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(54) **POWER STORAGE MODULE AND POWER STORAGE DEVICE**

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(57) **ABSTRACT**

A power storage module includes a plurality of single cells. The plurality of the single cells are stacked in a stacking direction. Each of the plurality of the single cells includes a case. The case has a rectangular-parallelepiped-like shape with six outer surfaces. The six outer surfaces include a terminal surface and an opposite surface. The terminal surface is an outer surface, among the six outer surfaces, to which a positive electrode terminal and a negative electrode terminal are provided. The opposite surface is an outer surface, among the six outer surfaces, that is located opposite to the terminal surface. Each of the terminal surface and the opposite surface is parallel to the stacking direction. The plurality of the single cells are aligned in the stacking direction in such a manner that the terminal surface alternates with the opposite surface.

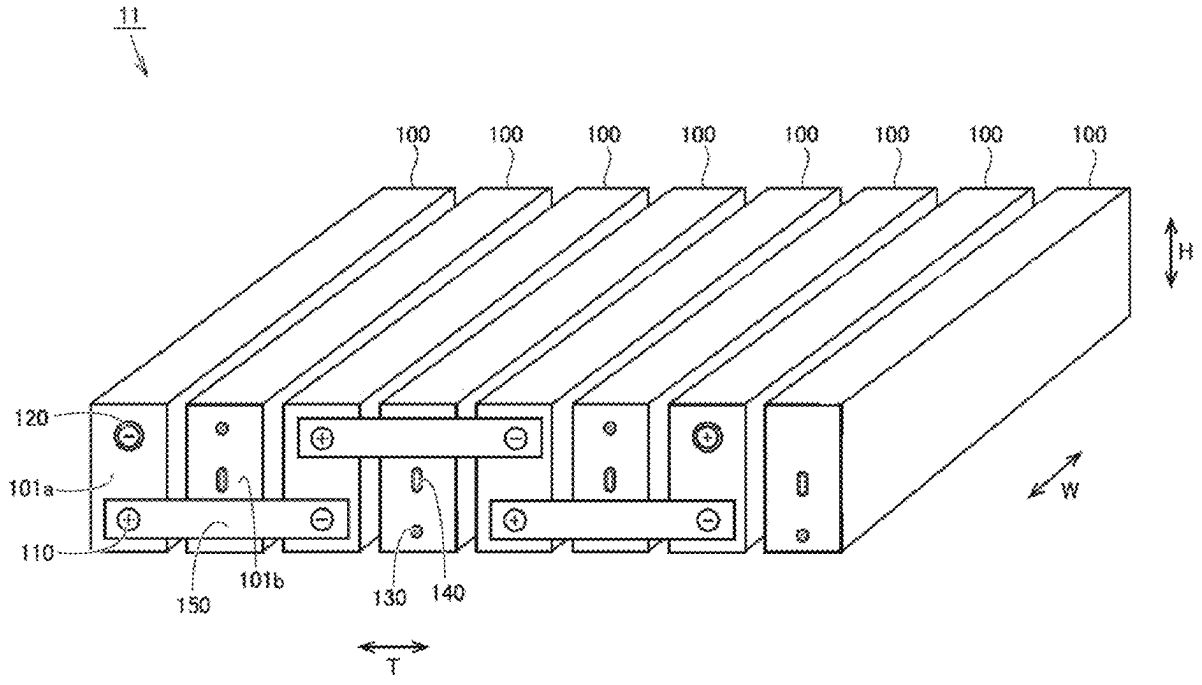
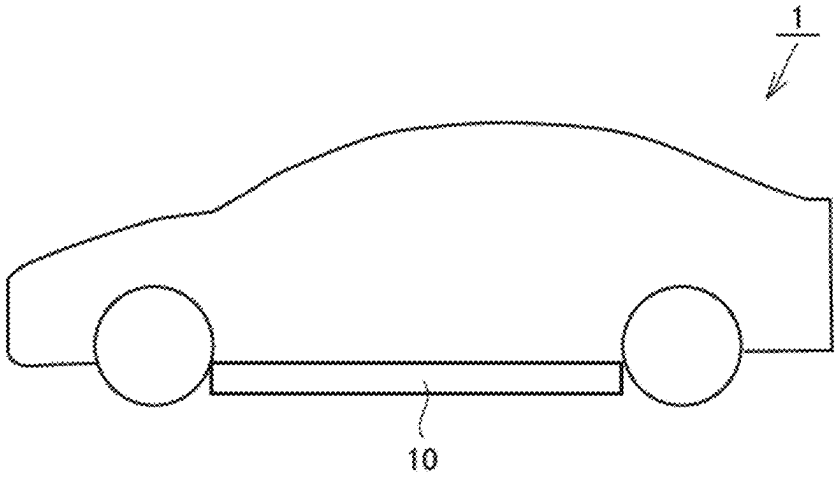


