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BATTERY CELL, BATTERY, AND ELECTRIC DEVICE

Abstract

A battery cell, a battery, and an electric device. The battery cell includes a casing, an electrode assembly, and a current collecting member. The electrode assembly includes a first tab. The casing is used for accommodating the electrode assembly. The current collecting member includes a first connection portion and a second connection portion. The first connection portion is electrically connected to the first tab. The second connection portion is connected to the first connection portion and protrudes in a direction away from the electrode assembly. The second connection portion includes at least one first protrusion and at least one second protrusion. The height of the second protrusion is greater than the height of the first protrusion. The at least one first protrusion is welded to the casing. The at least one second protrusion is welded to the casing.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The present application is a continuation of International Application No. PCT/CN2023/122224, filed on Sep. 27, 2023, which claims priority to Chinese Patent Application No. 202310200635.5 filed on Mar. 3, 2023 and entitled “Battery Cell, Battery, and Electric device”, which are incorporated herein by reference in their entirety.

TECHNICAL FIELD
[0002] The present application relates to the field of battery technologies, and in particular, to a battery cell, a battery, and an electric device.
BACKGROUND
[0003] Energy conservation and emission reduction are the key to the sustainable development of the automotive industry, and electric vehicles have become an important component of the sustainable development of the automotive industry due to energy saving and environment protection advantages thereof. For electric vehicles, a battery technology is an important factor for the development thereof.
[0004] A current collecting member in a battery needs to conduct a current generated by an electrode assembly to an electrode terminal to output electric power, and the reliability of a conductive connection of the current collecting member has significant impact on battery performance. The current collecting member is generally electrically connected to a casing through welding. High control precision is required for butt alignment and a welding path during welding, or otherwise cold solder joint or missing solder joint may occur due to the shift of a welding position, and further the reliability of a connection between the current collecting member and the casing is affected.
SUMMARY
[0005] The present application aims to solve at least one of the technical problems existing in the related art. To that end, one objective of the present application is to provide a battery cell, a battery, and an electric device, to improve the reliability of a conductive connection between a current collecting member and a casing.
[0006] In a first aspect, an embodiment of the present application provides a battery cell comprising a casing, an electrode assembly, and a current collecting member. The electrode assembly comprises a first tab. The casing defines an accommodation space and an opening located at one end of the accommodation space. The accommodation space is used for accommodating the electrode assembly. The current collecting member is located at one end in the accommodation space in close proximity to the opening. The current collecting member comprises a first connection portion and a second connection portion. The first connection portion is electrically connected to the first tab. The second connection portion is connected to the first connection portion and protrudes in a direction away from the electrode assembly. The second connection portion comprises at least one first protrusion and at least one second protrusion. The height of the second protrusion is greater than the height of the first protrusion. The at least one first protrusion is welded to the casing, and the at least one second protrusion is welded to the casing.

[0007] In the technical solution of the present embodiment of the present application, the second connection portion connected to the casing is disposed as the first protrusion and the second protrusion having different heights. In this way, a butt region for a welding connection between the current collecting member and the casing can be increased, and the length of a butt seam between the current collecting member and the casing can be increased, thereby improving the reliability of a conductive connection between the current collecting member and the casing.

[0008] In some embodiments, the second connection portion comprises a plurality of first protrusions and a plurality of second protrusions, and the first protrusions and the second protrusions are alternately disposed in a circumferential direction of the electrode assembly. The plurality of first protrusions and the plurality of second protrusions having different heights are alternately disposed, so that an end face of the second connection portion facing away from the electrode assembly may be formed into a surface with alternating heights, which is more conducive to reducing a requirement for welding alignment precision, reducing the occurrence of cold solder joint or missing solder joint, and improving the reliability of a welding connection between the second connection portion and the casing.

[0009] In some embodiments, the second connection portion further comprises at least one stress relieving portion, and the stress relieving portion is at least partially located between the first protrusion and second protrusion that are disposed adjacent to each other. Disposing the stress relieving portion between the first protrusion and the second protrusion that are adjacent to each other is conducive to assembling the current collecting member into the casing and welding.

[0010] In some embodiments, the stress relieving portion is configured as an indentation, and the indentation penetrates the second connection portion in a thickness direction of the second connection portion. The stress relieving portion configured as an indentation can provide a space for deformation of the second connection portion, so that stress can be relieved at the time of assembling the current collecting member into the casing and welding.

[0011] In some embodiments, the stress relieving portion comprises a first part and a second part that are connected to each other, the first part is disposed between the first protrusion and the second protrusion that are disposed adjacent to each other, and the second part is disposed on the first connection portion. Extending the stress relieving portion to the first connection portion can provide a sufficient deformation margin, which is conducive to stress relieving.

[0012] In some embodiments, the first connection portion comprises a hollowed-out portion, one end of the second part is in communication with the first part the first part, and the other end is in communication with the hollowed-out portion. The hollowed-out portion is disposed, so that the weight of the current collecting member can be reduced, thereby facilitating a lightweight design of a battery. The indentation is in communication with the hollowed-out portion, so that processing procedures can be simplified during processing.

[0013] In some embodiments, an outer side face of the second connection portion abuts against an inner side face of the casing. The outer side face of the second connection portion is disposed to abut against the inner side face of the casing, so that a gap between the current collecting member and the casing attached to each other can be reduced. This is conducive to improving welding quality.

[0014] In some embodiments, the casing comprises a third end face that forms the opening, and a first end face of the first protrusion facing away from the first connection portion and a second end face of the second protrusion facing away from the first connection portion are both lower than the third end face. The third end face being higher than the first end face and the second end face can provide an arrangement space within the casing for a weld formed after the current collecting member is welded to the casing, to reduce a risk of interference with another member.

[0015] In some embodiments, a minimum height difference between the second end face of the second protrusion and the third end face is greater than 0.4 mm. There is a sufficient interval space between the second end face and the third end face to accommodate a first fusion welding portion,

so as to mitigate interference caused by the weld to another member.

[0016] In some embodiments, the second connection portion is welded to the casing to form a first fusion welding portion, and a part of the first fusion welding portion is located at a butt seam between a side face of the first protrusion and the inner side face of the casing, and/or at a butt seam between a side face of the second protrusion and the inner side face of the casing, wherein the side face of the first protrusion is adjacent to the first end face of the first protrusion facing away from the first connection portion, and the side face of the second protrusion is adjacent to the second end face of the second protrusion facing away from the first connection portion. A part of the first fusion welding portion may be alternatively located at the butt seam between the side face of the first protrusion and the inner side face of the casing, and/or at the butt seam between the side face of the second protrusion and the inner side face of the casing, so that the length of the first fusion welding portion can be increased, and thus, an overcurrent area between the current collecting member and the casing is increased, and an overcurrent capability and connection reliability are improved.

[0017] In some embodiments, the second connection portion is welded to the casing to form the first fusion welding portion, and in an axial direction of the electrode assembly, the height H of the first fusion welding portion from the first connection portion satisfies: H**2**≤H≤H**1**, wherein H**1** is the maximum height of the second protrusion, and H**2** is the minimum height of the first protrusion. The height of the first fusion welding portion is controlled to be between the maximum height of the second protrusion and the minimum height of the first protrusion, so that a requirement for precision of butt alignment at the time of welding can be reduced.

