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FOLDED SHEET CASING

Abstract

A casing (**100, 201, 202, 300**) containing at least one electrode jelly roll assembly, wherein the casing comprises a folded sheet (**110, 210, 310**), defining a first open end portion (**113**) and a second open end portion (**114**) arranged on opposite sides of the casing. The folded sheet comprises a first sheet edge (**111, 211**) and a second sheet edge (**112, 212**) wherein the first sheet edge and the second sheet edge extend from the first open end portion to the second open end portion. The casing further comprises a joining plate (**120, 220, 320**) arranged to join at least a part of the first sheet edge and the second sheet edge, such that the folded sheet and the joining plate form a closed profile of the casing. Moreover, the casing comprises an interlocking structure (**250**) configured to secure the joining plate and the folded sheet.

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Background/Summary

TECHNICAL FIELD

[0001] The present disclosure generally relates to batteries for electric vehicles. More particularly, the present disclosure relates to casings for accommodating electrode jelly roll assemblies.

BACKGROUND

[0002] Rechargeable, also referred to as secondary, batteries find widespread use as electrical power supplies and energy storage systems. For example, in automobiles, battery packs formed of a plurality of battery modules, wherein each battery module includes a plurality of interconnected cells are provided as a means of effective storage and utilization of electric power.

[0003] Several different form factors exist for the cells applied in secondary batteries depending on their intended application field. In automotive applications, the most common cell types are cylindrical, prismatic and pouch cells. More particularly, there is a growing interest in efficiently packaging and securing prismatic cells within battery modules.

[0004] For example, cell casings, or cell housings, generally form part of a prismatic cell in secondary batteries, containing at least one electrode jelly roll assembly and protecting that at least one electrode jelly roll assembly from the environment surrounding the casing. Cell casings such as the one described above can for example be formed by deep drawing, or from an extruded material having a hollow cross-section.

[0005] However, there is still a need for alternative and improved casing designs for containing electrode jelly roll assemblies, in particular in view of the protection provided by the casing to the electrode jelly roll assemblies and in view of the minimization of cost of manufacturing process.

SUMMARY

[0006] It is an object of the present disclosure to provide an alternative configuration of casings of prismatic cells, formed of several separate components, improving the protection provided to the at least one electrode jelly roll assembly contained therein. It is also an object of the present disclosure to provide an improved method of forming those casings which is more energy efficient and which minimizes material waste compared with casings formed from extruded materials.

[0007] Hence, according to a first aspect, there is provided a casing containing at least one electrode jelly roll assembly, wherein the casing comprises a folded sheet, defining a first open end portion and a second open end portion arranged on opposite sides of the casing. The folded sheet comprises a first sheet edge and a second sheet edge wherein the first sheet edge and the second sheet edge extend from the first open end portion to the second open end portion. The casing further comprises a joining plate arranged to join at least a part of the first sheet edge and the second sheet edge, such that the folded sheet and the joining plate form a closed profile of the casing. Moreover, the casing comprises an interlocking structure configured to secure the joining plate and the folded sheet.

[0008] According to a second aspect, there is provided a method for manufacturing a casing containing at least one electrode assembly. The method comprises folding a sheet such that a first open end portion and a second open end portion are formed on opposite sides of the folded sheet and such that a first sheet edge and a second sheet edge extend from the first open end portion to the second open end portion. The method further comprises joining at least a part of the first sheet edge and the second sheet edge by means of a joining plate, such that the folded sheet and the

joining plate form a closed profile of the casing and securing the joining plate to the folded sheet by means of an interlocking structure.

[0009] The casing of the present disclosure is advantageous in that it provides protection of the electrode jelly roll assembly from the surroundings of the casing within the battery module. Furthermore, the casing provides protection for neighboring casings comprised in the battery module in the event of fault or failure, for example during a so-called ‘thermal runaway’ event, during which the electrode jelly roll assembly may swell and/or the internal chemical components (e.g. an electrolyte) of the electrode jelly roll assembly may produce gases, which may be heated as a result of exothermic processes.