FIG.1



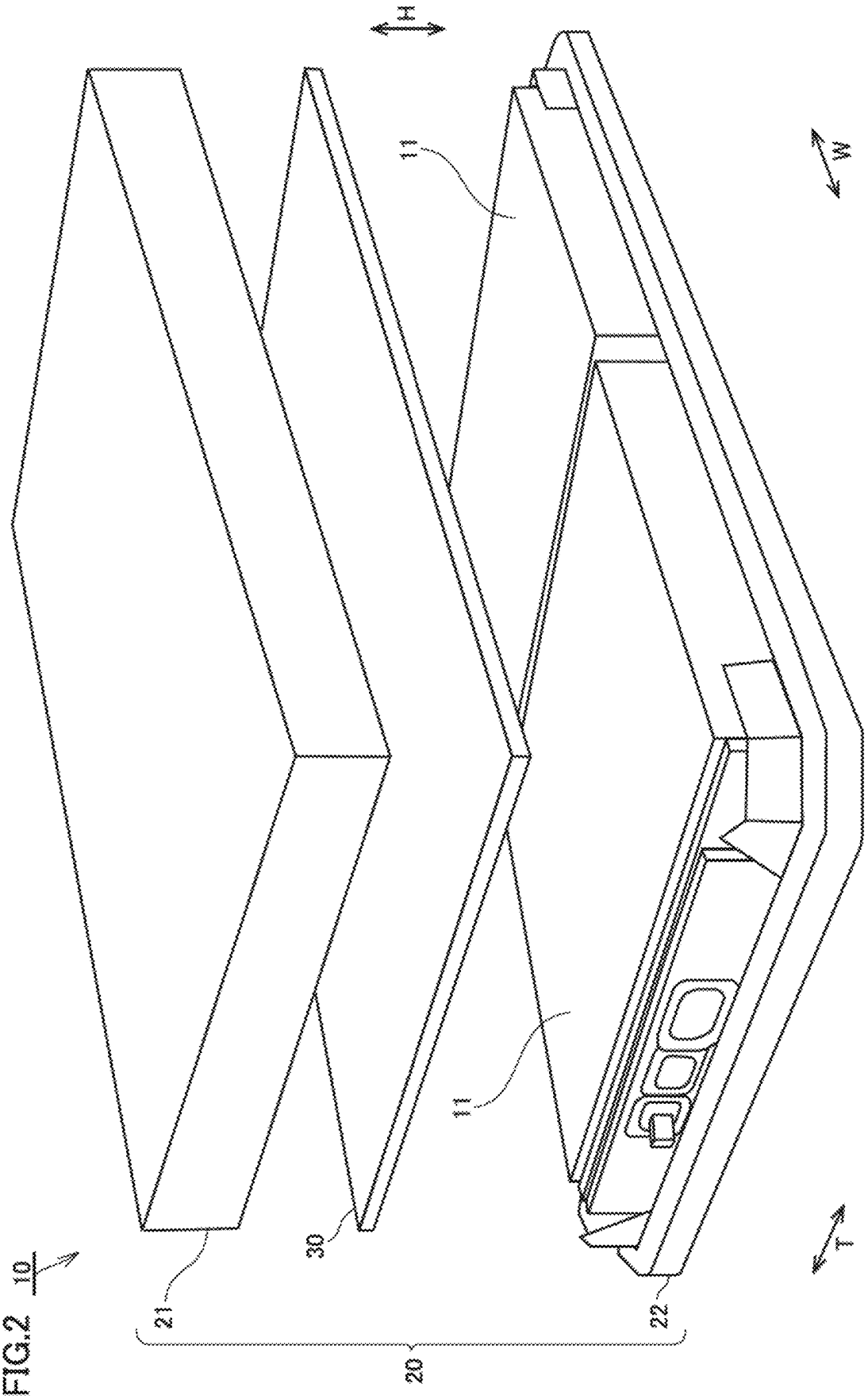


FIG.2

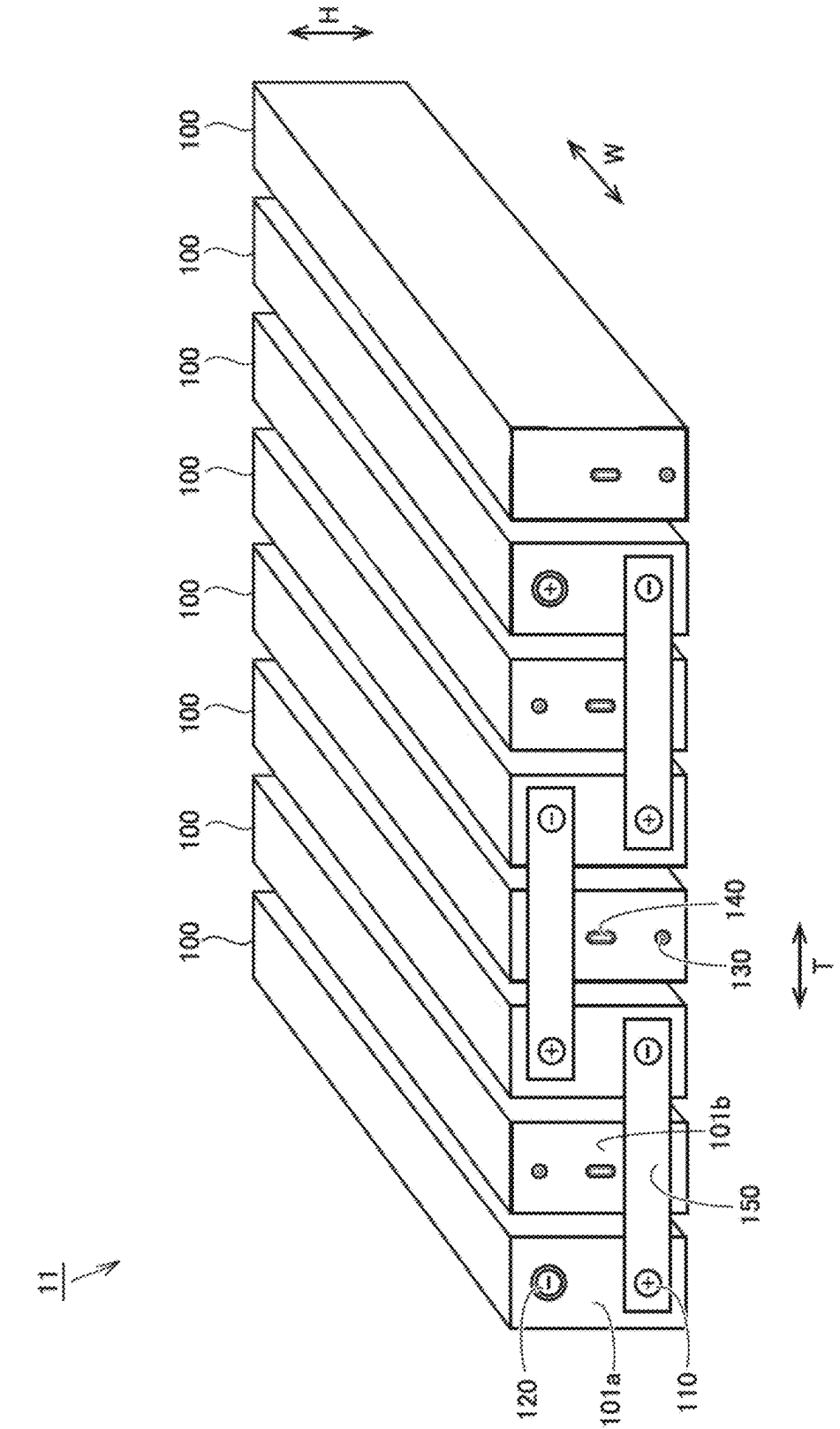

H
W
T
11
100
100
100
100
100
100
100
100
140
130
101b
150
120
101a
110

FIG.3

FIG.4

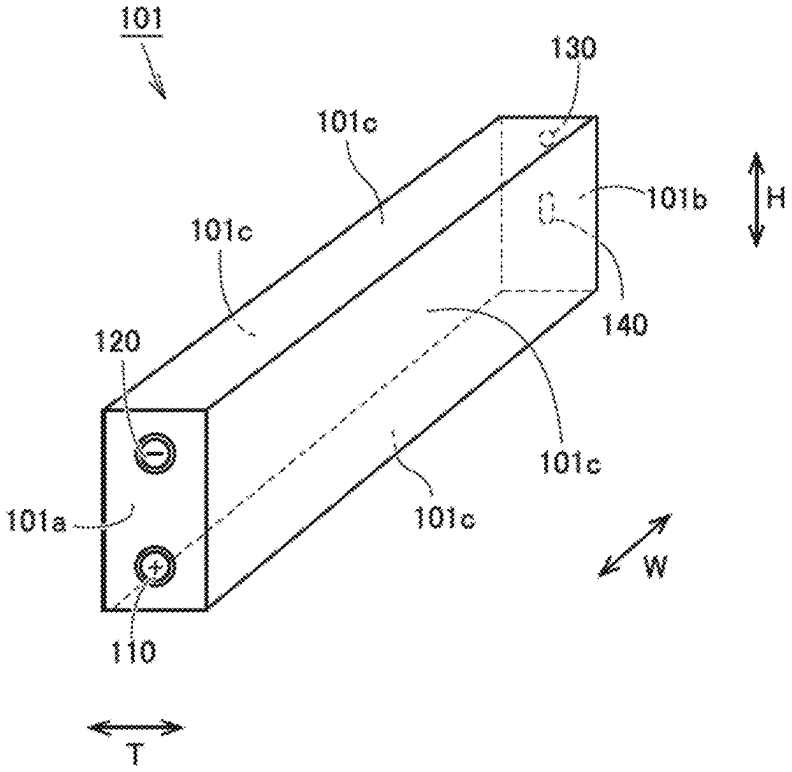
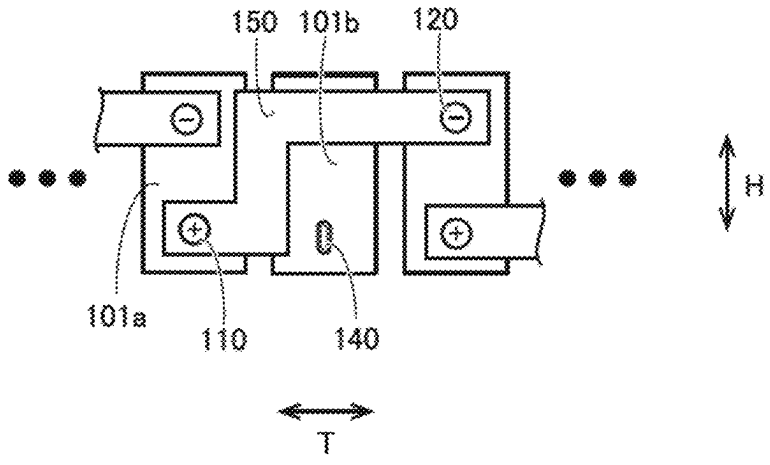

