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(54) POWER STORAGE CELL

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CPC ..... ***H01M 50/477*** (2021.01); ***H01M 50/103*** (2021.01); ***H01M 50/15*** (2021.01); ***H01M 50/486*** (2021.01)

(57) **ABSTRACT**

A power storage cell includes: an electrode assembly; and a cell case that accommodates the electrode assembly. The cell case has a case main body provided with an opening that opens upward, a lid connected to the case main body, and an elastic member disposed between the case main body and the electrode assembly. The elastic member has a center-facing portion facing a central portion of the electrode assembly, and the center-facing portion has a shape curved to protrude in a direction away from the electrode assembly.

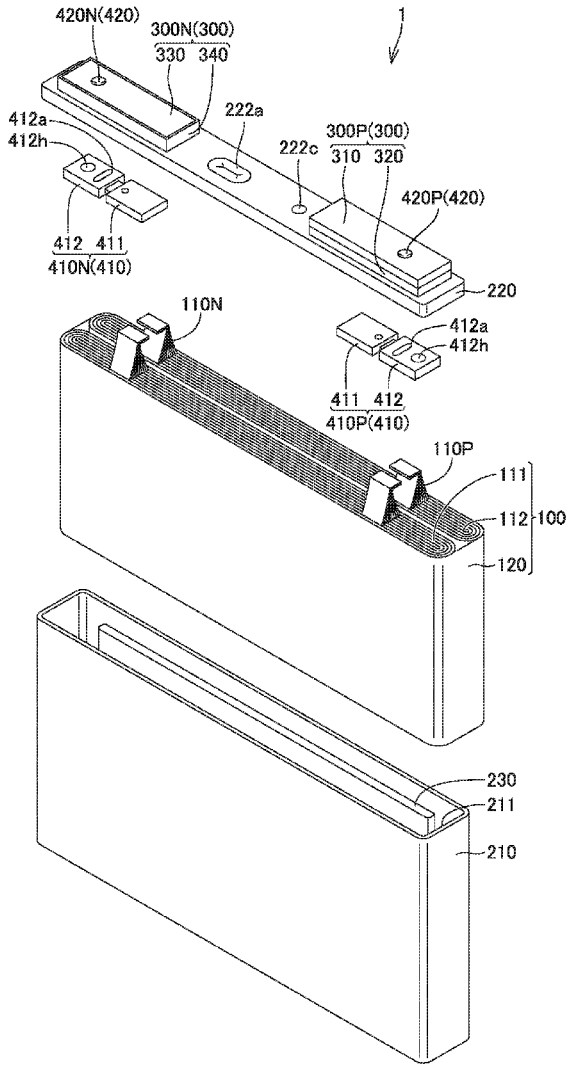


FIG.1

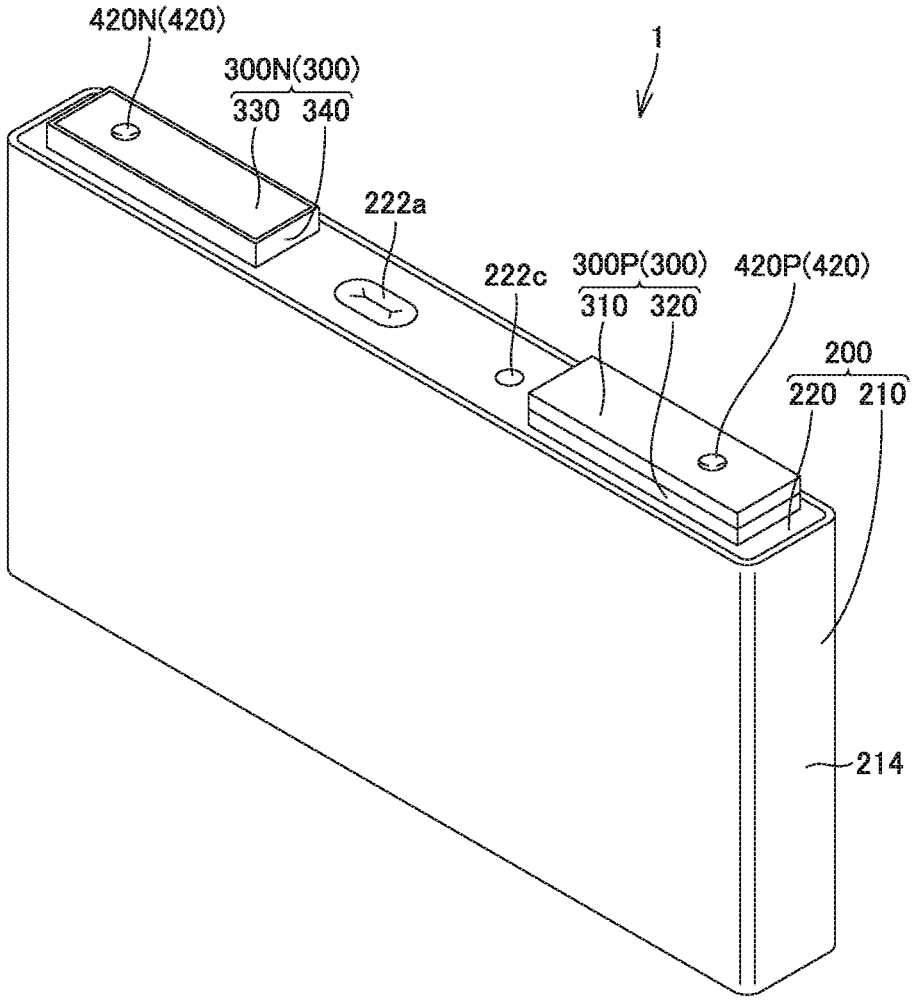
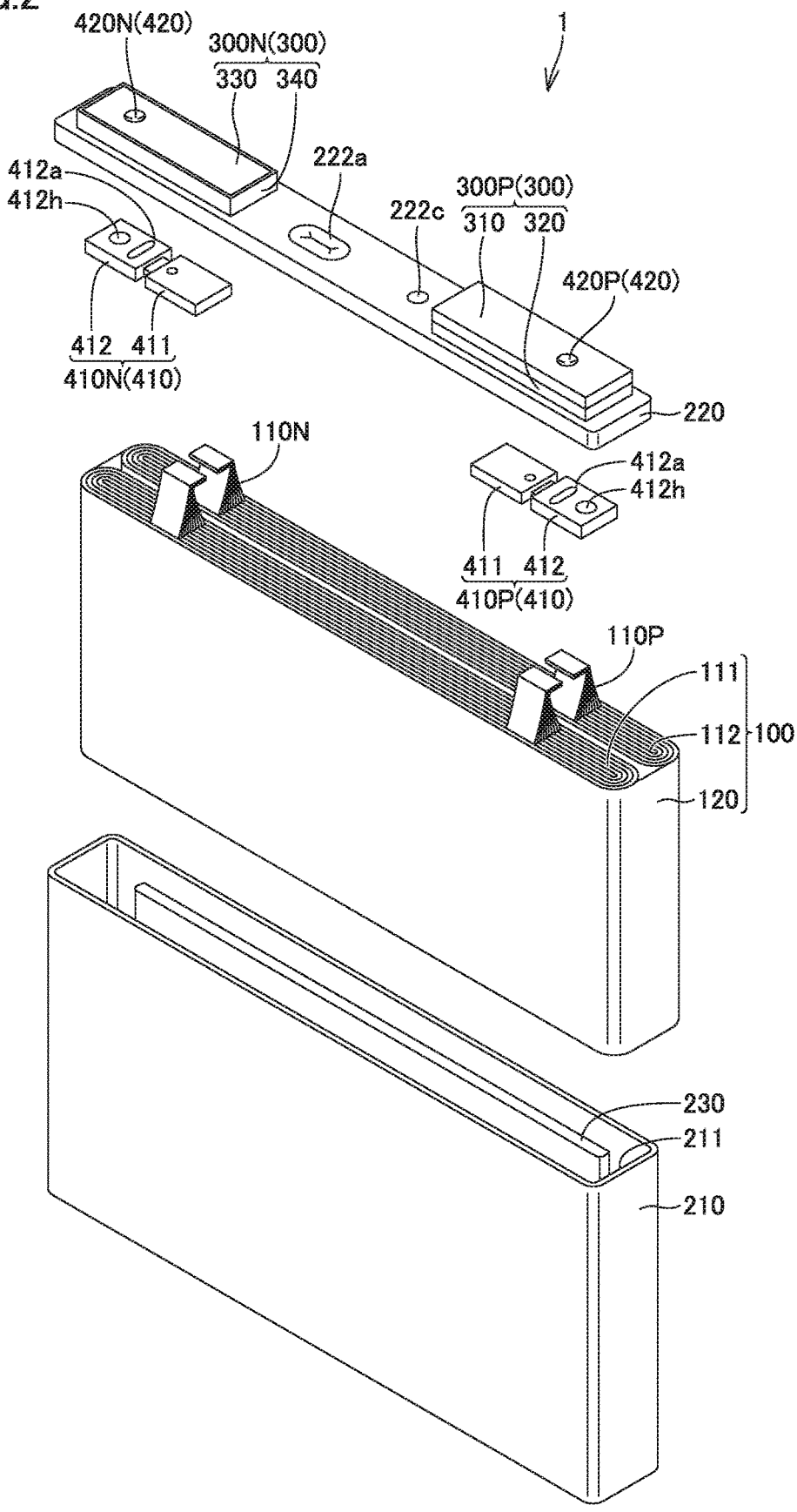