[0010] The method for manufacturing the casing of the present disclosure is, as well, advantageous in that it enables casings of different dimensions to be manufactured while minimizing material waste. Furthermore, the use of a joining plate to form the casing of the present disclosure enables assembly work to be performed on the joining plate prior to its securing to the folded sheet resulting in less complex manufacturing process in contrast to casings formed from extruded materials. Furthermore, and in contrast to casings formed from an extruded material, the method for manufacturing the casing according to the present disclosure represents a cold manufacturing process. That is, the folded sheet, the joining plate and their joining together do not require heating of the material therefore reducing the energy required for manufacturing the casings, in turn reducing the cost of manufacturing of the casings. As such, the cold manufacturing process also reduces the risk of material degradation, i.e. the change in properties of the material forming the casing when subjected to increased temperatures. The cold manufacturing process of the present disclosure therefore yields a structurally strengthened product in that the material folded into the folded sheet and the material forming the joining plate conserve their properties throughout the manufacturing process, ensuring a product with greater material integrity.

[0011] It will be appreciated that the folded sheet provides the prismatic form (e.g. cuboidal) of the casing, elongating between the first open end portion and second open end portion it defines, i.e. elongating in a length direction of the folded sheet. The folded sheet may comprise four folds, extending between the open end portions, such that sections of the folded sheet adjacent to a fold are substantially perpendicular to one another. It will be appreciated that the radius of curvature of each fold of the folded sheet may be substantially similar. It will further be appreciated that the radius of curvature of each fold is dependent on the thickness of the sections of the folded sheet adjacent to each fold. For example, sections of the folded sheet having a thickness of 0.8 mm may be adjacent to a fold having a radius of curvature of 1 mm. It will be appreciated that the radius of curvature of each fold of the folded sheet is preferably as minimal as possible without subjecting the casing to a higher risk of cracking of the folds when in use. The first open end portion and the second open end portion defined by the folded sheet may be configured to receive a first end plate and a second end plate comprising respective terminals for the electrode jelly roll assembly contained in the casing.

[0012] The first sheet edge and the second sheet edge of the folded sheet may be parallel edges of the sheet used to form the folded sheet. That is, following the folding of the sheet to form the folded sheet, the first sheet edge and the second sheet edge may be positioned in a same plane, opposite one another and extending between the two open end portions. The first sheet edge and second sheet edge may further be separated by a distance along at least part of the elongation of the folded sheet for receiving the joining plate.

[0013] The joining plate may join the first sheet edge and the second sheet edge of the folded sheet such that it bridges the distance separating the sheet edges between the open end portions. It will be appreciated that the joining plate may enable the joining of the complete length of the first sheet edge and second sheet edge in a length direction of the folded sheet, thus forming a closed profile of the casing. As used herein, “closed profile of the casing” may be understood as the casing having a cross-sectional outline which is continuous. Alternatively, the joining plate may enable the

joining of part of the first sheet edge and part of the second sheet edge of the folding plate. In this case, the part of the length of the first sheet edge and the corresponding part of the length of the second sheet edge which are not joined by the joining plate along the length direction of the casing may be in contact with one another such that the closed profile of the casing is also formed.
[0014] As used herein, “joining” may be understood as the securing, or fix attachment, of the first and second sheet edges to the joining plate. That is, at least part of the first sheet edge and the second sheet edge may be structurally connected to one another via the joining plate.
[0015] This securing of the joining plate and at least part of the first and second sheet edges is ensured by the interlocking structure. As used herein, “interlocking structure” may be understood as mechanical structure composed interacting portions of the joining plate and at least part of the first and second sheet edges providing fix attachment of the joining plate and at least part of the first and second sheet edges. Furthermore, the interlocking structure provides an additional securing of the joining plate and at least part of the first and second sheet edges to the welding of the joining plate and at least part of the first and second sheet edges which will be detailed later in the description.
[0016] In some embodiments, the interlocking structure may be a tongue and groove structure. As used herein, “tongue and groove” may be understood as a mechanical attachment formed by a protrusion, or tongue, fitting into/onto a corresponding channel, or groove to form a joint. The tongue and groove structure may be formed by the first sheet edge and a first plate edge, and by the second sheet edge and a second plate edge, the first plate edge and the second plate edge forming part of the joining plate and extending at least partly between the first open end portion to the second open end portion. For example, the first and second sheet edges may embody grooves and the first and second plate edges may embody tongues correspondingly fitted together to form the tongue and groove structure. As such, the tongue and groove structure enables the first and second plate edges to be supported by the first and second sheet edges thus increasing the strength of the joints securing the folded sheet and the joining plate.
[0017] In some embodiments, a length of the tongue of the tongue and groove structure exceeds a depth of the groove of the tongue and groove structure. This difference in dimensions ensures that a top surface of the tongue, i.e. the top surface of the first plate edge and the top surface of the second plate edge, is in contact with a corresponding bottom surface of the groove, i.e. the bottom surface of the groove of the first sheet edge and the bottom surface of the groove of the second sheet edge. This difference in dimensions therefore provides a contact between the top and bottom surfaces of the first and second plate edges and first and second sheet edges suitable for welding of the joints formed between the folded sheet and the joining plate by the tongue and groove structure. It will be appreciated the difference between the length of the tongue and the depth of the groove discussed herein further permits a greater range of tolerance when dimensioning the folded sheet and joining plate during manufacturing.
[0018] Alternatively to the tongue and groove structure, the interlocking structure, in some embodiments, may be formed by beveling the first sheet edge and the first plate edge, and by beveling the second sheet edge and the second plate edge. For example, the first sheet edge and the first plate edge may be beveled, or slanted, such that the beveled first plate edge of the joining plate may be securely fitted onto the correspondingly beveled first sheet edge and such that the beveled second plate edge of the joining plate may be securely fitted onto the correspondingly beveled second sheet edge. It will be appreciated that the present example of interlocking structure also enables the first and second plate edges to be supported by the first and second sheet edges in turn increasing the strength of the joints securing the folded sheet and the joining plate.
[0019] In some embodiments, the first sheet edge and the first plate edge, and the second sheet edge and the second plate edge are respectively joined together by means of a weld. It will be appreciated that the welding of the folded sheet and the joining plate may be performed on the joint formed between the folded sheet and the joining plate by the interlocking structure. Such welding,