101
130
101c
101b
H
101c
120
140
101c
101a
101c
W
110
T

FIG.5


150
101b
120
H
101a
110
140
T

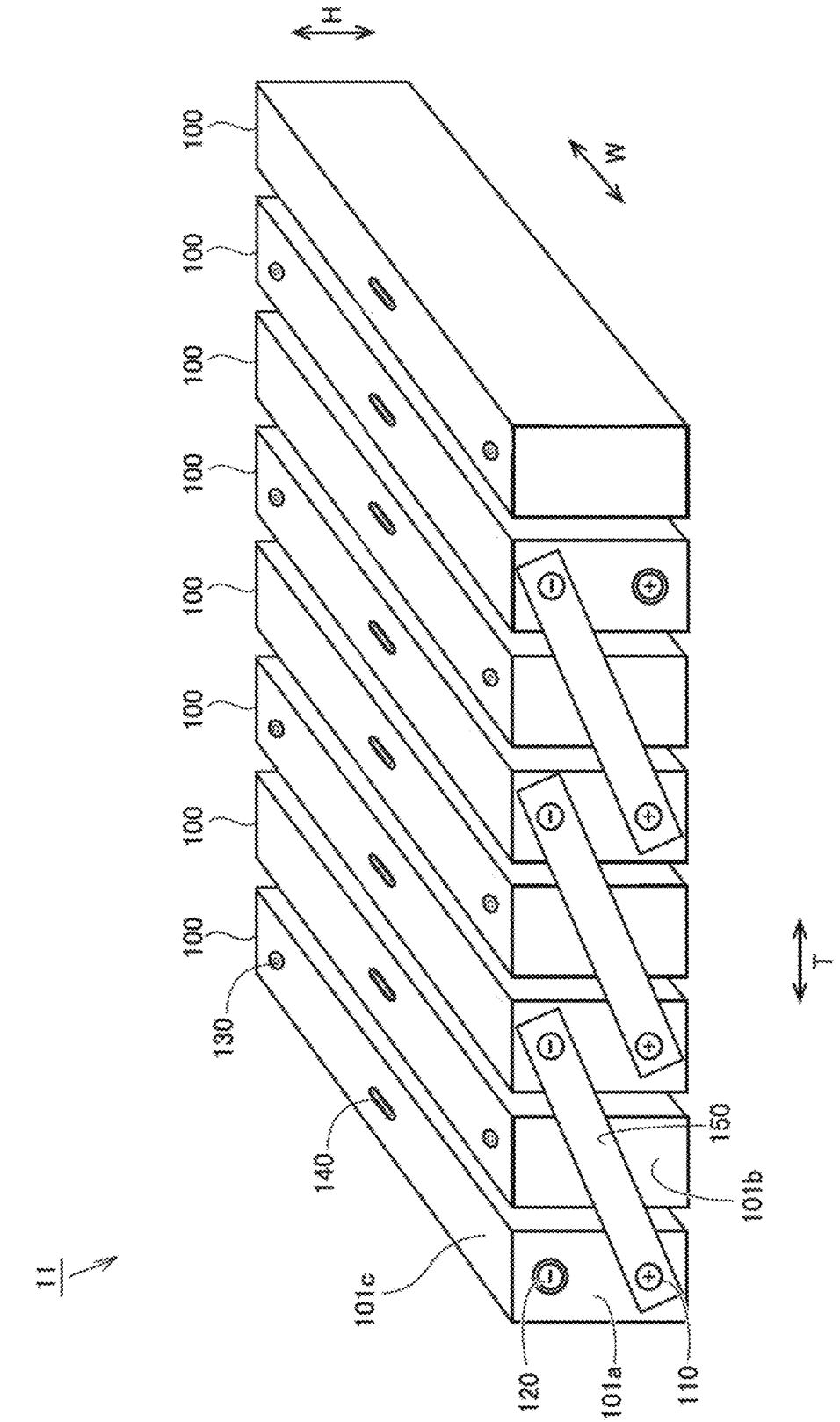


FIG.6

FIG.7

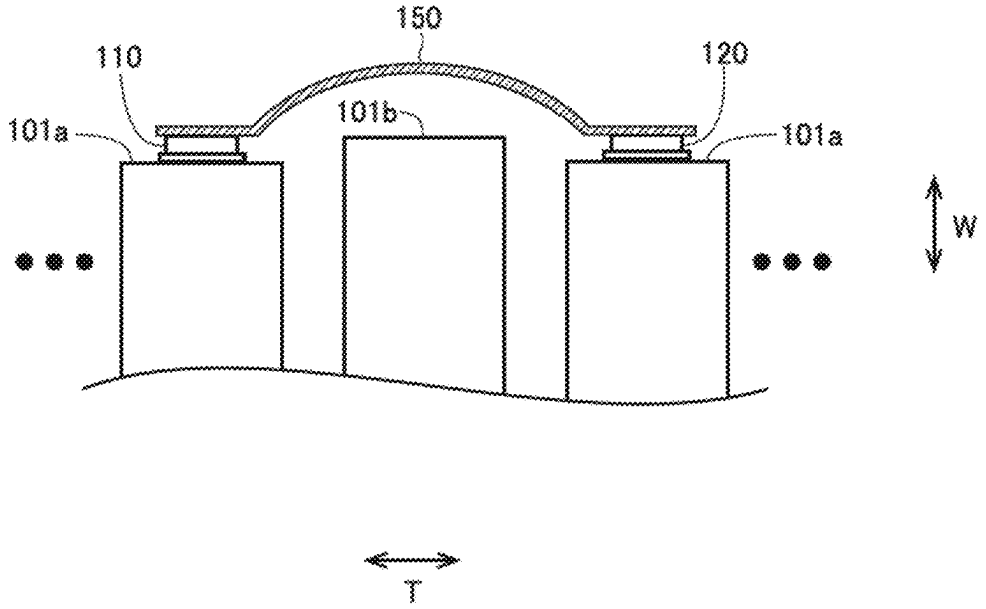


FIG.8

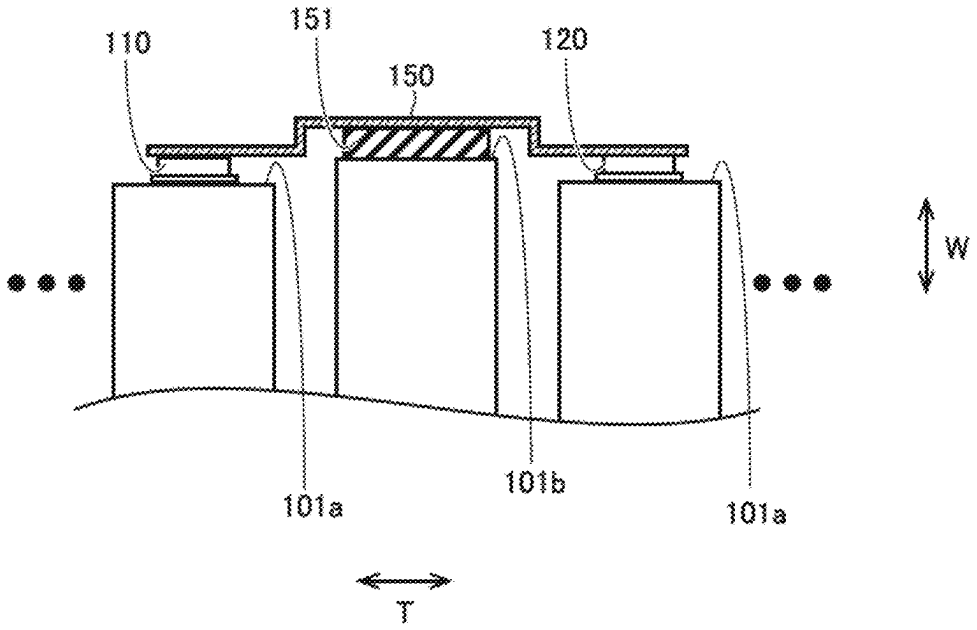


FIG.9

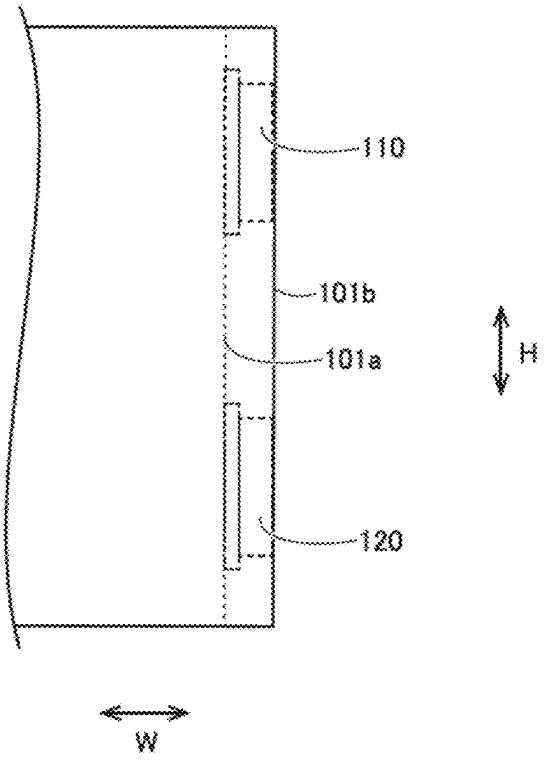

110
101b
101a
120
H
W

FIG.10

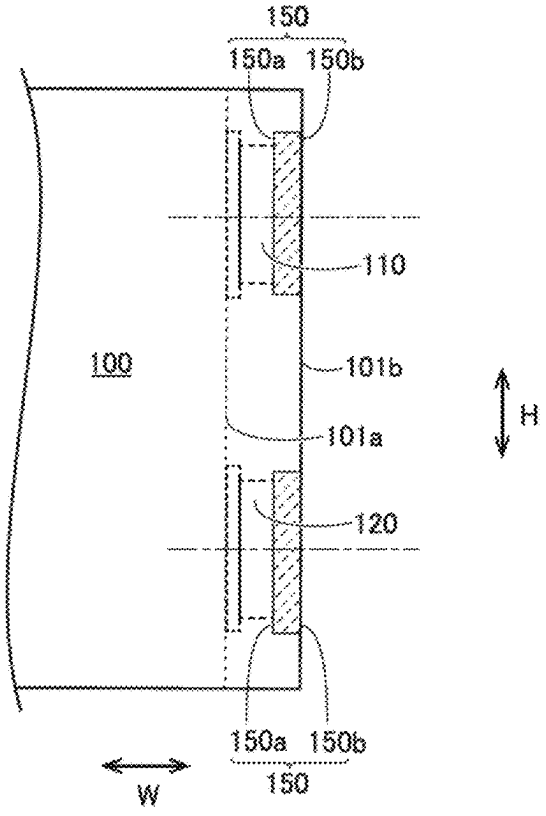
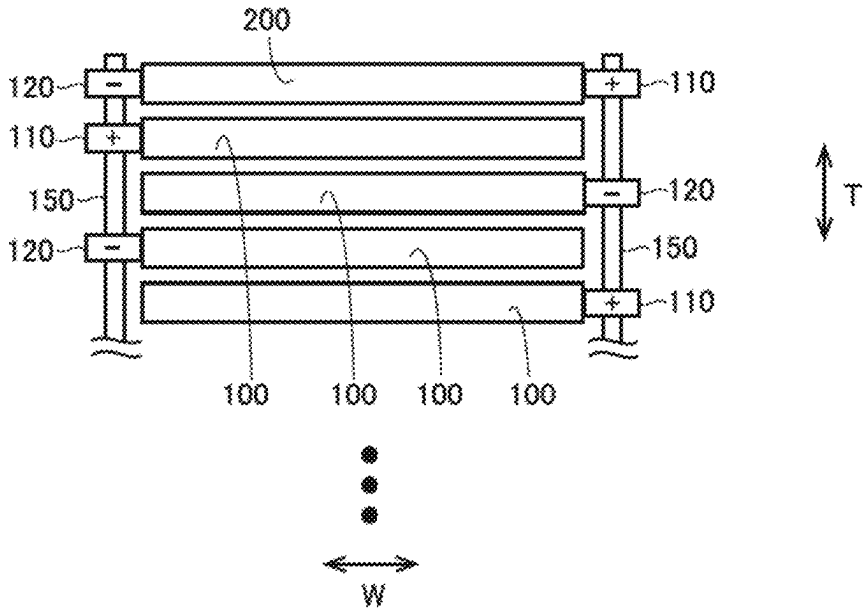

150
150a
150b
110
100
101b
101a
120
H
150a
150b
150
W

FIG.11



POWER STORAGE MODULE AND POWER STORAGE DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This nonprovisional application is based on Japanese Patent Application No. 2024-024304 filed on Feb. 21, 2024, with the Japan Patent Office, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE DISCLOSURE

Field of the Disclosure

[0002] The present disclosure relates to a power storage module and a power storage device.

Description of the Background Art

[0003] Japanese Patent Laying-Open No. 2014-232735 discloses a power storage module that has a structure where at the time when internal pressure of single cells rises, gaps between the single cells remain open and air can flow around the single cells.

SUMMARY OF THE DISCLOSURE

[0004] A power storage module includes a plurality of single cells. Each single cell may have a single terminal surface. "Terminal surface" refers to an outer surface, among the outer surfaces of the single cell, to which a terminal is provided. When there is only one terminal surface, both a positive electrode terminal and a negative electrode terminal are provided to the only one outer surface. When there is only one terminal surface, the local temperature near the terminal surface tends to be high. As a result, unevenness in the temperature of the power storage module can be great.

[0005] An object of the present disclosure is to reduce unevenness in the temperature of a power storage module.

[0006] Hereinafter, the technical configuration and effects of the present disclosure will be described. It should be noted that the action mechanism includes presumption. The action mechanism does not limit the technical scope of the present disclosure.

[0007] 1. A power storage module includes a plurality of single cells. The plurality of the single cells are stacked in a stacking direction. Each of the plurality of the single cells includes a case. The case has a rectangular-parallelepiped-like shape with six outer surfaces. The six outer surfaces include a terminal surface and an opposite surface. The terminal surface is an outer surface, among the six outer surfaces, to which a positive electrode terminal and a negative electrode terminal are provided. The opposite surface is an outer surface, among the six outer surfaces, that is located opposite to the terminal surface. Each of the terminal surface and the opposite surface is parallel to the stacking direction. The plurality of the single cells are aligned in the stacking direction in such a manner that the terminal surface alternates with the opposite surface.