420N(420)
300N(300)
330 340
1
222a
222c
300P(300)
310 320
420P(420)
200
220 210
214

FIG.2


420N(420)
300N(300)
330 340
1
222a
412a
412h
222c
300P(300)
310 320
420P(420)
412 411
410N(410)
220
110N
412a
412h
411 412
410P(410)
110P
111
112
100
120
230
211
210

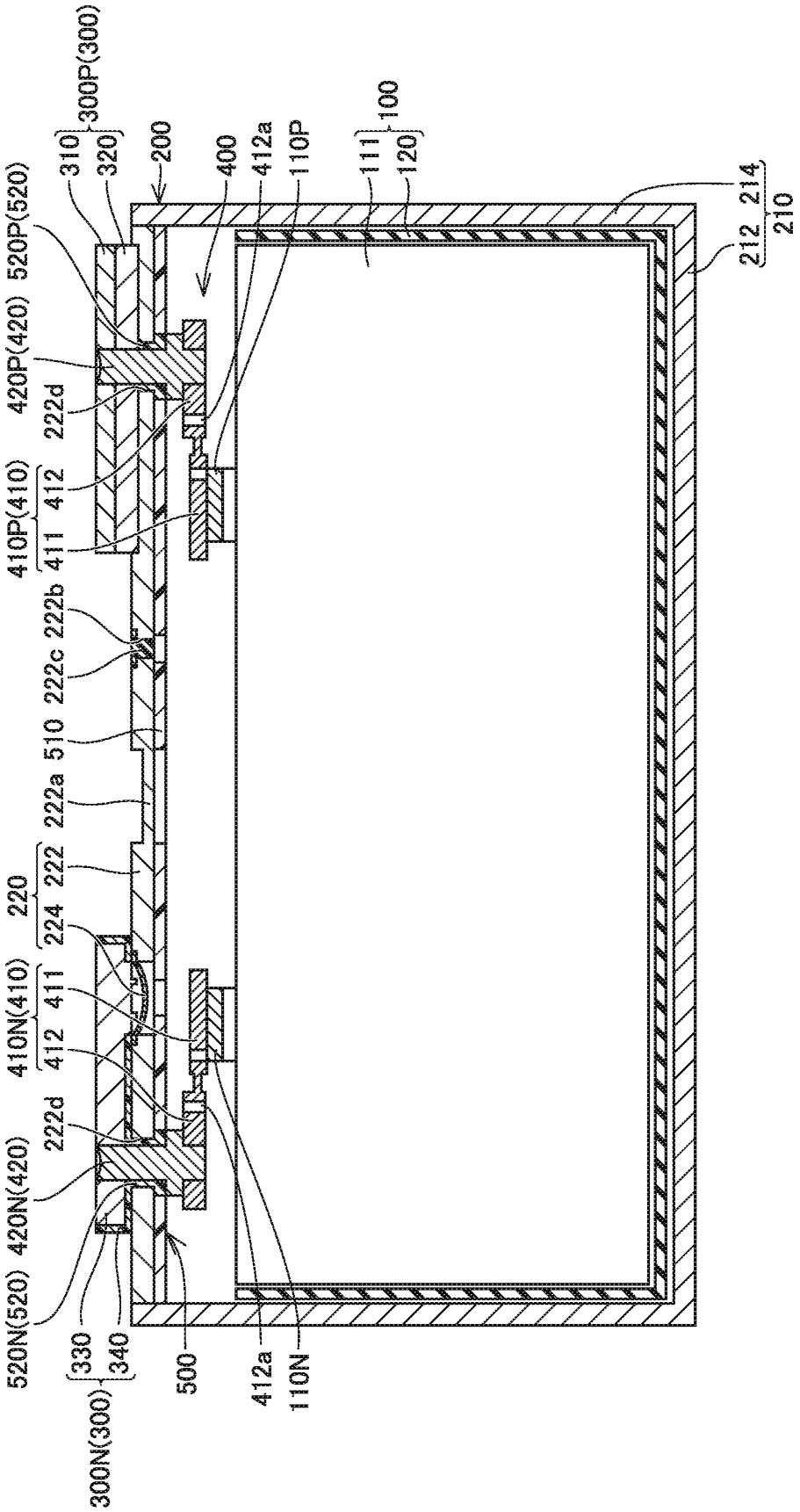

300P(300)
310
320
200
400
412a
110P
100
111
120
214
210
212
520P(520)
420P(420)
222d
410P(410)
412
411
222b
222c
510
222a
220
222
224
410N(410)
411
412
222d
420N(420)
520N(520)
330
340
300N(300)
500
412a
110N