[0018] In some embodiments, the perimeter of a projection of the inner side face of the casing on a plane perpendicular to the axial direction of the electrode assembly is L, and the length L**1** of the first fusion welding portion satisfies L**1**≥0.2L. Setting the length L**1** of the first fusion welding portion to be greater than or equal to 0.2L can provide a sufficient overcurrent area between the current collecting member and the casing, to satisfy an overcurrent requirement for the current collecting member in a battery.

[0019] In some embodiments, the first end face of the first protrusion away from the electrode assembly comprises at least one convex portion, and/or the second end face of the second protrusion away from the electrode assembly comprises at least one convex portion, and the at least one convex portion is one or more of a square tooth, an arc-shaped tooth, a trapezoidal tooth, or a triangular tooth. Disposing the first end face and the second end face to include at least one convex portion can increase the length of the butt seam between the second connection portion and the casing, so that the first fusion welding portion formed by welding can be sufficient in length to satisfy overcurrent and connection requirements.

[0020] In some embodiments, the electrode assembly further comprises a second tab, the second tab and the first tab are respectively located at both ends of the electrode assembly, the casing comprises a sidewall, the opening located at one end of the sidewall, and an end wall located at the other end of the sidewall, and the battery cell further comprises an end cap and an electrode lead-out portion, wherein the end cap covers the opening and is fixedly connected to the casing, and the electrode lead-out portion is insulated from and penetrates the end wall and is electrically connected to the second tab. Electrically connecting the electrode assembly to the casing and the electrode lead-out portion respectively can facilitate input and output of electric energy for the electrode assembly.

[0021] In a second aspect, an embodiment of the present application provides a battery comprising the battery cell provided in the above embodiments.

[0022] In a third aspect, an embodiment of the present application provides an electric device comprising the battery provided in the above embodiment, wherein the battery is used to supply electric energy.

[0023] The above description is merely an overview of the technical solutions of the present

application. For a clearer understanding of the technical means of the present application, the present application can be carried out in accordance with the content of the description, and in order to make the above and other objectives, characteristics, and advantages of the present application apparent and comprehensible, specific embodiments of the present application are described below.

Description

DESCRIPTION OF DRAWINGS

[0024] In the drawings, the same reference sign represents the same or similar components or elements throughout a plurality of drawings unless otherwise specified. The drawings are not necessarily drawn to scale. It should be understood that these drawings depict only some embodiments disclosed in accordance with the present application and are not to be considered as limiting the scope of the present application.

[0025] FIG. **1** is a schematic diagram of a structure of a vehicle according to some embodiments of the present application;

[0026] FIG. **2** is a schematic diagram of a decomposed structure of a battery according to some embodiments of the present application;

[0027] FIG. **3** is a schematic diagram of a decomposed structure of a battery cell according to some embodiments of the present application;

[0028] FIG. **4** is a schematic diagram of a structure of a current collecting member according to some embodiments of the present application;

[0029] FIG. **5** is a partial cross sectional view of the interior of a battery cell according to some embodiments of the present application;

[0030] FIG. **6** is a schematic diagram of a structure of a current collecting member according to some other embodiments of the present application;

[0031] FIG. **7** is a schematic diagram of a structure of a current collecting member according to still some other embodiments of the present application;

[0032] FIG. **8** is a schematic diagram showing that a current collecting member is connected to a casing through welding according to some embodiments of the present application;

[0033] FIG. **9** is a schematic diagram showing that a current collecting member is connected to a casing through welding according to some other embodiments of the present application; and

[0034] FIG. **10** is a schematic diagram showing that a current collecting member is connected to a casing through welding according to still some other embodiments of the present application.

DESCRIPTION OF REFERENCE SIGNS

[0035] Vehicle **1000**; [0036] Battery **100**; Controller **200**; Motor **300**; [0037] Box **10**; First sub-box **11**; Second sub-box **12**; [0038] Battery cell **20**; Casing **21**; Electrode assembly **22**; First tab **221**; Current collecting member **23**; First connection portion **231**; Second connection portion **232**; First protrusion **2321**; Second protrusion **2322**; Stress relieving portion **2323**; First part **2323**A; Second part **2323**B; First end face **2321**A; Second end face **2322**A; Third end face **211**; End cap **24**; First fusion welding portion **25**; First butt weld **251**; Second butt weld **252**; Electrode lead-out portion **26**; Preset welding trajectory S**1**.

DESCRIPTION OF EMBODIMENTS

[0039] Embodiments of the technical solutions of the present application are described in detail below with reference to the drawings. The following embodiments are only used to more clearly illustrate the technical solutions of the present application, and thus are used as examples only, and are not intended to limit the protection range of the present application.

[0040] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by a person skilled in the art to which the present application

belongs; the terms used herein are used for describing particular embodiments only and are not intended to limit the present application; and the terms “comprising”, “including”, and “having” and any variations thereof in the description, claims and the above drawings of the present application are intended to cover non-exclusive inclusion.

[0041] In the description of the embodiments of the present application, the technical terms “first”, “second”, and the like are used only for distinguishing between different objects, but cannot be construed to indicate or imply relative importance or implicitly indicate the number, specific order, or primary/secondary relationship of indicated technical features. In the description of the embodiments of the present application, “a plurality of” means two or more unless specifically defined otherwise.

[0042] Reference to “an embodiment” herein means that a particular feature, structure, or characteristic described with reference to the embodiment can be included in at least one embodiment of the present application. The phrase in various places in the description does not necessarily all refer to the same embodiment, or a separate or alternative embodiment mutually exclusive of other embodiments. It is explicitly and implicitly understood by a person skilled in the art that the embodiments described herein may be combined with other embodiments.

[0043] In the description of the embodiments of the present application, the term “and/or” merely describes an association relationship of associated objects, indicating that three relationships may exist, for example, A and/or B may mean that A exists alone, A and B exist simultaneously, or B exists alone. In addition, the character “/” herein generally indicates that associated objects are in a “or” relationship.

[0044] In the description of the embodiments of the present application, the term “a plurality of” means two or more (including two), and similarly, the term “a plurality of groups” means two or more groups (including two groups), and the term “a plurality of pieces” means two or more pieces (including two pieces).

[0045] In the description of the embodiments of the present application, orientations or positional relationships indicated by the technical terms such as “center”, “longitudinal”, “transverse”, “length”, “width”, “thickness”, “upper”, “lower”, “front”, “rear”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “inner”, “outer”, “clockwise”, “counter-clockwise”, “axial”, “radial”, “circumferential”, and the like are based on orientations or positional relationships shown in the drawings, and are merely for convenience of description of the embodiments of the present application and simplified description, and do not indicate or imply that an indicated apparatus or element must have a specific orientation or be configured and operated in a specific orientation, and thus should not be construed as limitations on the embodiments of the present application.

[0046] In the description of the embodiments of the present application, unless explicitly specified and defined otherwise, the terms “mount”, “couple”, “connect”, and “fasten” should be broadly understood, for example, they may be a fixed connection, a detachable connection, or an integral connection; or may be a mechanical connection, or an electrical connection; or may be a direct connection, or an indirect connection via an intermediate medium, or an internal communication between two elements or interaction between two elements. A person of ordinary skill in the art may understand the specific meanings of the above terms in the embodiments of the present application according to specific situations.