[0008] In a single cell, the temperature of an opposite surface located opposite to a terminal surface tends to be lower than that of the terminal surface. When single cells are aligned in such a manner that the terminal surface alternates with the opposite surface, high-temperature areas (terminal surfaces) are scattered within the power storage module. In addition, between adjacent single cells, the terminal surface of one single cell is adjacent to the opposite surface of the other single cell. It is expected that heat can be diffused from the terminal surface of one single cell to the opposite surface of the other single cell. These actions are expected to synergistically reduce unevenness in temperature. Hereinafter, an arrangement in which a terminal surface alternates with an opposite surface is also called "an alternate arrangement".

[0009] 2. The power storage module according to "1" above may include the following configuration, for example. The six outer surfaces further include four connection surfaces. Each of the four connection surfaces connects the terminal surface and the opposite surface to each other. Among all facing pairs out of the six outer surfaces, the terminal surface and the opposite surface have the longest distance between them.

[0010] In a single cell, as the distance between the terminal surface and the opposite surface increases, the difference in temperature between the terminal surface and the opposite surface can also increase. The longer the distance between the terminal surface and the opposite surface is, the more effective the alternate arrangement may be.

[0011] 3. The power storage module according to "1" or "2" above may include the following configuration, for example. The power storage module further includes a bus bar. The bus bar extends in the stacking direction. The bus bar connects two of the single cells together, leaving one single cell sandwiched therebetween.

[0012] In an alternate arrangement, two single cells may be connected together leaving one single cell sandwiched therebetween.

[0013] 4. The power storage module according to according to any one of "1" to "3" above may include the following configuration, for example. At least one of a liquid inlet hole and a gas-discharge valve is provided to the opposite surface.

[0014] 5. The power storage module according to "4" above may include the following configuration, for example. The gas-discharge valve is provided to the opposite surface. In a plane viewed in a direction of a normal to the opposite surface, the bus bar has a shape that does not overlap the gas-discharge valve.

[0015] In the case where the bus bar overlaps the gas-discharge valve, the bus bar can interfere with the gas-discharge valve. When the bus bar does not overlap the gas-discharge valve, the gas-discharge valve may function smoothly.

[0016] 6. The power storage module according to "3" above may include the following configuration, for example. The bus bar extends in such a manner that it straddles the opposite surface present between the terminal surfaces. The bus bar includes a portion that extends in a direction away from the opposite surface.

[0017] With the bus bar extending in a direction away from the opposite surface, interference from the bus bar on an adjacent single cell may be reduced. The entire bus bar may lie away from the opposite surface, or a part of it may lie away from the opposite surface. The bus bar may lie away from the opposite surface at some position(s).

[0018] 7. The power storage module according to any one of "1" to "3" above may include the following configuration,

for example. At least one of a liquid inlet hole and a gas-discharge valve is provided to at least one of the four connection surfaces.

[0019] 8. The power storage module according to "3" above may include the following configuration, for example. In a plane viewed in a direction of a normal to the opposite surface, the bus bar extends parallel to the stacking direction to connect two of the single cells together.

[0020] 9. The power storage module according to "3" above may include the following configuration, for example. In a plane viewed in a direction of a normal to the opposite surface, the bus bar extends in a direction crossing the stacking direction to connect two of the single cells together.

[0021] 10. The power storage module according to "3" above may include the following configuration, for example. At least part of the bus bar is fixed to the opposite surface.

[0022] In an alternate arrangement, misalignment of single cells may occur. With the bus bar being fixed to the opposite surface, misalignment is expected to be reduced. For example, an adhesive agent and/or the like may be used to fix the bus bar to the opposite surface.

[0023] 11. The power storage module according to "3" above may include the following configuration, for example. In a projected view where the positive electrode terminal, the negative electrode terminal, and the opposite surface are projected in the stacking direction to a hypothetical plane orthogonal to the opposite surface, edges of the positive electrode terminal and the negative electrode terminal lie on an inner side of the opposite surface.

[0024] In the projected view according to "11" above, with the edges of the terminals not extending off the opposite surface, space efficiency is expected to be enhanced.

[0025] 12. The power storage module according to "11" above may include the following configuration, for example. In the projected view, the edges of the positive electrode terminal and the negative electrode terminal are in contact with the opposite surface.

[0026] In the projected view according to "11" above, with the edges of the terminals being in contact with the opposite surface, space efficiency is expected to be enhanced.

[0027] 13. The power storage module according to "11" above may include the following configuration, for example. The bus bar has a first main face and a second main face. The first main face faces the single cell. The second main face is located opposite to the first main face. In the projected view where the second main face present on an axis of the positive electrode terminal or the negative electrode terminal is also projected, the second main face lies on the inner side of the opposite surface.

[0028] In the projected view according to "13" above, with the bus bar not extending off the opposite surface, space efficiency is expected to be enhanced.

[0029] 14. The power storage module according to above "13" may include the following configuration, for example. In the projected view, the second main face is in contact with the opposite surface.

[0030] In the projected view according to "13" above, with the bus bar being in contact with the opposite surface, space efficiency is expected to be enhanced.

[0031] 15. A power storage device comprises the power storage module according to any one of "1" to "14" above.

[0032] In the following, an embodiment of the present disclosure (which may also be simply called "the present embodiment" hereinafter) will be described. It should be noted that the present embodiment does not limit the technical scope of the present disclosure. The present embodiment is illustrative in any respect. The present embodiment is non-restrictive. The technical scope of the present disclosure encompasses any modifications within the meaning and the scope equivalent to the terms of the claims. For example, it is originally planned that any configurations of the present embodiment may be optionally combined.

[0033] The foregoing and other objects, features, aspects and advantages of the present disclosure will become more apparent from the following detailed description of the present disclosure when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] FIG. **1** is a conceptual view illustrating an example of a vehicle according to the present embodiment.

[0035] FIG. **2** is a schematic perspective view illustrating an example of a power storage device according to the present embodiment.

[0036] FIG. **3** is a first schematic perspective view illustrating an example of a power storage module according to the present embodiment.

[0037] FIG. **4** is a schematic perspective view illustrating an example of a single cell according to the present embodiment.

[0038] FIG. **5** is a schematic plan view illustrating an example of a bus bar according to the present embodiment.

[0039] FIG. **6** is a second schematic perspective view illustrating an example of a power storage module according to the present embodiment.

[0040] FIG. **7** is a first schematic cross-sectional view illustrating an example of a bus bar according to the present embodiment.

[0041] FIG. **8** is a second schematic cross-sectional view illustrating an example of a bus bar according to the present embodiment.

[0042] FIG. **9** is a first projected view according to the present embodiment.

[0043] FIG. **10** is a second projected view according to the present embodiment.

[0044] FIG. **11** is a conceptual view illustrating an example of an end-part structure according to the present embodiment.

DESCRIPTION OF THE EMBODIMENTS

Terms and Phrases

[0045] Terms such as "comprise", "include", and "have", and other similar terms are open-ended terms. In an open-ended term, in addition to a stated component, an additional component may or may not be further included. The term "consist of" is a closed-end term. However, even in a configuration that is expressed by a closed-end term, impurities present under ordinary circumstances as well as an additional element irrelevant to the technique of interest may be included. The term "consist essentially of" is a semi-closed-end term. A semiclosed-end term tolerates addition of an element that does not substantially affect the fundamental, novel features of the technique of interest.

[0046] Expressions such as "may" and "can" are not intended to mean "must" (obligation) but rather mean "there is a possibility" (tolerance).