FIG.3

FIG.4

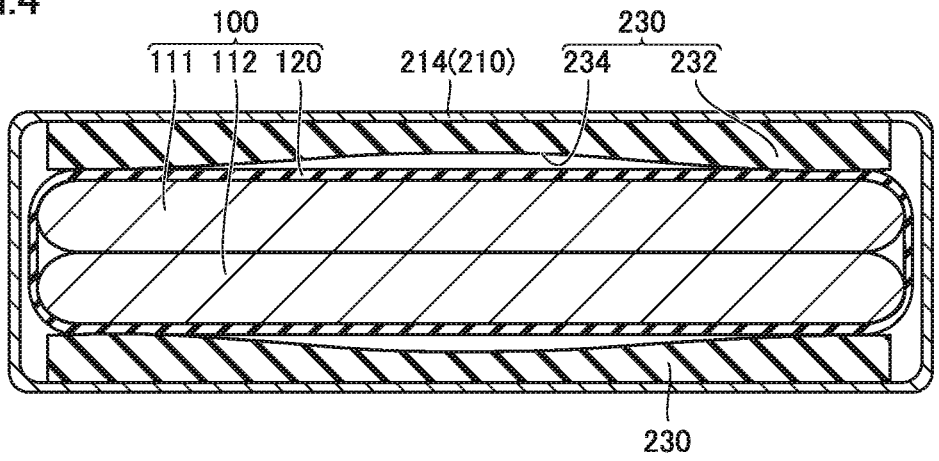
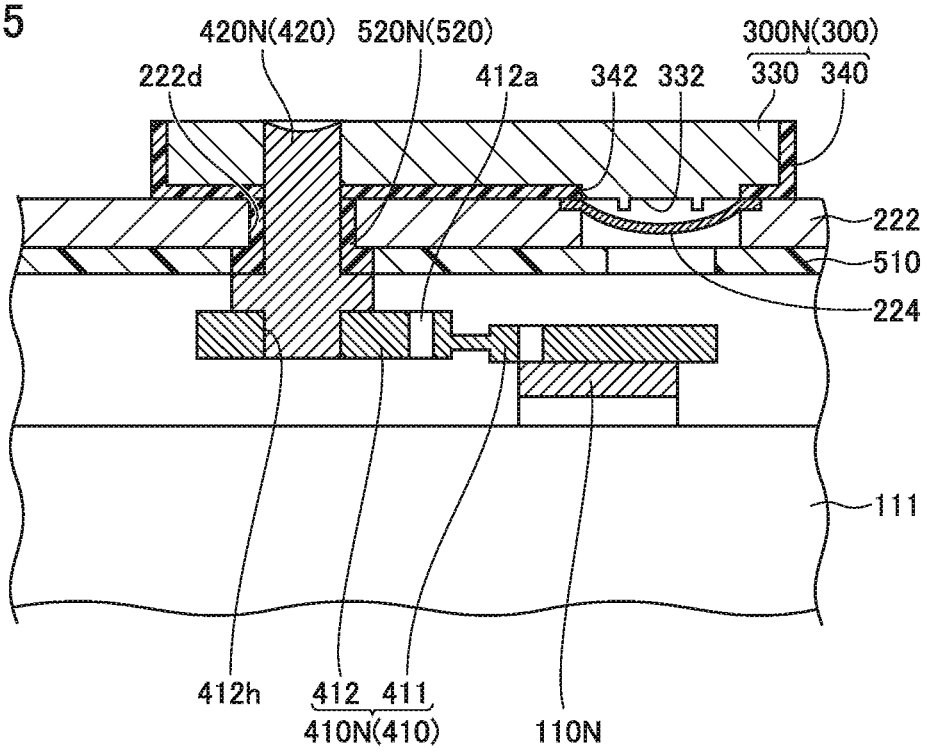

100
111 112 120
214(210)
230
234 232
230

FIG.5


420N(420)
520N(520)
300N(300)
222d
412a
342 332
330 340
222
510
224
111
412h
412 411
410N(410)
110N

# POWER STORAGE CELL

[0001] This nonprovisional application is based on Japanese Patent Application No. 2022-172245 filed on Oct. 27, 2022 with the Japan Patent Office, the entire contents of which are hereby incorporated by reference.

