim 1, wherein the first layer is further configured to permit lateral heat dissipation owing to a suitable pole arrangement.

5. The device as claim 1, wherein the second layer is electrically conductive and is separated from the first layer by an electrically insulating intermediate layer of the one or more printed circuit boards, wherein the electrically insulating intermediate layer includes a thermally conductive material.

6. The device as claimed in claim 1, further comprising electrical safety elements or tapered sections for overload protection provided in or on the first layer of the one or more printed circuit boards.

7. The device as claimed in claim 1, in which the electrical energy store includes a plurality of energy storage cells with poles including the electrically and thermally conductive contact element, which plurality of energy storage cells are connected in parallel in an energy storage cell group, wherein a plurality of energy storage cell groups each including energy storage cells connected in parallel are series-connected in the energy store, and wherein the energy storage cells include chemical or physical storage systems.

8. The device as claimed in claim 7, wherein the series-connected energy storage cell groups of the energy store are connected to an electronic monitoring unit in each case via sense lines which are provided in the one or more printed circuit boards, wherein the monitoring unit is configured to monitor an electrical voltage applied at each energy storage cell group of the energy store.

9. The device as claimed in claim 7, further comprising an electrical safety element for current limitation provided in or on said first layer of for a corresponding one of the one or more printed circuit boards for each energy storage cell group or for each individual energy storage cell of an energy storage cell group.

10. The device as claimed in claim 8, further comprising at least one temperature sensor associated with each energy storage cell or each energy storage cell group configured to detect the heat output by the associated energy storage cell or by the associated energy storage cell group of the energy store, wherein the at least one associated temperature sensor is provided on one of the one or more printed circuit boards, the at least one temperature sensor configured to transmit a signal indicative of the detected temperature to the electronic monitoring unit of the energy store via sense lines on the one or more printed circuit boards.

11. The device as claimed in claim 10, wherein the sense lines for the electronic monitoring unit and for the at least one temperature sensor are guided in one and the same one or said one or more printed circuit boards.

12. The device as claimed in claim 1, further comprising compensation resistors configured for converting excess charge from energy storage cells of the energy store into heat , whereby the heat produced thereby is output to the one or more printed circuit boards via the electrically and thermally conductive contact elements, wherein the heat output by the compensation resistors is uniformly distributed via thermally conductive layers included in the one or more printed circuit boards, in order to pre-heat the energy store.

13. The device as claimed in claim 9, further comprising at least one temperature sensor associated with each energy storage cell or each energy storage cell group configured to detect the heat output by the associated energy storage cell or by the associated energy storage cell group of the energy store , wherein the at least one associated temperature sensor is provided on one of the one or more printed circuit boards, the at least one temperature sensor configured to transmit a signal indicative of the detected temperature to the electronic monitoring unit of the energy store via sense lines on the one or more printed circuit boards.

14. The device as claimed in claim 9, wherein the sense lines for the electronic monitoring unit and for the at least one temperature sensor are guided in one and the same one or said one or more printed circuit boards.