[0047] Any geometric term should not be interpreted solely in its exact meaning. Examples of geometric terms include "parallel", "vertical", "orthogonal", and the like. For example, as long as substantially the same or similar functions are obtained, the relative direction, angle, distance, and the like may vary. Any geometric term herein may include tolerances and/or errors in terms of design, operation, production, and/or the like. The dimensional relationship in each figure may not necessarily coincide with the actual dimensional relationship. For the purpose of assisting understanding for the readers, the dimensional relationship in each figure may have been changed. For example, length, width, thickness, and the like may have been changed. A part of a given configuration may have been omitted.

[0048] "Rectangular-parallelepiped-like shape" has six outer surfaces. The planar shape of each outer surface may be a rectangle-like shape or a square-like shape, for example. Expressions such as "rectangular-parallelepiped-like shape", "rectangle-like shape", and "square-like shape" mean that the shape does not need to be the exact rectangular parallelepiped, rectangle, square, or the like in the geometrically strictest sense. For example, each of the outer surfaces may not be a flat plane. For example, each outer surface may be curved inwardly or outwardly. For example, each angle may be roundish. For example, each line may not be straight. For example, one outer surface and another outer surface may not be orthogonal to each other at where these outer surfaces are connected to each other. For example, the part at which one outer surface and another outer surface are connected to each other (ridge, edge) may be roundish. For example, due to the roundish connection part at which one outer surface and another outer surface are connected, the boundary between these two outer surfaces may be not clear. For example, a welding bead and/or the like may be formed at where one outer surface and another outer surface are connected to each other. For example, the areas of two facing outer surfaces may be different from each other. The rectangular-parallelepiped-like shape includes "a cube-like shape", "a quadrangular-prism-like shape", and the like. A cube-like shape and a quadrangular-prism-like shape do not need to be the exact cube and the exact quadrangular prism, respectively.

[0049] Expressions that describe relative or absolute positional relationships, such as "contact with", "flush with", and "the same", do not only mean the exact positional relationships. These expressions also mean those positional relationships including tolerances and/or errors. For example, as long as substantially the same or similar functions are obtained, the relative positional relationship between the target objects may vary. It should be noted that in a projected view, "an aspect in which a target object lies on the inner side of a surface" includes "an aspect in which a target object is in contact with a surface".

[0050] A singular form may also include its plural meaning, unless otherwise specified. For example, "a single cell" may mean a plurality of single cells (a group of single cells).

[0051] "At least one of A and B" includes "A" only, "B" only, and "both A and B". "At least one of A and B" may also be expressed as "A and/or B".

[0052] "Width of a case" means the outer dimension in the W direction. "Height of a case" means the outer dimension in the H direction. "Thickness of a case" means the outer dimension in the T direction. The W direction, the H direction, and the T direction may be orthogonal to each other. The H direction may or may not be parallel to the vertical direction, for example. The H direction may or may not be parallel to the direction of travel of the vehicle, for example. The T direction may or may not be parallel to the direction of travel of the vehicle, for example.

[0053] In the present embodiment, a power storage device and a power storage module "for vehicle applications" will be described. However, vehicle applications are merely an example of the purpose of use. The purpose of use is not particularly limited.

[0054] "Terminal" collectively refers to "positive electrode terminal" and "negative electrode terminal". The term "terminal" refers to at least one of a positive electrode terminal and a negative electrode terminal.

Vehicle

[0055] FIG. **1** is a conceptual view illustrating an example of a vehicle according to the present embodiment. A vehicle **1** may be a BEV (Battery Electric Vehicle), an HEV (Hybrid Electric Vehicle), a PHEV (Plug-in Hybrid Electric Vehicle), or the like, for example. Vehicle **1** includes a power storage device **10**. The position to mount the power storage device **10** is not particularly limited. For example, power storage device **10** may be placed under the floor of vehicle **1**.

Power Storage Device

[0056] FIG. **2** is a schematic perspective view illustrating an example of a power storage device according to the present embodiment. Power storage device **10** includes a power storage module **11**. Power storage device **10** may include a plurality of power storage modules **11**. Power storage device **10** may include one to four power storage modules **11**, for example. Power storage device **10** may further include a housing case **20**, a cooler **30**, and the like, for example. Housing case **20** accommodates power storage module **11**. Housing case **20** may include an upper case **21** and a lower case **22**. There may be a gap between power storage modules **11**. For example, a divider (not illustrated) may be provided between power storage modules **11**. For example, cooler **30** may be provided on the upper case **21** side, or may be provided on the lower case **22** side. Cooler **30** is capable of cooling power storage module **11**. Cooler **30** may include a coolant flow path and/or the like, for example.

Power Storage Module

[0057] FIG. **3** is a first schematic perspective view illustrating an example of a power storage module according to the present embodiment. Power storage module **11** includes a plurality of single cells **100**. The plurality of single cells **100** may be electrically connected either in series or in parallel. As an example, a series connection is illustrated. The number of single cells **100** is not particularly limited as long as it is two or more. For example, the number of single cells **100** may be from 2 to 200, or from 10 to 150, or from 50 to 100.

Single Cell

[0058] FIG. **4** is a schematic perspective view illustrating an example of a single cell according to the present embodiment. Single cell **100** is the smallest constituent unit of power storage device **10**. Single cell **100** may be a lithium-ion battery, for example. Each single cell **100** includes a case **101**. Case **101** accommodates a power generation element

(not illustrated). The power generation element may be a stack-type one, or may be a wound-type one. The power generation element includes a positive electrode active material, a negative electrode active material, and an electrolyte, for example. The positive electrode active material may include lithium iron phosphate, lithium-nickel composite oxide, and/or the like, for example. The negative electrode active material may include graphite, silicon oxide, silicon, and/or the like, for example. The electrolyte may be liquid, gel, or solid.

Case

[0059] Case **101** may be made of metal, for example. Case **101** may be made of aluminum alloy, for example. Case **101** has a rectangular-parallelepiped-like shape. Case **101** may be a long plate, for example. The width of case **101** may be 500 mm or more, or 750 mm or more, or 1000 mm or more, for example. The width of case **101** may be 2000 mm or less, or 1500 mm or less, or 1250 mm or less, for example. The height of case **101** may be 50 mm or more, or 75 mm or more, or 100 mm or more, for example. The height of case **101** may be 200 mm or less, or 150 mm or less, or 125 mm or less, or 100 mm or less, for example. The thickness of case **101** may be 5 mm or more, or 10 mm or more, or 15 mm or more, or 20 mm or more, for example. The thickness of case **101** may be 30 mm or less, or 25 mm or less, or 20 mm or less, or 15 mm or less, or 10 mm or less, for example.

[0060] The ratio of width to height may be from 5 to 20, for example. The ratio of width to thickness may be from 50 to 200, for example.

Terminal Surface, Opposite Surface, Connection Surface

[0061] Case **101** has six outer surfaces. The six outer surfaces are a terminal surface **101***a*, an opposite surface **101***b*, and four connection surfaces **101***c*. That is, single cell **100** has a single terminal surface **101***a*. To terminal surface **101***a*, both a positive electrode terminal **110** and a negative electrode terminal **120** are provided. Each of positive electrode terminal **110** and negative electrode terminal **120** is electrically connected to the power generation element (not illustrated) inside the case **101**. Opposite surface **101***b* is located opposite to terminal surface **101***a*. Each of the four connection surfaces **101***c* connects terminal surface **101***a* and opposite surface **101***b* to each other.

[0062] For example, the four connection surfaces **101***c* may constitute a tubular case body. For example, the four connection surfaces **101***c* may constitute a single-piece component, or may be four plates assembled together. For example, the case body may have the shape of a cylindrical prism. For example, each of terminal surface **101***a* and opposite surface **101***b* may constitute a cap. The cap may close an opening of the case body. For example, the cap and the case body may be bonded together by laser beam welding.