[0047] At present, in view of the development of the market, the use of power batteries is becoming increasingly more widespread. Power batteries are used not only in energy storage power systems such as hydropower, thermal power, wind power, and solar power plants, but also in electric tools such as electric bicycles, electric motorcycles, and electric vehicles, as well as military equipment, aerospace, and many other fields. As an application field of power batteries continues to expand, a market demand for power batteries continues to increase.

[0048] The applicant has noted that a current collecting member inside a battery cell and a casing of the battery cell may be conductively connected through welding. For example, a butt seam

between an end face of the current collecting member and an inner side face of the casing may be welded by laser to form a butt weld, but such a connection manner has high requirements for dimension precision and butt alignment precision of the current collecting member and the casing, and if there are large errors such as dimensional tolerance of mechanical structural members (the casing and the current collecting member), tolerance of an apparatus and a clamp, and tolerance accumulation of alignment precision, a laser welding mark may shift up or down, resulting in poor welding effect. For example, when the laser welding mark shifts up and deviates from a butt position between the current collecting member and the casing, a welding connection between the current collecting member and the casing cannot be achieved. For another example, when the laser welding mark shifts down and laser light is completely irradiated on a surface of the current collecting member, cold solder joint may occur between the current collecting member and the casing and a reliable connection cannot be achieved because the current collecting member is different from the casing in terms of materials and the absorptivity to laser.

[0049] To alleviate a problem of a poor connection between the current collecting member and the casing, the applicant has found through research that the butt position between the flat end face of the current collecting member and the inner side face of the casing is at the same height, and in an ideal state, the weld is a full circle of butt weld formed along the height. In this case, an overcurrent area of the weld is excessive, and therefore, it is possible to optimize a design of an end face structure of a part in which the current collecting member and the casing butts against each other, and a requirement for alignment precision during welding can be reduced. Thus, even if a welding path is shifted, it is possible to ensure that a welding mark with a sufficient length can be formed between the current collecting member and the casing to achieve a reliable connection and an overcurrent.

[0050] Based on the above considerations, to improve the reliability of a connection between the current collecting member and the casing and an overcurrent capacity, the applicant has designed a battery cell after in-depth study. An end face on which the current collecting member butts against the casing is disposed to an end face with different heights, to expand a height range of a butt region between the casing and the current collecting member of the battery cell, and even when a welding mark is shifted, a good welding connection can be formed between a part of the current collecting member and the casing, so that a molten pool having a sufficient length can be formed between the current collecting member and the casing, the reliability of a conductive connection can be improved, and requirements for processing precision of components, aligning precision of a tooling fixture, and welding control precision can be reduced.

[0051] The battery cell disclosed in the embodiments of the present application may be, but not limited to, used in an electric device such as a vehicle, a ship, or an aircraft. A power supply system of the electric device can be composed of the battery cell, the battery, and the like disclosed in the present application.

[0052] Provided in the embodiments of the present application is an electric device using a battery as a power source. The electric device may be, but is not limited to, a mobile phone, a tablet computer, a notebook computer, an electric toy, an electric tool, a battery-powered vehicle, an electric vehicle, a ship, a spacecraft, etc. The electric toy may include a stationary or mobile electric toy, such as a game machine, an electric car toy, an electric ship toy, an electric airplane toy, and the like, and the spacecraft may be an airplane, a rocket, a space shuttle, a spaceship, etc.

[0053] To facilitate description, in the following embodiments, as an example for description, an electric device in an embodiment of the present application is a vehicle **1000**.

[0054] Referring to FIG. **1**, FIG. **1** is a schematic diagram of a structure of a vehicle **1000** according to some embodiments of the present application. The vehicle **1000** may be a fuel vehicle, a gas vehicle, or a new energy vehicle, and the new energy vehicle may be a battery electric vehicle, a hybrid vehicle, or a range-extended electric vehicle. Inside the vehicle **1000**, a battery **100** is provided, which may be provided at the bottom, head, or tail of the vehicle **1000**. The battery

100 may be used to power the vehicle **1000**, for example, the battery **100** may be used as an operating power source of the vehicle **1000**. The vehicle **1000** may further include a controller **200** and a motor **300**, and the controller **200** is used to control the battery **100** to power the motor **300**, for example, for a working power requirement for the vehicle **1000** during starting, navigating, and driving the vehicle **1000**.

[0055] In some embodiments of the present application, the battery **100** may be used not only as the operating power source of the vehicle **1000**, but also as a driving power source of the vehicle **1000**, instead of or partially instead of fuel or natural gas to provide driving power for the vehicle **1000**.

[0056] Referring to FIG. **2**, FIG. **2** is a schematic diagram of a decomposed structure of a battery **100** according to some embodiments of the present application. The battery **100** includes a box **10** and a battery cell **20**. The battery cell **20** is accommodated in the box **10**. Here, the box **10** is used for providing an accommodation space for the battery cell **20**, and the box **10** may have various structures. In some embodiments, the box **10** may include a first sub-box **11** and a second sub-box **12**, the first sub-box **11** and the second sub-box **12** cover each other, and the first sub-box **11** and the second sub-box **12** jointly define the accommodation space for accommodating the battery cell **20**. The second sub-box **12** may be a hollow structure with an opening at one end, the first sub-box **11** may be a plate-shaped structure, and the first sub-box **11** covers an opening side of the second sub-box **12**, so that the first sub-box **11** and the second sub-box **12** jointly define the accommodation space. Alternatively, the first sub-box **11** and the second sub-box **12** each may be a hollow structure with an opening at one end, and an opening side of the first sub-box **11** covers an opening side of the second sub-box **12**. Certainly, the box **10** formed by the first sub-box **11** and the second sub-box **12** may be in various shapes such as cylinder, rectangular cuboid, etc.

[0057] In the battery **100**, a plurality of battery cells **20** may be provided, and the plurality of battery cells **20** may be subjected to series connection, parallel connection, or series-parallel connection. The series-parallel connection means that the plurality of battery cells **20** are subjected to both series connection and parallel connection. The plurality of battery cells **20** may be subjected to series connection, parallel connection, or series-parallel connection directly, and then an integration formed by the plurality of battery cells **20** is accommodated in the box **10**. Certainly, the battery **100** may be alternatively a battery module formed by integrating the plurality of battery cells **20** by series connection, parallel connection, or series-parallel connection, and then a plurality of battery modules are integrated by series connection, parallel connection, or series-parallel connection, and accommodated in the box **10**. The battery **100** may further include other structures. For example, the battery **100** may further include a current converging component for implementing an electrical connection between the plurality of battery cells **20**.

[0058] Here, each battery cell **20** may be a secondary battery or a primary battery, or may be a lithium-sulfur battery, a sodium-ion battery, or a magnesium-ion battery, but is not limited thereto. The battery cell **20** may be in the shape of cylinder, flat body, rectangular cuboid, etc.