in combination with the interlocking structure, improves the structural strength of the casing by providing an additional securing of the joining plate and the folded sheet. It will further be appreciated that joining the joining plate together with the folded sheet by means of a weld provides a sealing effect to the enclosure formed by the casing and by the first and second end plates arranged at the first and second open ends of the casing. This sealing effect may in turn protect the electrode jelly roll assembly contained in the casing from the surroundings of the casing.

[0020] In some embodiments, the joining plate may further comprise a vent arranged between the first open end portion and the second open end portion of the casing. Such vent is configured to open, or rupture, in response to events of fault or failure of the cell comprising the casing, during which the electrode jelly roll assembly may swell and/or produce gases, such that gases or other ejecta may vented out of the casing.

[0021] In some embodiments, the vent may be integrally formed with the joining plate. That is, the vent may be formed into the material of the joining plate, for example by means of a stamping process. The vent may therefore be formed into the joining plate prior to, or after, its joining to the folded sheet during manufacturing. The vent being integrally formed with the joining plate is advantageous in that it reduces the number of components forming the casing, thus resulting in a less complex and less time-consuming manufacturing process.

[0022] Alternatively, the vent may be a component of the casing separate from the joining plate. To this end, in some embodiments the joining plate may comprise an aperture, arranged between the first open end portion and the second open end portion of the casing and the casing may comprise an engagement structure configured to secure a perimeter of the vent to a corresponding perimeter of the aperture of the joining plate. As used herein, “aperture” may be understood as an opening through the joining plate configured to receive the vent. As used herein, “perimeter” may be understood as an edge portion, or outer-most portion, of the vent and of the aperture of the joining plate, forming the outline of the vent and the outline of the aperture. The engagement structure may be characterized similarly as the interlocking structure, i.e. ensuring the securing of the perimeter of the vent and the perimeter of the aperture of the joining plate. For example, the engagement structure may be a tongue and groove structure or may be formed by beveling the perimeter of the vent and the perimeter of the aperture of the joining plate.

[0023] In some embodiments, the perimeter of the vent may be joined to the corresponding perimeter of the aperture of the joining plate by means of a weld. It will be appreciated that the welding of the perimeter of the vent together with the perimeter of the aperture may be performed on the joint formed between the perimeter of the vent and the perimeter of the aperture by the engagement structure, further securing the vent to the joining plate. It will further be appreciated such weld provides a sealing effect to the enclosure formed by the casing and by the first and second end plates arranged at the first and second open ends of the casing, allowing gases and ejecta to exit the casing only via the vent in the event of fault or failure. This sealing effect may in turn protect the electrode jelly roll assembly contained in the casing from the surroundings of the casing.