[0063] For example, the four connection surfaces **101***c* and opposite surface **101***b* may constitute the case body. For example, the case body may be a vessel that has a bottom face. For example, the case body may be a vessel having the shape of a cylindrical prism with a bottom. Opposite to the bottom face, the case body may have an opening. Terminal surface **101***a* may constitute a cap. The cap may close the opening of the case body.

[0064] At least one of the four connection surfaces **101***c* may have the largest area among the six outer surfaces. For example, one connection surface **101***c* may have the largest area. For example, two connection surfaces **101***c* facing each other may have the largest area. For example, all the four connection surfaces **101***c* may equally have the largest area. Alternatively, at least one of the four connection surfaces **101***c* may have the smallest area among the six outer surfaces. Alternatively, the area of at least one of the four connection surfaces **101***c* may be between the largest area and the smallest area.

[0065] For example, terminal surface **101***a* may have the smallest area among the six outer surfaces. For example, terminal surface **101***a* may have the largest area among the six outer surfaces. For example, the area of terminal surface **101***a* may be between the largest area and the smallest area. For example, the area of opposite surface **101***b* may be the same as, or different from, that of terminal surface **101***a*.

[0066] For example, among all the facing pairs out of the six outer surfaces, terminal surface **101***a* and opposite surface **101***b* may have the longest distance between them. For example, the distance between terminal surface **101***a* and opposite surface **101***b* may be the shortest. For example, the distance between terminal surface **101***a* and opposite surface **101***b* may be between the longest distance and the shortest distance. For example, the distance between connection surfaces **101***c* may be the longest. For example, the distance between connection surfaces **101***c* may be the shortest. For example, the distance between connection surfaces **101***c* may be between the longest distance and the shortest distance. For example, as illustrated in FIG. **4**, the distance between terminal surface **101***a* and opposite surface **101***b* may be the outer dimension in the W direction (the width). For example, the distance between connection surfaces **101***c* may be the outer dimension in the T direction (the thickness). For example, the distance between connection surfaces **101***c* may be the outer dimension in the H direction (the height). When the distance between two outer surfaces is not uniform, the distance between the two outer surfaces refers to the shortest distance between the two.

Liquid Inlet Hole, Gas-Discharge Valve

[0067] For example, at least one of a liquid inlet hole **130** and a gas-discharge valve **140** may be provided to opposite surface **101***b*. For example, at the time of assembly of single cell **100**, an electrolyte solution (a liquid electrolyte) may be injected through liquid inlet hole **130** into case **101**. For example, liquid inlet hole **130** may be closed with a plug (not illustrated). For example, when the internal pressure of case **101** has risen, gas may be discharged through gas-discharge valve **140**. Alternatively, at least one of liquid inlet hole **130** and gas-discharge valve **140** may be provided to at least one of the four connection surfaces **101***c*. Alternatively, at least one of liquid inlet hole **130** and gas-discharge valve **140** may be provided to terminal surface **101***a*. In terminal surface **101***a*, liquid inlet hole **130** and gas-discharge valve **140** may be interposed between positive electrode terminal **110** and negative electrode terminal **120**, for example.

Alternate Arrangement

[0068] The plurality of single cells **100** are stacked in the stacking direction (the T direction). Each of terminal surface **101***a* and opposite surface **101***b* is parallel to the stacking

direction. In the stacking direction, single cells **100** may be adhered to one another. In the stacking direction, there may be gaps between single cells **100**. In the stacking direction, the plurality of single cells **100** form an alternate arrangement. More specifically, as illustrated in FIG. **3**, the plurality of single cells **100** are aligned in the stacking direction in such a manner that terminal surface **101***a* alternates with opposite surface **101***b*. In the alternate arrangement, unevenness in temperature is expected to be reduced. The orientation of single cells **100** in the H direction may be alternate as in FIG. **3**, or may be uniform as in FIG. **6**.

[0069] Power storage module **11** may have a single arrangement pattern, for example. More specifically, in power storage module **11**, all the single cells **100** may constitute an alternate arrangement. As long as an alternate arrangement is included, power storage module **11** may include a plurality of arrangement patterns. For example, at an end in the stacking direction, the arrangement pattern may change. Among all the single cells **100** in power storage module **11**, at least 50%, or at least 80%, or at least 90% of single cells **100** may constitute an alternate arrangement, for example.

Bus Bar

[0070] As illustrated in FIG. **3**, power storage module **11** may further include a bus bar **150**. Bus bar **150** may extend in the stacking direction (the T direction), for example. In the stacking direction, bus bar **150** may connect two single cells **100** together, leaving one single cell sandwiched therebetween. Bus bar **150** may be made of metal, for example. Bus bar **150** may be a plate, for example. Bus bar **150** may have a hole in it. A terminal may be inserted through the hole and, thereby, the terminal may be connected to bus bar **150**. For example, bus bar **150** may be welded to an end face of a terminal.

[0071] For example, in FIG. **3**, the W direction is the direction of a normal to opposite surface **101***b*. For example, as illustrated in FIG. **3**, in a plane viewed in the direction of a normal to opposite surface **101***b*, bus bar **150** may extend parallel to the stacking direction (the T direction) to connect two single cells **100** together, for example. Bus bar **150** may extend straight, for example. Bus bar **150** may extend in a curved manner, for example. Bus bar **150** may be bent, for example.

[0072] For example, as illustrated in FIG. **3**, in a plane viewed in the direction of a normal to opposite surface **101***b*, bus bar **150** may have a shape that does not overlap gas-discharge valve **140**. When bus bar **150** does not overlap gas-discharge valve **140**, gas-discharge valve **140** is capable of functioning smoothly without being interfered by bus bar **150**.

[0073] Bus bar **150** may have a shape that overlaps liquid inlet hole **130**. More specifically, liquid inlet hole **130** may be positioned directly below the bus bar **150**.

[0074] FIG. **5** is a schematic plan view illustrating an example of a bus bar according to the present embodiment. In FIG. **5**, a plane viewed in the direction of a normal to opposite surface **101***b* is illustrated. For example, bus bar **150** may be curved or bent in an in-plane direction so that it does not overlap gas-discharge valve **140**. The in-plane direction in FIG. **5** is a direction that does not stick out of the paper surface of FIG. **5**. The in-plane direction in FIG. **5** includes the T direction and the H direction.

[0075] FIG. **6** is a second schematic perspective view illustrating an example of a power storage module according to the present embodiment. In FIG. **6**, the W direction is the direction of a normal to opposite surface **101***b*. For example, as illustrated in FIG. **6**, in a plane viewed in the direction of a normal to opposite surface **101***b*, bus bar **150** may extend in a direction crossing the stacking direction (the T direction) to connect two single cells **100** together.

[0076] FIG. **7** is a first schematic cross-sectional view illustrating an example of a bus bar according to the present embodiment. As illustrated in FIG. **7**, bus bar **150** may extend in such a manner that it straddles opposite surface **101***b* present between terminal surfaces **101***a*. For example, bus bar **150** may be curved in an out-of-plane direction. The out-of-plane direction in FIG. **7** is a direction within the paper surface of FIG. **7** that crosses the T direction. The out-of-plane direction in FIG. **7** includes the W direction. That is, bus bar **150** may have a portion that extends in a direction away from opposite surface **101***b*. When there is a gap between bus bar **150** and opposite surface **101***b*, gas-discharge valve **140** is capable of functioning smoothly without being interfered by bus bar **150**, for example. Bus bar **150** may have a bridge-like shape, for example. Bus bar **150** may have an arc-like shape, for example. Bus bar **150** may be curved, describing a parabola, for example. Bus bar **150** may be curved in the U shape, for example. Bus bar **150** may be bent in the V shape, for example.