## BACKGROUND

### Field

[0002] The present disclosure relates to a power storage cell.

### Description of the Background Art

[0003] Japanese Patent Application Laid-Open No. 2011-96485 discloses a secondary battery including a battery element, a battery case that houses the battery element, and an elastic member disposed between a side surface of the battery element and the battery case. The battery element is held in a state of being pressed against the battery case by the compressive force of the elastic member.

## SUMMARY

[0004] In the secondary battery described in Japanese Patent Application Laid-Open No. 2011-96485, the surface pressure acting on the electrode assembly becomes uneven due to expansion of the electrode assembly during charging or the like. For this reason, there is a concern that reaction unevenness may occur in the electrode assembly.

[0005] It is an object of the present disclosure to provide a power storage cell to suppress occurrence of reaction unevenness in an electrode assembly.

[0006] A power storage cell according to one aspect of the present disclosure includes: an electrode assembly; and a cell case that accommodates the electrode assembly, wherein the cell case has a case main body that accommodates the electrode assembly, the case main body being provided with an opening that opens upward, a lid connected to the case main body so as to close the opening of the case main body, and an elastic member disposed between the case main body and the electrode assembly, the elastic member has a center-facing portion facing a central portion of the electrode assembly, and the center-facing portion has a shape curved to protrude in a direction away from the electrode assembly.

[0007] 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

[0008] FIG. **1** is a perspective view schematically showing a power storage cell according to an embodiment of the present disclosure.

[0009] FIG. **2** is an exploded perspective view of the power storage cell shown in FIG. **1**.

[0010] FIG. **3** is a cross-sectional view of the power storage cell shown in FIG. **1**.

[0011] FIG. **4** is a cross-sectional view of the power storage cell in a plane different from that of FIG. **3**.

[0012] FIG. **5** is an enlarged cross-sectional view of the vicinity of a negative electrode coupling pin.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Embodiments of the present disclosure will be described with reference to the drawings. In the drawings referred to below, the same or corresponding members are denoted by the same reference numerals.

[0014] FIG. **1** is a perspective view schematically showing a power storage cell according to an embodiment of the present disclosure. FIG. **2** is an exploded perspective view of the power storage cell shown in FIG. **1**. FIG. **3** is a cross-sectional view of the power storage cell shown in FIG. **1**. FIG. **4** is a cross-sectional view of the power storage cell in a plane different from that of FIG. **3**.

[0015] As shown in FIGS. **1** to **4**, the power storage cell **1** includes an electrode assembly **100**, a cell case **200**, external terminals **300**, a coupling member **400**, and an insulating member **500**.

[0016] The electrode assembly **100** includes a plurality of unit electrode assemblies **111**, **112** and an insulating film **120**. In the present embodiment, the plurality of unit electrode assemblies includes two unit electrode assemblies **111** and **112**. Each of the unit electrode assemblies **111** and **112** includes a plurality of tabs, that is, a plurality of positive electrode tabs **110**P and a plurality of negative electrode tabs **110**N. The unit electrode assemblies **111** and **112** have the same structure. Therefore, the unit electrode assembly **111** will be described below.

[0017] The unit electrode assembly **111** includes a positive electrode sheet, a separator, and a negative electrode sheet. The positive electrode sheet, the negative electrode sheet, and the separator are formed in a long rectangular shape.

[0018] The positive electrode sheet includes a metal foil and a positive electrode composite layer provided on the metal foil. An uncoated portion in which a positive electrode composite layer is not formed is formed in the upper long side portion of the metal foil, and the plurality of positive electrode tabs **110**P are formed at intervals in the uncoated portion.

[0019] The negative electrode sheet includes a metal foil and a negative electrode composite layer formed on the metal foil. An uncoated portion in which the negative electrode composite layer is not formed is formed in the upper long side portion of the metal foil, and the plurality of negative electrode tabs **110**N are formed at intervals in the uncoated portion.

[0020] In a state in which each sheet is wound, each positive electrode tab **110**P is arranged in the thickness direction (a direction orthogonal to the sheet of FIG. **3**) and each negative electrode tab **110**N is arranged in the thickness direction. The positive electrode tab **110**P and the negative electrode tab **110**N are arranged at intervals in the width direction (direction orthogonal to both the thickness direction and the height direction).