[0024] In some embodiments, the engagement structure may be configured to secure the perimeter of the vent to the corresponding perimeter of the aperture of the joining plate from within the casing. That is, the aperture of the joining plate may receive the vent on the surface of the joining plate facing the inside of the enclosure formed by the casing. Such configuration permits the vent to be supported by the joining plate, reducing the risk of rupture of the engagement structure and weld due to fatigue generated by the pressure differential between the inside of the casing in which the electrode jelly roll assembly is contained and the outside of the casing. It will be appreciated that the perimeter of the vent may be secured to the corresponding perimeter of the aperture of the joining plate prior to the securing to the joining plate and the folded sheet.

[0025] Alternatively, in some embodiments the engagement structure may be configured to secure

the perimeter of the vent to the corresponding perimeter of the aperture of the joining plate from outside the casing. That is, the aperture of the joining plate may receive the vent on the surface of the joining plate facing away from the enclosure formed by the casing, i.e. the surface of the joining plate exposed to the surroundings of the casing. It will be appreciated that the perimeter of the vent may be secured to the corresponding perimeter of the aperture of the joining plate prior to, or after the securing to the joining plate and the folded sheet.

[0026] In some embodiments, the folded sheet may be formed of a material selected from the list consisting of: aluminum, steel. Similarly, the joining plate may be formed of a material selected from the list consisting of: aluminum, steel. Preferably, the material forming the folded sheet and the joining plate may be the same, providing higher strength to the welds securing the joining plate and the folded sheet. For example, the folded sheet and the joining plate may be formed of 3 series aluminum, such as Al 3003, or 1 series aluminum, such as Al1050. Furthermore, the folded sheet and the joining plate may be formed of the same material but with different parameters. For example, the folded sheet may be formed of 3 series aluminum (e.g. Al 3003) and the joining plate may be formed of 1 series aluminum (e.g. Al1050).

[0027] It will be appreciated that the casing of the present disclosure improves the protection of the electrode jelly roll assembly it contains, thereby reducing the need for additional components fulfilling a function of protection of the electrode jelly roll assembly.

[0028] Hence, according to a third aspect, there is provided a battery cell comprising at least one electrode jelly roll assembly and a casing, according to first aspect, containing the at least one electrode jelly roll assembly. The battery cell further comprises a first end plate and a second end plate, arranged in the first open end portion and the second open end portion of the casing, wherein the first end plate comprises a first terminal and the second end plate comprises a second terminal of the battery cell.

[0029] Further objectives of, features of, and advantages with the present disclosure will become apparent when studying the following detailed description, the drawings, and the appended claims. Those skilled in the art will realize that different features of the present disclosure can be combined to create embodiments other than those described in the following.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0030] One or more embodiments will be described, by way of example only, and with reference to the following figures, in which:

[0031] FIG. **1***a* schematically illustrates an exploded view of a casing according to embodiments of the present disclosure;

[0032] FIG. **1***b* schematically illustrates a perspective view of an assembled casing according to embodiments of the present disclosure;

[0033] FIG. **2***a* schematically illustrates a cross sectional view of a casing according to embodiments of the present disclosure;

[0034] FIG. **2***b* schematically illustrates a cross sectional view of a casing according to embodiments of the present disclosure; and

[0035] FIG. **3** schematically illustrates a cross sectional view of a casing according to embodiments of the present disclosure.

DETAILED DESCRIPTION

[0036] The present disclosure is described in the following by way of a number of illustrative examples. It will be appreciated that these examples are provided for illustration and explanation only and are not intended to be limiting on the scope of the disclosure.

[0037] Furthermore, although the examples may be presented in the form of individual

embodiments, it will be recognized that the present disclosure also covers combinations of the embodiments described herein.