[0077] FIG. **8** is a second schematic cross-sectional view illustrating an example of a bus bar according to the present embodiment. As illustrated in FIG. **8**, bus bar **150** may be bent in an out-of-plane direction to form a sharp-cornered convex shape. As described above, to opposite surface **101***b* present between terminal surfaces **101***a*, liquid inlet hole **130**, gas-discharge valve **140**, and the like may be provided.

[0078] At least part of bus bar **150** may be fixed to opposite surface **101***b*. For example, bus bar **150** may be fixed to opposite surface **101***b* by way of a fixing member **151**. Fixing member **151** may be electrically insulating. Fixing member **151** may include an adhesive agent and/or the like, for example. The adhesive agent may include epoxy resin, acrylic resin, and/or the like, for example. For example, when bus bar **150** connects two single cells **100** leaving one single cell sandwiched therebetween, misalignment of single cells **100** may occur. With bus bar **150** being fixed to opposite surface **101***b*, misalignment is expected to be reduced.

[0079] FIG. **9** is a first projected view according to the present embodiment. The first projected view is a view where positive electrode terminal **110**, negative electrode terminal **120**, and opposite surface **101***b* are projected in the stacking direction (the T direction) to a hypothetical plane orthogonal to opposite surface **101***b*. For example, in the first projected view, the edges of positive electrode terminal **110** and negative electrode terminal **120** may lie on the inner side of opposite surface **101***b*. In the first projected view, with the edges of the terminals not extending off the opposite surface **101***b*, space efficiency is expected to be enhanced. For example, in the first projected view, the edges of the terminals may be in contact with opposite surface **101***b*. In the first projected view, with the edges of the terminals being in contact with opposite surface **101***b*, space efficiency is expected to be enhanced.

[0080] FIG. **10** is a second projected view according to the present embodiment. The second projected view is a view

where bus bar **150** is projected in the stacking direction to the hypothetical plane in the first projected view. Each of the dash-dot lines in the second projected view represents the axis of a terminal. Bus bar **150** may have a first main face **150***a* and a second main face **150***b*. First main face **150***a* faces single cell **100**. Second main face **150***b* is located opposite to first main face **150***a*. For example, in the second projected view, second main face **150***b* on the axis of a terminal may lie on the inner side of opposite surface **101***b*. In the second projected view, with second main face **150***b* not extending off the opposite surface **101***b*, space efficiency is expected to be enhanced. For example, bus bar **150** connected to positive electrode terminal **110** may lie on the inner side of opposite surface **101***b*. For example, bus bar **150** connected to negative electrode terminal **120** may lie on the inner side of opposite surface **101***b*. For example, both the bus bar **150** connected to positive electrode terminal **110** and the bus bar **150** connected to negative electrode terminal **120** may lie on the inner side of opposite surface **101***b*.

[0081] For example, in the second projected view, second main face **150***b* may be in contact with opposite surface **101***b*. In the second projected view, with second main face **150***b* being in contact with opposite surface **101***b*, space efficiency is expected to be enhanced. In the second projected view, with second main face **150***b* being in contact with opposite surface **101***b*, second main face **150***b* may be flush with opposite surface **101***b*. "Being flush with" means that two surfaces are substantially on the same plane. As a result, the outer frame of power storage module **11** may be smooth, for example.

End-Part Structure

[0082] FIG. **11** is a conceptual view illustrating an example of an end-part structure according to the present embodiment. For example, at an end in the stacking direction (the T direction), the terminal of single cell **100** may be electrically connected to housing case **20**. For example, at an end of power storage module **11**, a both-side type single cell **200** may be placed. Both-side type single cell **200** has two terminal surfaces. These two terminal surfaces face each other. To one of the terminal surfaces, positive electrode terminal **110** is provided. To the other terminal surface, negative electrode terminal **120** is provided. With both-side type single cell **200** placed at an end of the stacking direction, all the plurality of single cells **100** may be connected in series. Alternatively, single cells **100** at both ends may be connected to each other with a long bus bar (not illustrated).

[0083] The plurality of single cells **100** may form a single row. The plurality of single cells **100** may form two or more rows, for example. When the plurality of single cells **100** form a plurality of rows, these rows may be electrically in parallel or in series. The rows may be aligned in parallel, for example. The number of single cells **100** forming a single row may be from 2 to 50, for example.

What is claimed is:

1. A power storage module comprising a plurality of single cells, wherein
- the plurality of the single cells are stacked in a stacking direction,
- each of the plurality of the single cells includes a case,
- the case has a rectangular-parallelepiped-like shape with six outer surfaces,
- the six outer surfaces include a terminal surface and an opposite surface,
- the terminal surface is an outer surface, among the six outer surfaces, to which a positive electrode terminal and a negative electrode terminal are provided,
- the opposite surface is an outer surface, among the six outer surfaces, that is located opposite to the terminal surface,
- each of the terminal surface and the opposite surface is parallel to the stacking direction, and
- the plurality of the single cells are aligned in the stacking direction in such a manner that the terminal surface alternates with the opposite surface.

2. The power storage module according to claim **1**, wherein
- the six outer surfaces further include four connection surfaces,
- each of the four connection surfaces connects the terminal surface and the opposite surface to each other, and
- among all facing pairs out of the six outer surfaces, the terminal surface and the opposite surface have the longest distance between them.

3. The power storage module according to claim **1**, further comprising a bus bar, wherein
- the bus bar extends in the stacking direction, and
- the bus bar connects two of the single cells together, leaving one single cell sandwiched therebetween.

4. The power storage module according to claim **3**, wherein at least one of a liquid inlet hole and a gas-discharge valve is provided to the opposite surface.

5. The power storage module according to claim **4**, wherein
- the gas-discharge valve is provided to the opposite surface, and
- in a plane viewed in a direction of a normal to the opposite surface, the bus bar has a shape that does not overlap the gas-discharge valve.

6. The power storage module according to claim **3**, wherein
- the bus bar extends in such a manner that it straddles the opposite surface present between the terminal surfaces, and
- the bus bar includes a portion that extends in a direction away from the opposite surface.

7. The power storage module according to claim **2**, wherein at least one of a liquid inlet hole and a gas-discharge valve is provided to at least one of the four connection surfaces.

8. The power storage module according to claim **3**, wherein
- in a plane viewed in a direction of a normal to the opposite surface, the bus bar extends parallel to the stacking direction to connect two of the single cells together.

9. The power storage module according to claim **3**, wherein
- in a plane viewed in a direction of a normal to the opposite surface, the bus bar extends in a direction crossing the stacking direction to connect two of the single cells together.

10. The power storage module according to claim **3**, wherein at least part of the bus bar is fixed to the opposite surface.

11. The power storage module according to claim **3**, wherein in a projected view where the positive electrode

terminal, the negative electrode terminal, and the opposite surface are projected in the stacking direction to a hypothetical plane orthogonal to the opposite surface, edges of the positive electrode terminal and the negative electrode terminal lie on an inner side of the opposite surface.

12. The power storage module according to claim **11**, wherein in the projected view, the edges of the positive electrode terminal and the negative electrode terminal are in contact with the opposite surface.

13. The power storage module according to claim **11**, wherein

the bus bar has a first main face and a second main face,

the first main face faces the single cell,

the second main face is located opposite to the first main face, and

in the projected view where the second main face present on an axis of the positive electrode terminal or the negative electrode terminal is also projected, the second main face lies on the inner side of the opposite surface.

14. The power storage module according to claim **13**, wherein in the projected view, the second main face is in contact with the opposite surface.

15. A power storage device comprising the power storage module according to claim **1**.

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