[0059] Referring to FIG. **3** to FIG. **5**, FIG. **3** is a schematic diagram of a decomposed structure of a battery cell **20** according to some embodiments of the present application, FIG. **4** is a schematic diagram of a structure of a current collecting member **23** according to some embodiments of the present application, and FIG. **5** is a partial cross sectional view of a battery cell **20** according to some embodiments of the present application. The battery cell **20** refers to a minimum unit constituting a battery. The battery cell **20** includes a casing **21**, an electrode assembly **22**, a current collecting member **23**, and other functional components. The electrode assembly **22** includes a first tab **221**. The casing **21** defines an accommodation space and an opening located at one end of the accommodation space. The accommodation space is used for accommodating the electrode assembly **22**. The current collecting member **23** is located at one end in the accommodation space in close proximity to the opening. The current collecting member **23** includes a first connection portion **231** and a second connection portion **232**. The first connection portion **231** is electrically

connected to the first tab **221**. The second connection portion **232** is connected to the first connection portion **231** and protrudes in a direction away from the electrode assembly **22**. The second connection portion **232** includes at least one first protrusion **2321** and at least one second protrusion **2322**. The height of the second protrusion **2322** is greater than the height of the first protrusion **2321**. The at least one first protrusion **2321** is welded to the casing **21**, and the at least one second protrusion **2322** is welded to the casing **21**.

[0060] The casing **21** is an assembly that forms an internal environment of the battery cell **20**. Here, the formed internal environment may be used to accommodate the electrode assembly **22**, an electrolyte, and another assembly. The casing **21** may be in various shapes and various dimensions, such as rectangular cuboid, cylinder, hexagonal prism, etc. Specifically, the shape of the casing **21** may be determined based on a specific shape and dimension of the electrode assembly **22**. The casing **21** may be made of various materials, such as copper, iron, aluminum, stainless steel, aluminum alloy, plastic, etc. This is not specially limited in the embodiments of the present application.

[0061] The electrode assembly **22** is a component in the battery cell **20** in which an electrochemical reaction occurs. The casing **21** may include one or more electrode assemblies **22**. The electrode assembly **22** is mainly formed by winding or stacking a positive electrode sheet and a negative electrode sheet, and a separator is generally provided between the positive electrode sheet and the negative electrode sheet. Parts of the positive electrode sheet and the negative electrode sheet with an active material constitute a main body of the electrode assembly, and parts of the positive electrode sheet and the negative electrode sheet with no active material each constitutes a tab. Tabs may be classified into a first tab and a second tab. One of the first tab and the second tab is a positive tab, and the other is a negative tab. The first tab and the second tab may be jointly located at one end of the main body or at both ends of the main body respectively. In a charging/discharging process of a battery, an active material of a positive electrode and an active material of a negative electrode react with the electrolyte, and the tab is connected to an electrode lead-out portion to form a current circuit.

[0062] The first tab **221** may be connected to the current collecting member **23** and electrically connected to the casing **21** via the current collecting member **23**. In this way, the casing **21** may serve as an electrode lead-out portion of the first tab **221** for inputting or outputting electric power.

[0063] The current collecting member **23** is located at one end in an accommodation space of the casing **21** in close proximity to the opening, and is connected to the first tab **221** of the electrode assembly **22** and the casing **21** respectively to conduct a current generated by the electrode assembly **22** to the casing **21**. The shape of the current collecting member **23** may adapt to the shape of the casing **21**. For example, the casing **21** is in a cylindrical shape, the first connection portion **231** of the current collecting member **23** may also be in a circular shape, and the second connection portion **232** may be located at an outer edge of the circular shape of the first connection portion **231** and protrude in a direction away from the electrode assembly **22**.

[0064] Because the current collecting member **23** is located inside the casing **21**, welding is limited by a space inside the casing. In addition, during butt welding, high requirements are imposed on a processing dimension and alignment precision of a member to be welded, or otherwise, there may be a significant deviation between an actual welding position and a preset welding path during welding. Because the current collecting member **23** and the casing **21** are different in terms of materials, the current collecting member **23** and the casing **21** have different welding performance. In the example of laser welding, power of laser during butt welding is maintained at a specified value, to fuse and connect a butt member at a butt position. If the laser is not emitted to a butt seam, that is, welding shift occurs, the specified laser power can not necessarily satisfy a requirement for forming a molten pool under another condition. For example, when the actual welding position is shifted in a direction approaching the electrode assembly, the laser is no longer emitted to a butt seam between the second connection portion **232** of the current collecting member **23** and casing

21, but is entirely emitted to a surface of the second connection portion **232**. In this case, to form a molten pool for welding, the laser needs to penetrate the second connection portion to form a deep-molten weld. However, laser power required by deep penetration welding is greater than laser power required by butt welding. In this case, the specified laser power cannot satisfy the requirement for forming the molten pool, and cold solder joint or missing solder joint occurs between the second connection portion **232** and the casing **21**. When the actual welding position is shifted to a direction approaching the opening of the casing **21**, there may be no current collecting member **23** in a region irradiated with the laser, and as such, a fusion weld cannot be formed between the current collecting member **23** and the casing **21**.

[0065] The first connection portion **231** includes a first side face and a second side face that are opposite to each other, the first side face is a side surface away from the electrode assembly **22**, the second side face is a side surface facing the electrode assembly **22**, and the second connection portion **232** is located on the first side face of the first connection portion **231** and protrudes in a direction away from the electrode assembly **22**.

[0066] The second connection portion **232** includes a first protrusion **2321** and a second protrusion **2322**, the height of the second protrusion **2322** refers to the height of the second protrusion **2322** from the first side face of the first connection portion **231** in an axial direction of the electrode assembly **22**, and the height of the first protrusion **2321** refers to the height of the second protrusion **2322** from the first side face of the first connection portion **231** in the axial direction of the electrode assembly **22**. There may be one or more first protrusions **2321**, and there may be one or more second protrusions **2322**. A plurality of first protrusions **2321** and a plurality of second protrusions **2322** may be alternately disposed, for example, one first protrusion **2321** is disposed between two adjacent second protrusions **2322**. Alternatively, the plurality of first protrusions **2321** and the plurality of second protrusions **2322** may be disposed non-alternately, for example, a plurality of first protrusions **2321** are provided between two adjacent second protrusions **2322**.

[0067] The height of the first protrusion **2321** is different from that of the second protrusion **2322**, so that a part of a weld formed between the second connection portion **232** and the casing **21** is located between the first protrusion **2321** and the casing **21**, and the other part is located between the second protrusion **2322** and the casing **21**.

[0068] It may be understood that the second connection portion **232** may further include at least one protrusion having a height different from the height of the first protrusion **2321** and the height of the second protrusion **2322**, so that butt positions between the second connection portion **232** and the casing **21** may be distributed at positions with different heights in the axial direction of the electrode assembly. This is advantageous in that a weld with a sufficient length can be formed even when a welding position is shifted.

[0069] In the present embodiment, the second connection portion **232** includes the first protrusion **2321** and the second protrusion **2322** having different heights. Thereby, butt seams between the second connection portion **232** and the casing **21** are not at the same height, but at a plurality of different heights distributed in the axial direction of the electrode assembly **22**. As such, a butt region for a welding connection between the current collecting member **23** and the casing **21** can be increased, and the length of the butt seam between the current collecting member **23** and the casing **21** can be increased. In this way, even when the actual welding position is shifted from the preset welding position, there can be a corresponding butt seam for welding therebetween to form a fused weld, so that the reliability of the connection between the current collecting member **23** and the casing **21** is improved.

[0070] In some embodiments, the second connection portion **232** includes a plurality of first protrusions **2321** and a plurality of second protrusions **2322**, and the first protrusions **2321** and the second protrusions **2322** are alternately disposed at intervals in a circumferential direction of the electrode assembly **22**.