[0038] FIG. **1***a* schematically illustrates an exploded view of a casing **100** according to embodiments of the present disclosure. The casing **100** is shown comprising a folded sheet **110**, elongating between a first open end portion **113** and a second open end portion **114**, i.e. in a length direction L of the casing **100**. It will be appreciated that the folded sheet **110** provides a prismatic form to the casing **100**. The folded sheet **110** is further shown comprising a first sheet edge **111** and a second sheet edge **112** also extending between the first open end portion **113** and the second open end portion **114** along the length direction L of the folded sheet **110**. FIG. **1***a* depicts the folded sheet **110** having four folds such that the first sheet edge **111** and the second sheet edge **112** are positioned in the same plane, opposite one another. The casing **100** is further shown comprising a joining plate **120** configured to join the first sheet edge **111** and the second sheet edge **112**. The joining plate **120** comprises a first plate edge **121** and a second plate edge **122** extending between the first open end portion **113** and the second open end portion **114** along the length direction L of the casing **100**. It will be appreciated that the first sheet edge **111** and the first plate edge **121**, as well as the second sheet edge **112** and the second plate edge **122**, may form an interlocking structure (not visible in FIG. **1***a*) configured to secure the joining plate **120** to the folded sheet **110**. FIG. **1***a* further illustrates an aperture **123** arranged through the joining plate **120** and positioned between the first open end portion **113** and the second end portion **114**. The aperture **123** is configured to receive a vent **130** such that an engagement structure (not visible in FIG. **1***a*) is configured to secure a perimeter **131** of the vent **130** to a corresponding perimeter **124** of the aperture **123**. It will be appreciated that for the embodiment illustrated in FIG. **1***a* the vent **130** and the joining plate **120** are separate components forming part of the casing **100** and the aperture **123** is configured to receive the vent **130** on a surface of the joining plate **120** facing away from the enclosure of the casing **110**. That is, the perimeter **131** of the vent **130** may be secured to the corresponding perimeter **124** of the aperture **123** of the joining plate **120** from outside the casing **100**.

[0039] FIG. **1***b* schematically illustrates a perspective view of the assembled casing **100** shown in FIG. **1***a*. That is, the joining plate **130** and the folded sheet **110** are shown joined together to form a closed profile of the casing **100**. FIG. **1***b* further illustrates joints **125** formed by the interlocking structure (not visible in FIG. **1***b*) securing the first sheet edge and the first plate edge, and the second sheet edge and the second plate edge. Similarly, joint **135** is shown formed by the securing of the perimeter of the vent **130** to the corresponding perimeter of the aperture of the joining plate **120** by the engagement structure (not visible in FIG. **1***b*). It will be appreciated that the folded sheet **110** and the joining plate **130** may be further secured by applying a weld on the joints **125**. Similarly, it will be appreciated that the vent **130** and the aperture of the joining plate **120** may be further secured by applying a weld on the joint **135**.

[0040] FIG. **2***a* schematically illustrates a cross sectional view of a casing **201** according to embodiments of the present disclosure. It will be appreciated that FIG. **2***a* illustrates part of the cross-section of the casing **201**, more particularly the part of the cross-section of the casing **201** in which the joining plate **220** and vent **230** are visible. FIG. **2***a* therefore illustrates a folding sheet **210** comprising a first sheet edge **211** and a second sheet edge **212** joined together via the joining plate **220**. FIG. **2***a* further depicts a vent **230** integrally formed with the joining plate **220**. That is, the vent **230** is formed on the joining plate **220**, for example by means of a stamping process. The casing **201** further comprises an interlocking structure **250** configured to secure the joining plate **220** and the folded sheet **210**. The interlocking structure **250** is a tongue and groove structure formed by the first sheet edge **211** and a first plate edge **221**, and by the second sheet edge **212** and a second plate edge **222**, the first plate edge **221** and the second plate edge **222** forming part of the joining plate **220**. For illustrative purposes, FIG. **2***a* shows an enlarged view of the portion of interlocking structure **250** securing the first sheet edge **211** and the first plate edge **221**. It will be

appreciated that the following characterization of the interlocking structure **250** depicted in the enlargement shown in FIG. **2***a* also applies to portion of the interlocking structure **250** securing of the second sheet edge **212** and the second plate edge **222**. The enlarged portion of the interlocking structure **250** shows the first sheet edge **211** forming a groove **251**. The groove **251** may have a step-like structure configured to receive the tongue **252** formed by the first plate edge **221**. FIG. **2***a* therefore illustrates the tongue **252** fitted into the groove **251** to form the interlocking structure **250**. As such, the tongue and groove structure **250** enables the first plate edge **221** to be supported by the first sheet edge **211** thus increasing the strength of the securing of the folded sheet **210** and the joining plate **220**. Moreover, the enlarged portion of the interlocking structure **250** shows the length of the tongue **252**, along direction A, exceeding the depth of the groove **251** in the same direction. The difference between the length of the tongue **252** and the depth of the groove **251** ensures that the top surface **262** of the tongue **252** formed by the first plate edge **221** is in contact with the bottom surface **261** of the groove **251** formed by the first sheet edge **211**. The contact between the top surface **262** and the bottom surface **261** further enables the interlocking structure **250** to form a joint **225** along the first sheet edge **211** and the first plate edge **221**. It will be appreciated that, in addition the interlocking structure **250**, the folded sheet **210** and the joining plate **220** may be secured by applying a weld on the joint **225**. Still further, FIG. **2***a* illustrates a gap **270**, or space **270**, formed between the tongue **252** and the groove **251** as a result of the difference between the length of the tongue **252** and the depth of the groove **251**.