[0021] The insulating film **120** has a shape that collectively covers the peripheral surface and the bottom surface of the plurality of unit electrode assemblies **111** and **112**.

[0022] The cell case **200** houses the electrode assembly **100**. The cell case **200** contains an electrolyte solution (not shown). The cell case **200** is sealed. As shown in FIGS. **2** to **4**, the cell case **200** includes a case main body **210**, a lid **220**, and an elastic member **230**.

[0023] The case main body **210** has an opening **211** that opens upward. The case main body **210** is made of metal such as aluminum. The case main body **210** includes a

bottom wall **212** and a peripheral wall **214**. The bottom wall **212** is formed in a rectangular and flat plate shape. The peripheral wall **214** rises from the bottom wall **212**. The peripheral wall **214** is formed in a quadrangular cylindrical shape. The length of the peripheral wall **214** in the width direction is longer than the length of the peripheral wall **214** in the thickness direction. The length of the peripheral wall **214** in the height direction is longer than the length of the peripheral wall **214** in the thickness direction.

**[0024]** The lid **220** closes the opening **211** of the case main body **210**. The lid **220** is connected to the opening **211** by welding or the like. The lid **220** is formed in a flat plate shape. The lid **220** is made of metal such as aluminum. The lid **220** includes a lid main body **222** and an inversion plate **224**.

**[0025]** The lid main body **222** is connected to the case main body **210** by welding or the like. The lid main body **222** is formed with a pressure release valve **222***a*, a liquid injection hole **222***b*, a sealing member **222***c*, and a pair of pin insertion holes **222***d*.

**[0026]** The pressure release valve **222***a* is formed at the center of the lid main body **222**. The pressure release valve **222***a* is formed so as to break when the internal pressure of the cell case **200** becomes equal to or higher than a predetermined pressure. When the pressure release valve **222***a* breaks, the gas in the cell case **200** is released to the outside of the cell case **200** through the pressure release valve **222***a*, so that the internal pressure of the cell case **200** decreases.

**[0027]** The liquid injection hole **222***b* is a through hole for injecting the electrolyte solution into the cell case **200** in the manufacturing process of the power storage cell **1**.

**[0028]** The sealing member **222***c* seals the liquid injection hole **222***b*. After the electrolyte solution is injected into the case main body **210**, the liquid injection hole **222***b* is sealed by the sealing member **222***c*.

**[0029]** The pair of pin insertion holes **222***d* are formed at intervals in the width direction. Each pin insertion hole **222***d* is a through hole through which a coupling pin **420** described later is inserted.

**[0030]** The inversion plate **224** is connected to the lid main body **222** by welding or the like. The inversion plate **224** has a shape curved so as to be convex from the outside toward the inside of the lid main body **222**. When the internal pressure of the cell case **200** becomes equal to or higher than a predetermined pressure, the inversion plate **224** is deformed into a curved shape convex from the inside toward the outside of the cell case **200**.

**[0031]** The elastic member **230** is disposed between the case main body **210** and the electrode assembly **100**. The elastic member **230** is made of rubber, resin, or the like. As shown in FIGS. **2** and **4**, the elastic member **230** is disposed at a position opposed to the electrode assembly **100** in the thickness direction. The length of the elastic member **230** in the width direction is set to be equal to or longer than the length of the electrode assembly **100** in the same direction. However, the length of the elastic member **230** in the width direction may be shorter than the length of the electrode assembly **100** in the same direction.

**[0032]** As shown in FIG. **4**, the elastic member **230** includes a peripheral-edge-facing portion **232** and a center-facing portion **234**.

**[0033]** The peripheral-edge-facing portion **232** faces the peripheral edge portion of the electrode assembly **100**. The peripheral-edge-facing portion **232** is in contact with the peripheral edge portion of the electrode assembly **100**. The thickness of the peripheral-edge-facing portion **232** is smaller than the thickness of each of the unit electrode assemblies **111** and **112**.

**[0034]** The center-facing portion **234** faces the central portion of the electrode assembly **100**. The center-facing portion **234** is recessed in a direction away from the electrode assembly **100**. More specifically, the center-facing portion **234** has a shape curved so as to be convex in a direction away from the electrode assembly **100** (outward in the thickness direction). The difference between the minimum thickness of the center-facing portion **234** and the thickness of the peripheral-edge-facing portion **232** may be set to 10% or more and 50% or less of the thickness of each of the unit electrode assemblies **111** and **112**.

**[0035]** The external terminal **300** is fixed to the upper surface of the cell case **200**. A bus bar (not shown) is connected to the external terminal **300** by welding or the like. The external terminal **300** includes a positive electrode member **300**P and a negative electrode member **300**N.