[0071] The second connection portion **232** includes the first protrusions **2321** and the second

protrusions **2322**, the first protrusions **2321** and the second protrusions **2322** are alternately disposed in sequence in the circumferential direction of the electrode assembly **22**, and the heights of the first protrusions **2321** and the second protrusions **2322** respectively refer to the heights thereof protruding from the first connection portion **231**, for example, the height of the first protrusion **2321** may be the height of an end surface of the first protrusion **2321** away from the first connection portion **231** relative to a first side face, and the height of the second protrusion **2322** may be the height of an end surface of the second protrusion **2322** away from the first connection portion **231** relative to the first side face.

[0072] In the present embodiment, the plurality of first protrusions **2321** and the plurality of second protrusions **2322** having different heights are alternately disposed, so that an end surface of the second connection portion **232** away from the electrode assembly **22** can be formed as a surface having alternating heights. This is more advantageous in reducing a requirement for welding alignment precision, reducing the occurrence of cold solder joint or missing solder joint caused by insufficient welding precision, and improving the reliability of a welding connection between the second connection portion **232** and the casing **21**.

[0073] Referring to FIG. **6**, FIG. **6** is a schematic diagram of a structure of a current collecting member **23** according to some other embodiments of the present application. In some embodiments, the second connection portion **232** further includes at least one stress relieving portion **2323**, and the stress relieving portion **2323** is at least partially located between the first protrusion **2321** and the second protrusion **2322** that are disposed adjacent to each other.

[0074] The current collecting member **23** needs to be assembled to a specified position inside the casing **21** before being welded, and the second connection portion **232** needs to be held in conforming alignment with the casing **21** during welding to reduce a gap therebetween, so as to form, through welding, a fusion weld satisfying a quality requirement. Therefore, the dimension of an outer ring of the current collecting member **23** needs to be matched with the dimension of an inner ring of the casing **21** as much as possible. In this way, the casing **21** tends to squeeze the current collecting member **23** when the current collecting member **23** is being fitted into the casing, causing uncontrollable deformation to the current collecting member **23** due to compressive stress, thereby affecting alignment during assembly and welding. Likewise, thermal stress generated during welding may also cause stress deformation to the current collecting member **23**, making it disadvantageous in maintaining alignment precision and welding precision.

[0075] When the current collecting member **23** is being fitted into the casing or is being welded, the stress relieving portion **2323** can conduct and relieve, in a timely manner, the compressive stress or the thermal stress generated during welding that is experienced by the second connection portion **232**. In particular, the first protrusion **2321** and the second protrusion **2322** are different from each other in height, stress concentration is likely to occur at a boundary position therebetween. Disposing the stress relieving portion **2323** between the first protrusion **2321** and the second protrusion **2322** that are adjacent to each other can relieve the stress concentration at the boundary position between the first protrusion **2321** and the second protrusion **2322**, reduce impact exerted by stress deformation on a surrounding structure, offset the lack of alignment precision or the lack of welding precision caused by the stress effect, and facilitate fitting and assembling of the current collecting member **23** into the casing and welding.

[0076] The stress relieving portion **2323** may be configured as a weak portion between the first protrusion **2321** and the second protrusion **2322**, and the structural strength of the weak portion is weaker than that of the first protrusion **2321** and the second protrusion **2322**. In this way, stress can be relieved through structural deformation, and a risk of a structural failure caused by the stress concentration can be reduced. In one example, the weak portion may be a groove that is recessed in a thickness direction of the second connection portion **232**. In this case, the thickness of the weak portion is thinner than the thicknesses of the first protrusion **2321** and the second protrusion **2322** that are adjacent to each other. Thus, the weak portion may be greatly deformed under stress to

relieve the stress. In other examples, the stress relieving portion **2323** may be alternatively configured as an elastic portion having certain elasticity, and the stress may be relieved through elastic deformation. In some other examples, the stress relieving portion **2323** may be a hole or a slot that penetrates the second connection portion **232** along the thickness of the second connection portion **232**. In this way, the stress relieving portion **2323** may relieve stress by using a free edge on the edge. It should be noted that a structural form of the stress relieving portion **2323** described in the present embodiment is illustrative and should not be construed as a limitation on the present embodiment.

[0077] In some embodiments, as shown in FIG. **6**, the stress relieving portion **2323** is configured as an indentation, and the indentation penetrates the second connection portion **232** in the thickness direction of the second connection portion **232**.

[0078] The stress relieving portion **2323** may be an indentation located between the first protrusion **2321** and the second protrusion **2322** that are adjacent to each other, and the indentation penetrates the second connection portion **232** in the thickness direction of the second connection portion **232**, so that a groove passing through is formed between the first protrusion **2321** and the second protrusion **2322** that are adjacent to each other, and the height of the bottom of the groove from the first connection portion **231** is less than the height of the first protrusion **2321** and the height of the second protrusion **2322**. In this way, edges of the first protrusion **2321** and the second protrusion **2322** on a side close to the groove become free edges, which can be deformed under stress to relieve the stress.

[0079] Configuring the stress relieving portion **2323** as an indentation can relieve the stress in a timely manner, control an impact range of stress deformation, and facilitate maintaining precision of assembly alignment and welding.

[0080] Referring to FIG. **7**, FIG. **7** is a schematic diagram of a structure of a current collecting member **23** according to still some other embodiments of the present application. In some embodiments, the stress relieving portion **2323** includes a first part **2323**A and a second part **2323**B that are connected to each other, the first part **2323**A is disposed between the first protrusion **2321** and the second protrusion **2322** that are disposed adjacent to each other, and the second part **2323**B is disposed on the first connection portion **231**.

[0081] The second part **2323**B being disposed on the first connection portion **231** means that the stress relieving portion **2323** extends from the second connection portion **232** to the first connection portion **231**. As such, the first protrusion **2321** and the second protrusion **2322** of the second connection portion **232** that are located on both sides of the stress relieving portion **2323** are completely spaced apart by the stress relieving portion **2323**. The first part **2323**A and the second part **2323**B may have the same structural form or different structural forms. In one example, the first part **2323**A is an indentation that penetrates the second connection portion **232** in the thickness direction of the second connection portion **232**, the second part **2323**B may be a groove that is recessed in a thickness direction of the first connection portion **231**, or the second part **232**B is also an indentation that penetrates the first connection portion **231** in the thickness direction of the first connection portion **231**, and a communicated groove-shaped indentation is formed between the first part **2323**A and the second part **2323**B.

[0082] Extending the stress relieving portion **2323** to the first connection portion **231** may be more advantageous in blocking negative impact caused by stress deformation, and disposing the second part **2323**B on the first connection portion **231** may also provide a space for an outer edge of the first connection portion **231** to relieve stress.

[0083] In some embodiments, as shown in FIG. **7**, the first connection portion **231** includes a hollowed-out portion **2312**, one end of the second part **2323**B is in communication with the first part **2323**A, and the other end is in communication with the hollowed-out portion **2312**.

[0084] The first connection portion **231** may include a tab connection portion **2311** and a hollowed-out portion **2312**, and the hollowed-out portion **2312** refers to a hollowed-out structure that

penetrates the first connection portion **231** in the thickness direction of the first connection portion **231**. The tab connection portion **2311** is used to be connected to the first tab **221** through welding. The hollowed-out portion **2312** may include a plurality of hollowed-out regions that are spaced apart from each other, and the tab connection portion **2311** is located between adjacent hollowed-out regions.