[0041] FIG. **2***b* schematically illustrates a cross sectional view of a casing **202** according to embodiments of the present disclosure. Similarly as illustrated in FIG. **2***a*, FIG. **2***b* shows the folding sheet **210** comprising a first sheet edge **211** and a second sheet edge **212** joined together via the joining plate **220**. FIG. **2***b* further depicts a vent **230** integrally formed with the joining plate **220**. Furthermore, FIG. **2***b* shows an alternative interlocking structure **280** to the tongue and groove interlocking structure **250** depicted in FIG. **2***a*. The interlocking structure **280** is formed by beveling of the first sheet edge **211** and the first plate edge **221** and by the beveling of the second sheet edge **212** and the second plate edge **222**. The first sheet edge **211** and the first plate edge **221** are therefore shown slanted wherein the beveled first plate edge **221** of the joining plate **220** is securely fitted onto the correspondingly beveled first sheet edge **211** and the beveled second plate edge **222** of the joining plate **220** is securely fitted onto the correspondingly beveled second sheet edge **212**. As such, the interlocking structure **280** enables the first and second plate edges **2221**, **222** to be supported by the first and second sheet edges **211**, **212** thus increasing the strength the securing of the folded sheet **210** and the joining plate **220**.

[0042] FIG. **3** schematically illustrates a cross sectional view of a casing **300** according to embodiments of the present disclosure. It will be appreciated that FIG. **3** illustrates part of the cross-section of the casing **300**, more particularly the part of the cross-section of the casing **300** in which the joining plate **320** and vent **330** are visible. As illustrated, the joining plate **320** comprises an aperture **323**, arranged through the joining plate **320**, configured to receive the vent **330**. It will be appreciated that for the embodiment illustrated in FIG. **3** the vent **330** and the joining plate **320** are separate components forming part of the casing **300** and the aperture **323** is configured to receive the vent **330** on the surface of a joining plate **320** facing the inside of the enclosure of the casing **300**. FIG. **3** further illustrates the engagement structure **350** securing a perimeter **331** of the vent **330** to a corresponding perimeter **324** of the aperture **323**. For illustrative purposes, FIG. **3** shows an enlarged view of the portion of engagement structure **350** securing the vent **330** and the joining plate **320**. It will be appreciated that the following characterization of the engagement structure **350** depicted in the enlargement shown in FIG. **3** applies to the entire perimeter **331** of the vent **330** and to the entire corresponding perimeter **324** of the aperture **323**. The enlarged portion of the engagement structure **350** is also shown forming a tongue and groove structure. That is, the perimeter **324** of the aperture **323** is shown forming a groove **352**. The groove **352** may have a step-like structure configured to receive the tongue **351** formed by the perimeter **331** of the vent

330. FIG. **3** therefore illustrates the tongue **351** fitted into the groove **352** to form the interlocking structure **350**. As such, the tongue and groove structure **350** enables the vent **330** to be supported by the joining plate **320** thus reducing the risk of rupture of the engagement structure **350** due to the force exerted on the vent **330** by the pressure differential between the inside of the casing **300**, in which the electrode jelly roll assembly is contained, and the outside of the casing **300**. Moreover, the enlarged portion of the interlocking structure **350** shows the length of the tongue **351**, along direction B, exceeding the depth of the groove **352** in the same direction. The difference between the length of the tongue **351** and the depth of the groove **352** ensures that the vent **330** may be properly received by/fitted into the aperture **323**. FIG. **3** further illustrates a gap **380**, or space **380**, formed between the tongue **351** and the groove **352** as a result of the difference between the length of the tongue **351** and the depth of the groove **352**. It will be appreciated that, in addition the interlocking structure **350**, the perimeter **324** of the aperture **323** of the joining plate **320** and the perimeter **331** of the vent **330** may be secured by applying a weld to bridge the gap **380**.