**[0036]** The positive electrode member **300**P is connected to the upper surface of the cell case **200** by welding or the like. The positive electrode member **300**P includes a positive electrode terminal plate **310** and a terminal block **320**.

**[0037]** The positive electrode terminal plate **310** is formed in a rectangular parallelepiped shape. The positive electrode terminal plate **310** is made of a metal such as aluminum.

**[0038]** The terminal block **320** is formed in a rectangular parallelepiped shape. The terminal block **320** is made of a metal (e.g., iron) different from the metal constituting the positive electrode terminal plate **310**. The terminal block **320** is connected to the upper surface of the lid main body **222** by welding, and the positive electrode terminal plate **310** is connected to the upper surface of the terminal block **320** by welding or the like. That is, the case main body **210** and the lid **220** are electrically connected to the positive electrode terminal plate **310** via the terminal block **320**, and are charged to the same polarity as the positive electrode terminal plate **310**. Each of the positive electrode terminal plate **310** and the terminal block **320** is formed with a through hole through which a positive electrode coupling pin **420**P described later is inserted.

**[0039]** The negative electrode member **300**N is connected to the upper surface of the cell case **200** by welding or the like. The negative electrode member **300**N is spaced apart from the positive electrode member **300**P in the width direction. The negative electrode member **300**N includes a negative electrode terminal plate **330** and an insulating plate **340**.

**[0040]** The negative electrode terminal plate **330** is formed in a substantially rectangular parallelepiped shape. The negative electrode terminal plate **330** is disposed above the inversion plate **224**. As shown in FIG. **5**, the negative electrode terminal plate **330** has an opposing portion **332** opposed to the inversion plate **224**. When the internal pressure of the cell case **200** is less than the predetermined pressure (normal time), the inversion plate **224** is separated from the opposing portion **332**.

**[0041]** The insulating plate **340** is fixed to the upper surface of the lid **220**. The insulating plate **340** holds the negative electrode terminal plate **330**. The insulating plate **340** insulates the lid **220** from the negative electrode terminal plate **330**. Each of the negative electrode terminal plate **330** and the insulating plate **340** is formed with a through

hole through which a negative electrode coupling pin **420**N described later is inserted. As shown in FIGS. **3** and **5**, the insulating plate **340** has an exposure port **342** for exposing the opposing portion **332**.

**[0042]** The coupling member **400** connects the plurality of tabs **110**P and **110**N to the external terminal **300**. The coupling member **400** includes a current collector plate **410** and a coupling pin **420**.

**[0043]** The current collector plate **410** is connected to a plurality of tabs. The current collector plate **410** includes a positive electrode current collector plate **410**P and a negative electrode current collector plate **410**N.

**[0044]** The positive electrode current collector plate **410**P is connected to a plurality of positive electrode tabs **110**P by welding or the like. The positive electrode current collector plate **410**P includes a first flat plate portion **411** and a second flat plate portion **412**.

**[0045]** A plurality of positive electrode tabs **110**P are connected to the first flat plate portion **411** by ultrasonic welding or the like. A through hole is formed in the first flat plate portion **411**. The plurality of positive electrode tabs **110**P are connected to the lower surface of the first flat plate portion **411**. However, the plurality of positive electrode tabs **110**P may be connected to the upper surface of the first flat plate portion **411**.

**[0046]** The second flat plate portion **412** is disposed outside the first flat plate portion **411** in the width direction. A coupling hole **412***h* and a fuse portion **412***a* are formed in the second flat plate portion **412**. The fuse portion **412***a* is formed by a through hole penetrating the second flat plate portion **412** in the thickness direction. As shown in FIG. **3**, a thin portion may be formed between the second flat plate portion **412** and the first flat plate portion **411**.

**[0047]** The negative electrode current collector plate **410**N is connected to a plurality of negative electrode tabs **110**N by welding or the like. The configuration of the negative electrode current collector plate **410**N is substantially the same as the configuration of the positive electrode current collector plate **410**P.

**[0048]** The coupling pin **420** connects the current collector plate **410** and the external terminal **300**. The coupling pin **420** includes a positive electrode coupling pin **420**P and a negative electrode coupling pin **420**N.

**[0049]** The positive electrode coupling pin **420**P connects the positive electrode current collector plate **410**P and the positive electrode terminal plate **310**. The positive electrode coupling pin **420**P is formed in a cylindrical shape. The lower end portion of the positive electrode coupling pin **420**P is connected to the second flat plate portion **412** in a state of being inserted into the coupling hole **412***h*. The upper end of the positive electrode coupling pin **420**P is caulked to the positive electrode terminal plate **310**.