[0085] In one example, the first part **2323**A is an indentation that penetrates the second connection portion **232** in the thickness direction of the second connection portion **232**, the second part **2323**B may be an indentation that penetrates the first connection portion **231** in the thickness direction of the first connection portion **231**, one end of the second part **2323**B is in communication with the first part **2323**A, and the other end is in communication with the hollowed-out portion **2312**, so that a connected hollowed-out structure is formed between the first part **2323**A and the hollowed-out portion **2312**.

[0086] Disposing the hollowed-out portion **2312** can reduce the weight of the current collecting member **23**, thereby facilitating a lightweight design of a battery cell **20**. The stress relieving portion **2323** is in communication with the hollowed-out portion **2312**, so that the outer edge of the current collecting member **23** can be divided into a plurality of sub-structures independent from each other, facilitating assembly alignment and welding alignment of the current collecting member **23**, and further improving connection reliability.

[0087] In some embodiments, an outer side face of the second connection portion **232** abuts against an inner side face of the casing **21**.

[0088] The outer side face of the second connection portion **232** refers to a side surface of the second connection portion **232** facing away from the axis of the electrode assembly **22**, and the inner side face of the casing **21** refers to a side surface facing the electrode assembly **22**. The current collecting member **23** needs to be inserted into the casing **21** during assembly, and the outer side face of the second connection portion **232** butts and is positioned against the inner side face of the casing **21**, and then, welding is performed to form a weld. Abutting means that when the outer side face of the second connection portion **232** and the inner side face of the casing **21** butt and are positioned against each other, the two surfaces come into contact with each other, to reduce the gap therebetween and reduce a possibility of cold solder joint or missing solder joint. In one example, the outer side face of the second connection portion **232** and the inner side face of the casing **21** may be in interference fit to ensure abutment therebetween.

[0089] Abutting the outer side face of the second connection portion **232** and the inner side face of the casing **21** against each other makes it possible to reduce a bonding gap as much as possible, thereby facilitating improvement of welding quality.

[0090] Referring to FIG. **8**, FIG. **8** is a schematic diagram showing that the current collecting member **23** is connected to the casing **21** through welding according to some embodiments of the present application. In some embodiments, the casing **21** includes a third end face **211** that forms an opening, and the first end face **2321**A of the first protrusion **2321** facing away from the first connection portion **231** and the second end face **2322**A of the second protrusion **2322** facing away from the first connection portion **231** are both lower than the third end face **211**.

[0091] Both the first end face **2321**A and the second end face **2322**A being lower than the third end face **211** means that after the current collecting member **23** is assembled into the casing **21**, in an axial direction of the electrode assembly **22**, the highest points (in a non-planar case) of the first end face **2321**A and the second end face **2322**A remain lower than the third end face **211**.

[0092] In the present embodiment, the third end face **211** is higher than the first end face **2321**A and the second end face **2322**A, so that the current collecting member **23** may be completely accommodated in the accommodation space formed by the casing **21** without protruding out of the casing **21** to interfere with another member.

[0093] In some embodiments, as shown in FIG. **8**, a minimum height difference H**3** between the second end face **2322**A and the third end face **211** is greater than 0.4 millimeters (mm).

[0094] Considering that the second end face **2322**A and the third end face **211** may not be planes, for example, may be curved surfaces, the minimum height difference H**3** between the second end face **2322**A and the third end face **211** refers to a distance between two points with the shortest distance between the second end face **2322**A and the third end face **211** in the axial direction of the electrode assembly **22**.

[0095] Setting a height difference between the second end face **2322**A and the third end face **211** to be greater than 0.4 millimeters (mm) may provide a sufficient arrangement space for the butt weld between the second connection portion **232** and the casing **21**. In another aspect, the inner side face of the casing **21** is also a surface to be fused during welding. Because certain welding stress is generated and welding deformation is caused during welding, there should be a sufficient space between the second end face **2322**A and the third end face **211** for accommodating the butt weld to reduce a risk of interference.

[0096] Referring to FIG. **9** and FIG. **10**, FIG. **9** is a schematic diagram showing that the current collecting member **23** is connected to the casing **21** through welding according to some other embodiments of the present application, and FIG. **10** is a schematic diagram showing that the current collecting member **23** is connected to the casing **21** through welding according to still some embodiments of the present application. In some embodiments, the second connection portion **232** is welded to the casing **21** to form a first fusion welding portion **25**, and a part of the first fusion welding portion **25** is located at a butt seam between a side face of the first protrusion **2321** and the inner side face of the casing **21**, and/or at a butt seam between a side face of the second protrusion **2322** and the inner side face of the casing **21**. The side face of the first protrusion **2321** is adjacent to the first end face **2321**A of the first protrusion **2321** facing away from the first connection portion **231**, and the side face of the second protrusion **2322** is adjacent to the second end face **2322**A of the second protrusion **2322** facing away from the first connection portion **231**.

[0097] The height of the first protrusion **2321** is different from that of the second protrusion **2322**, and the butt seam formed between the second connection portion **232** and the casing **21** may further include the butt seam formed between the side face of the first protrusion **2321** and the inner side face of the casing **21** and/or the butt seam formed between the side face of the second protrusion **2322** and the inner side face of the casing **21**, in addition to butt seams formed between the first end face **2321**A and the inner side face of the casing **21** and between the second end face **2322**A and the inner side face of the casing **21**. As shown in FIG. **9**, the first protrusions **2321** and the protrusions **2322** are alternately disposed to form a serrated surface with a square tooth-shaped surface. When a welding position is shifted, welds formed between the second connection portion **232** and the casing **21** through welding include a first butt weld **251** formed at the butt seam between the first end face **2321**A and the casing **21** and/or the butt seam between the second end face **2322**A and the casing **21**, and further include a second butt weld **252** formed at the butt seam between the side face of the first protrusion **2321** and the casing **21** and/or the butt seam between the side face of the second protrusion **2322** and the casing **21**. The length of the first fusion welding portion **25** formed in this way includes the length of the first butt weld **251** and the length of the second butt weld **252**.

[0098] In one example, as shown in FIG. **10**, a stress relieving portion **2323** configured as an indentation is disposed between the first protrusion **2321** and the second protrusion **2322**, and the bottom of the stress relieving portion **2323**, the side face of the first protrusion **2321**, and the side face of the second protrusion **2322** each form a part of butt seam between the second connection portion **232** and the casing **21**. The first fusion welding portion **25** formed at the time of welding may include not only the first butt weld **251** between the first end face **2321**A and the casing **21** and between the second end face **2322**A and the casing **21**, but also the second butt weld **252** between the side face of the first protrusion **2321** and the casing **21** and between the side face of the second protrusion **2322** and the casing **21**.

[0099] In the present embodiment, a part of the first fusion welding portion **25** may also be located at the butt seam between the side face of the first protrusion **2321** and the inner side face of the

casing **21**, and/or the butt seam between the side face of the second protrusion **2322** and the inner side face of the casing **21**, so that the length of the first fusion welding portion **25** can be increased, and thus, an overcurrent area between the current collecting member **23** and the casing **21** can be increased, thereby improving an overcurrent capability and connection reliability.

[0100] In some embodiments, the second connection portion **232** is welded to the casing **21** to form the first fusion welding portion **25**, and in the axial direction of the electrode assembly **22**, the height H of the first fusion welding portion **25** from the first connection portion **231** satisfies: H**2**≤H≤H**1**, where H**1** is the maximum height of the second protrusion **2322**, and H**2** is the minimum height of the first protrusion **2321**.