[0043] It will be appreciated that, although the above aspects are presented separately, they may be combined in any suitable manner such that a casing may benefit from all of the advantages provided by respective aspects of the present disclosure.

[0044] Furthermore, whilst the forgoing description and the appended drawings are provided as exemplary or preferred realizations of the disclosed aspects, it will be appreciated that the disclosed aspects need not be limited to the exact form shown and/or described.

Claims

1. A casing (**100**, **201**, **202**, **300**) adapted to contain at least one electrode jelly roll assembly, the casing comprises: a folded sheet (**110**, **210**, **310**), defining a first open end portion (**113**) and a second open end portion (**114**) arranged on opposite sides of the casing, wherein the folded sheet comprises a first sheet edge (**111**, **211**) and a second sheet edge (**112**, **212**), the first sheet edge and the second sheet edge extending from the first open end portion to the second open end portion; a joining plate (**120**, **220**, **320**) arranged to join at least a part of the first sheet edge and the second sheet edge, such that the folded sheet and the joining plate form a closed profile of the casing; and an interlocking structure (**250**) configured to secure the joining plate and the folded sheet.

2. The casing according to claim 1, wherein the interlocking structure is a tongue and groove structure formed by the first sheet edge and a first plate edge (**121**, **221**), and by the second sheet edge and a second plate edge (**122**, **222**), the first plate edge and the second plate edge forming part of the joining plate and extending at least partly between the first open end portion to the second open end portion.

3. The casing according to claim 2, wherein a length of a tongue of the tongue and groove structure exceeds a depth of a groove of the tongue and groove structure.

4. The casing according to claim 1, wherein the interlocking structure is formed by beveling the first sheet edge and the first plate edge, and the second sheet edge and the second plate edge.

5. The casing according to claim 1, wherein the joining plate further comprises a vent (**130**, **230**, **330**) arranged between the first open end portion and the second open end portion of the casing.

6. The casing according to claim 5, wherein the vent is integrally formed with the joining plate.

7. The casing according to claim 1, wherein the joining plate further comprises an aperture (**123**, **323**) arranged between the first open end portion and the second open end portion of the casing.

8. The casing according to claim 7, further comprising an engagement structure (**350**) configured to secure a perimeter (**131**, **331**) of the vent to a corresponding perimeter (**124**, **324**) of the aperture of the joining plate.

9. The casing according to claim 8, wherein the engagement structure is configured to secure the perimeter of the vent to the corresponding perimeter of the aperture of the joining plate from within the casing.

10. The casing according to claim 8, wherein the engagement structure is configured to secure the perimeter of the vent to the corresponding perimeter of the aperture of the joining plate from outside the casing.
11. The casing according to claim 2, wherein the first sheet edge and the first plate edge, and the second sheet edge and the second plate edge are respectively joined together by means of a weld.
12. The casing according to claim 9, wherein the perimeter of the vent is joined to the corresponding perimeter of the aperture of the joining plate by means of a weld.
13. The casing according to claim 1, wherein at least one of the folded sheet or the joining plate is formed of a material selected from the list consisting of: aluminum, steel.
14. A method for manufacturing the casing (**100**, **201**, **202**, **300**) according to claim 1, the method comprising the steps of: folding a sheet such that a first open end portion (**113**) and a second open end portion (**114**) are formed on opposite sides of the folded sheet and such that a first sheet edge (**111**, **211**) and a second sheet edge (**112**, **212**) extend from the first open end portion to the second open end portion; joining at least a part of the first sheet edge and the second sheet edge by means of a joining plate (**120**, **220**, **320**) such that the folded sheet and the joining plate form a closed profile of the casing; and securing the joining plate to the folded sheet by means of an interlocking structure (**250**).
15. The method according to claim 14, wherein the step of joining at least a part of the first sheet edge and the second sheet edge by means of a joining plate further comprises welding at least part of the first sheet edge to a first plate edge and welding at least part of the second sheet edge to a second plate edge, the first plate edge and the second plate edge forming part of the joining plate and extending at least partly between the first open end portion to the second open end portion.
16. A battery cell, comprising: at least one electrode jelly roll assembly; and a casing (**100**, **201**, **202**, **300**), according to claim 1, containing the at least one electrode jelly roll assembly and comprising a first end plate and a second end plate arranged in the first open end portion (**113**) and the second open end portion (**114**) of the casing; wherein the first end plate comprises a first terminal and the second end plate comprises a second terminal of the battery cell.