**[0050]** The negative electrode coupling pin **420**N connects the negative electrode current collector plate **410**N and the negative electrode terminal plate **330**. The negative electrode coupling pin **420**N is formed in a cylindrical shape. The lower end portion of the negative electrode coupling pin **420**N is connected to the second flat plate portion **412** in a state of being inserted into the coupling hole **412***h*. The upper end of the negative electrode coupling pin **420**N is caulked to the negative electrode terminal plate **330**.

**[0051]** The insulating member **500** insulates the coupling member **400** from the cell case **200**. The insulating member **500** includes an insulating sheet **510** and an insulator **520**.

**[0052]** The insulating sheet **510** is connected to the lower surface of the lid main body **222**. A through hole is formed in a portion of the insulating sheet **510** which overlaps the pressure release valve **222***a* in the height direction, a portion which overlaps the liquid injection hole **222***b*, a portion which overlaps the pin insertion hole **222***d*, and a portion which overlaps the inversion plate **224**.

**[0053]** The insulator **520** has a shape surrounding the coupling pin **420**, and insulates the coupling pin **420** from the cell case **200**. The insulator **520** includes a positive electrode side insulator **520**P and a negative electrode side insulator **520**N.

**[0054]** The positive electrode side insulator **520**P covers the positive electrode coupling pin **420**P. The positive electrode side insulator **520**P is formed in a cylindrical shape. The positive electrode side insulator **520**P insulates the positive electrode coupling pin **420**P from the lid main body **222**.

**[0055]** The negative electrode side insulator **520**N covers the negative electrode coupling pin **420**N. The structure of the negative electrode side insulator **520**N is the same as the structure of the positive electrode side insulator **520**P.

**[0056]** In the power storage cell **1** described above, when the internal pressure of the cell case **200** rises to the predetermined pressure or higher due to the occurrence of an abnormality or the like in the electrode assembly **100**, the inversion plate **224** is inverted (deformed into a shape curved to be convex upward) to contact the opposing portion **332** of the negative electrode terminal plate **330**. Thus, since the external terminal **300**, the coupling member **400**, and the electrode assembly **100** form a closed circuit through the lid **220**, a large current flows through the circuit. Then, the fuse portion **412***a* formed in the second flat plate portion **412** is fused. As a result, the electrical connection between the electrode assembly **100** and the cell case **200** is interrupted.

**[0057]** As described above, in the power storage cell **1** according to the present embodiment, since the center-facing portion **234** of the elastic member **230** has a shape which is curved so as to be convex in a direction away from the electrode assembly **100**, even when the electrode assembly **100** expands during charging or the like, the surface pressure acting on the electrode assembly **100** is prevented from becoming uneven. Therefore, the generation of the reaction unevenness on the electrode assembly **100** is suppressed.

**[0058]** It will be appreciated by those skilled in the art that the exemplary embodiments described above are specific examples of the following aspects.

Embodiment 1

**[0059]** A power storage cell comprising:

**[0060]** an electrode assembly; and

**[0061]** a cell case that accommodates the electrode assembly, wherein

**[0062]** the cell case has

**[0063]** a case main body that accommodates the electrode assembly, the case main body being provided with an opening that opens upward,

**[0064]** a lid connected to the case main body so as to close the opening of the case main body, and

**[0065]** an elastic member disposed between the case main body and the electrode assembly,

**[0066]** the elastic member has a center-facing portion facing a central portion of the electrode assembly, and

**[0067]** the center-facing portion has a shape curved to protrude in a direction away from the electrode assembly.

**[0068]** In this power storage cell, since the center-facing portion of the elastic member is curved so as to be convex in a direction away from the electrode assembly, even when the electrode assembly expands during charging or the like, the surface pressure acting on the electrode assembly is prevented from becoming uneven. Therefore, the generation of the reaction unevenness on the electrode assembly is suppressed.

**[0069]** Although the present disclosure has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present disclosure being interpreted by the terms of the appended claims.

What is claimed is:

**1**. A power storage cell comprising:

an electrode assembly; and

a cell case that accommodates the electrode assembly, wherein

the cell case has

a case main body that accommodates the electrode assembly, the case main body being provided with an opening that opens upward,

a lid connected to the case main body so as to close the opening of the case main body, and

an elastic member disposed between the case main body and the electrode assembly,

the elastic member has a center-facing portion facing a central portion of the electrode assembly, and

the center-facing portion has a shape curved to protrude in a direction away from the electrode assembly.

* * * * *