[0101] An end face of the second connection portion **232** away from the electrode assembly **22** is no longer a plane at the same height, but a surface with alternating heights. A preset welding trajectory S**1** formed when the second connection portion **232** is welded to the casing **21** to form the first fusion welding portion **25** may no longer be a trajectory of a constant height, but a welding trajectory with fluctuating welding positions provided that the trajectory can at least partially coincide with the butt seam between the second connection portion **232** and the casing **21**, so that the first fusion welding portion **25** formed by welding has a sufficient length to satisfy requirements for connection and overcurrent.

[0102] In one example, the preset welding trajectory S**1** for forming the first fusion welding portion **25** may completely coincide with the butt seam between the second connection portion **232** and the casing **21**. Because an end of the second connection portion **232** away from the electrode assembly **22** presents an uneven surface, the length of the butt seam between the second connection portion **232** and the casing **21** can be increased. In this case, the preset welding trajectory S**1** completely coincides with the butt seam, the length of the first fusion welding portion **25** can be relatively increased even if cold solder joint or missing solder joint is caused due to an error, thereby satisfying the requirements for connection and overcurrent.

[0103] The height H of the first fusion welding portion **25** from the first connection portion **231** is between the minimum height H**2** of the first protrusion **2321** and the maximum height H**1** of the second protrusion **2322**, which means that the preset welding trajectory S**1** also varies between the minimum height H**2** of the first protrusion **2321** and the maximum height H**1** of the second protrusion **2322**. This is equivalent to that a fluctuation range of the preset welding trajectory S**1** is expanded, thereby reducing a precision requirement for butt alignment during welding.

[0104] In some embodiments, the perimeter of a projection of the inner side face of the casing **21** on a plane perpendicular to the axial direction of the electrode assembly **22** is L (not shown in the drawings), and the length L**1** (not shown in the drawings) of the first fusion welding portion **25** satisfies L**1**≥0.2L.

[0105] The projection of the inner side face of the casing **21** on the plane perpendicular to the axial direction of the electrode assembly **22** is a closed line. For example, a projection of an inner side face of a cylindrical casing **21** on the plane perpendicular to the axial direction of the electrode assembly **22** is a circle, and the perimeter L of the projection is the length of the circumference. The length L**1** of the first fusion welding portion **25** is an accumulated length of the butt weld formed between the second connection portion **232** and the casing **21**. In some examples, the length L**1** of the first fusion welding portion **25** includes an accumulated length of the first butt weld **251** and an accumulated length of the second butt weld **252**.

[0106] In some embodiments, the length L**1** of the first fusion welding portion satisfies L**1**≥0.33L. In this way, the overcurrent area between the current collecting member **23** and the casing **21** can be increased, and the reliability of the welding connection can be improved.

[0107] Setting the length L**1** of the first fusion welding portion **25** to be greater than or equal to 0.2L can provide a sufficient overcurrent area between the current collecting member **23** and the casing **21**, so as to satisfy an overcurrent requirement of the current collecting member **23** in the battery, and improve the reliability of a connection between the current collecting member **23** and

the casing **21**.

[0108] In some embodiments, the first end face **2321**A of the first protrusion **2321** away from the electrode assembly **22** includes at least one convex portion, and/or the second end face **2322**A of the second protrusion **2322** away from the electrode assembly includes at least one convex portion. The at least one convex portion is one or more of a square tooth, an arc-shaped tooth, a trapezoidal tooth, or a triangular tooth.

[0109] The first end face **2321**A and/or the second end face **2322**A may be non-flat surfaces. For example, the first end face **2321**A may include one convex portion to make the first end face **2321**A present a non-flat surface that is higher in the middle and lower on both sides. In one instance, the first end face **2321**A may further include a plurality of convex portions to make the first end face **2321** present a continuous serrated surface. The convex portion may be a raised toothed structure such as one or more of a square tooth, an arc-shaped tooth, a trapezoidal tooth, or a triangular tooth. The second end face **2322**A may also include one or more convex portions, and a structural form of the second end face **2322**A may be the same as or different from that of the first end face **2321**A. The embodiments of the present application impose no limitation thereto.

[0110] Disposing the first end face **2321**A and/or the second end face **2322**A to include at least one convex portion can increase the length of the butt seam between the second connection portion **232** and the casing **21**. This helps form the first fusion welding portion **25** having a sufficient length through welding to satisfy the requirements for overcurrent and connection.

[0111] In some embodiments, the electrode assembly **22** further includes a second tab **222**, and the second tab **222** and the first tab **221** are respectively located at both ends of the electrode assembly **22**. The casing **21** includes a sidewall **212**, an opening located at one end of the sidewall **212**, and an end wall **213** located at the other end of the sidewall **212**. The battery cell **20** further includes an end cap **24** and an electrode lead-out portion **26**, the end cap **24** covers the opening and is fixedly connected to the casing **21**, and the electrode lead-out portion **26** is insulated from and penetrates the end wall **213** and is electrically connected to the second tab **222**.

[0112] The end cap **24** is a component that covers the opening of the casing **21** to insulate an internal environment of the battery cell **20** from an external environment. Without limitation, the shape of the end cap **24** may adapt to the shape of the casing **21** to fit the casing **21**. In some embodiments, the end cap **24** may be made of a material with certain hardness and strength (e.g., aluminum alloy). As such, the end cap **24** is less prone to deformation under compressive impact, thereby enabling the battery cell **20** to have higher structural strength and improved safety performance. The end cap **24** may be provided with a functional component such as an electrode terminal. The electrode terminal may be used to be electrically connected to the electrode assembly **22** for outputting electric energy from or inputting electric energy into the battery cell **20**. In some embodiments, a pressure relief mechanism for relieving internal pressure may be further disposed on the end cap **24** when the internal pressure or temperature of the battery cell **20** reaches a threshold value. The end cap **24** may be made of various materials, such as copper, iron, aluminum, stainless steel, aluminum alloy, plastic, etc. The embodiments of the present application impose no special limitations thereto. In some embodiments, an insulation piece may be further disposed on an inner side of the end cap **24**, and the insulation piece may be used to isolate an electrical connection component in the casing **21** from the end cap **24** to reduce a risk of a short circuit. For example, the insulation piece may be plastic, rubber, etc.

[0113] The casing **21** and the end cap **24** may be separate components, or the end cap **24** and the casing **21** may be integrated. Specifically, the end cap **24** and the casing **21** may form a common connection surface before other components is fitted into the casing, and then the end cap **24** is brought to cover the casing **21** when an inner side of the casing **21** needs to be enclosed.

[0114] In the present embodiment, respectively disposing the first tab **221** and the second tab **222** at both ends of the electrode assembly **22** and conductively connecting the first tab **221** and the second tab **222** to the casing **21** and the electrode lead-out portion **26** respectively are conducive to

input and output of electric energy to and from the electrode assembly **22**.

[0115] In a second aspect, an embodiment of the present application provides a battery **100** including the battery cell **20** provided in the above embodiments.

[0116] In a third aspect, an embodiment of the present application provides an electric device including the battery **100** provided in the above embodiment, and the battery **100** is used to supply electric energy.

[0117] The battery cell **20** in the present application is further described in detail with reference to an embodiment.

[0118] The battery cell **20** includes a casing **21**, an electrode assembly **22**, a current collecting member **23**, an end cap **24**, and an electrode lead-out portion **26**.

[0119] The casing **21** includes a sidewall **212**, an opening located at one end of the sidewall **212**, and an end wall **213** located at the other end of the sidewall **212**. The casing **21** defines an accommodation space for accommodating the electrode assembly **22**.

[0120] The electrode assembly **22** further includes a second tab **222**, and the second tab **222** and the first tab **221** are respectively located at both ends of the electrode assembly **22**.

[0121] The current collecting member **23** is located at one end in the accommodation space in close proximity to the opening. The current collecting member **23** includes a first connection portion **231** and a second connection portion **232**. The first connection portion **231** is electrically connected to the first tab **221**. The second connection portion **232** is connected to the first connection portion **231** and protrudes in a direction away from the electrode assembly **22**. The second connection portion **232** includes at least one first protrusion **2321** and at least one second protrusion **2322**. The height of the second protrusion **2322** is greater than the height of the first protrusion **2321**. The at least one first protrusion **2321** is welded to the casing **21**, and the at least one second protrusion **2322** is welded to the casing **21**. First protrusions **2321** and second protrusions **2322** are alternately disposed in a circumferential direction of the electrode assembly **22**.

[0122] The second connection portion **232** further includes a stress relieving portion **2323** located between the first protrusion **2321** and the second protrusion **2322** that are adjacent to each other, and the stress relieving portion **2323** is configured as an indentation that penetrates the second connection portion **232** in the thickness direction of the second connection portion **232**.

[0123] The end cap **24** covers the opening and is fixedly connected to the casing **21**, and the electrode lead-out portion **26** is insulated from and penetrates the end wall **213** and is electrically connected to the second tab **222**.

[0124] The second connection portion **232** is welded to the casing **21** to form a first fusion welding portion **25**. The first fusion welding portion **25** includes a first butt weld **251** formed at a butt seam between the first end face **2321**A and the casing **21**, and/or at a butt seam between the second end face **2322**A and the casing **21**, and a second butt weld **252** formed at a butt seam between a side face of the first protrusion **2321** and the casing **21**, and/or at a butt seam between a side face of the second protrusion **2322** and the casing **21**. The perimeter of a projection of the inner side face of the casing **21** on the plane perpendicular to the axial direction of the electrode assembly is L, and the length L**1** of the first fusion welding portion **25** satisfies L**1**≥0.2L.

[0125] Finally, it should be noted that the above embodiments are only for the purpose of illustrating the technical solutions of the present application and are not to be construed as limiting the present application. Although the present application has been described in detail with reference to the above embodiments, it should be understood by a person of ordinary skill in the art that modifications may be made to the technical solutions described in the above embodiments, or equivalent replacement may be made to some or all of the technical features thereof. However, the modifications or replacements do not make the nature of corresponding technical solutions depart from the scope of the technical solutions of the embodiments of the present application, all of which shall fall within the scope of the claims and the description of the present application. In particular, the technical features mentioned in the embodiments may be combined in any manner

provided that there is no structural conflict. The present application is not limited to the specific embodiments disclosed herein, but includes all technical solutions falling within the scope of the claims.

Claims

1. A battery cell, comprising: an electrode assembly comprising a first tab; a casing defining an accommodation space and an opening located at one end of the accommodation space, wherein the accommodation space is used for accommodating the electrode assembly; and a current collecting member located at one end in the accommodation space in close proximity to the opening, wherein the current collecting member comprises: a first connection portion electrically connected to the first tab; and a second connection portion connected to the first connection portion and protruding in a direction away from the electrode assembly, wherein the second connection portion comprises at least one first protrusion and at least one second protrusion, the height of the second protrusion is greater than the height of the first protrusion, the at least one first protrusion is welded to the casing, and the at least one second protrusion is welded to the casing.
2. The battery cell according to claim 1, wherein the second connection portion comprises a plurality of first protrusions and a plurality of second protrusions, and the first protrusions and the second protrusions are alternately disposed in a circumferential direction of the electrode assembly.
3. The battery cell according to claim 2, wherein the second connection portion further comprises at least one stress relieving portion, and the stress relieving portion is at least partially located between the first protrusion and the second protrusion that are disposed adjacent to each other.
4. The battery cell according to claim 3, wherein the stress relieving portion is configured as an indentation, and the indentation penetrates the second connection portion in a thickness direction of the second connection portion.
5. The battery cell according to claim 4, wherein the stress relieving portion comprises a first part and a second part that are connected to each other, the first part is disposed between the first protrusion and the second protrusion that are disposed adjacent to each other, and the second part is disposed on the first connection portion.
6. The battery cell according to claim 5, wherein the first connection portion comprises a hollowed-out portion, one end of the second part is in communication with the first part, and the other end is in communication with the hollowed-out portion.
7. The battery cell according to claim 1, wherein an outer side face of the second connection portion abuts against an inner side face of the casing.
8. The battery cell according to claim 1, wherein the casing comprises a third end face that forms the opening, and a first end face of the first protrusion facing away from the first connection portion and a second end face of the second protrusion facing away from the first connection part are both lower than the third end face.
9. The battery cell according to claim 8, wherein a minimum height difference between the second end face of the second protrusion and the third end face is greater than 0.4 mm.
10. The battery cell according to claim 1, wherein: the second connection portion is welded to the casing to form a first fusion welding portion, and a part of the first fusion welding portion is located at a butt seam between a side face of the first protrusion and the inner side face of the casing, and/or at a butt seam between a side face of the second protrusion and the inner side face of the casing; and the side face of the first protrusion is adjacent to the first end face of the first protrusion facing away from the first connection portion, and the side face of the second protrusion is adjacent to the second end face of the second protrusion facing away from the first connection portion.
11. The battery cell according to claim 1, wherein: the second connection portion is welded to the casing to form the first fusion welding portion, and in an axial direction of the electrode assembly,

the height H of the first fusion welding portion from the first connection portion satisfies H**2**≤H≤H**1**; and H**1** is the maximum height of the second protrusion from the first connection portion, and H**2** is the minimum height of the first protrusion from the first connection portion.

12. The battery cell according to claim 11, wherein the perimeter L of a projection of the inner side face of the casing on a plane perpendicular to the axial direction of the electrode assembly and the length L**1** of the first fusion welding portion satisfy L**1**≥0.2L.

13. The battery cell according to claim 1, wherein the first end face of the first protrusion away from the electrode assembly comprises at least one convex portion, and/or the second end face of the second protrusion away from the electrode assembly comprises at least one convex portion, and the at least one convex portion is one or more of a square tooth, an arc-shaped tooth, a trapezoidal tooth, or a triangular tooth.

14. The battery cell according to claim 1, wherein: the electrode assembly further comprises a second tab, the second tab and the first tab are respectively located at both ends of the electrode assembly, and the casing comprises a sidewall, the opening located at one end of the sidewall, and an end wall located at the other end of the sidewall; and the battery cell further comprising: an end cap that covers the opening and is fixedly connected to the casing; and an electrode lead-out portion that is insulated from and penetrates the end wall and is electrically connected to the second tab.

15. A battery, comprising the battery cell according to claim 1.

16. An electric device, comprising the battery according to claim 15, wherein the battery is used for supplying electric energy.