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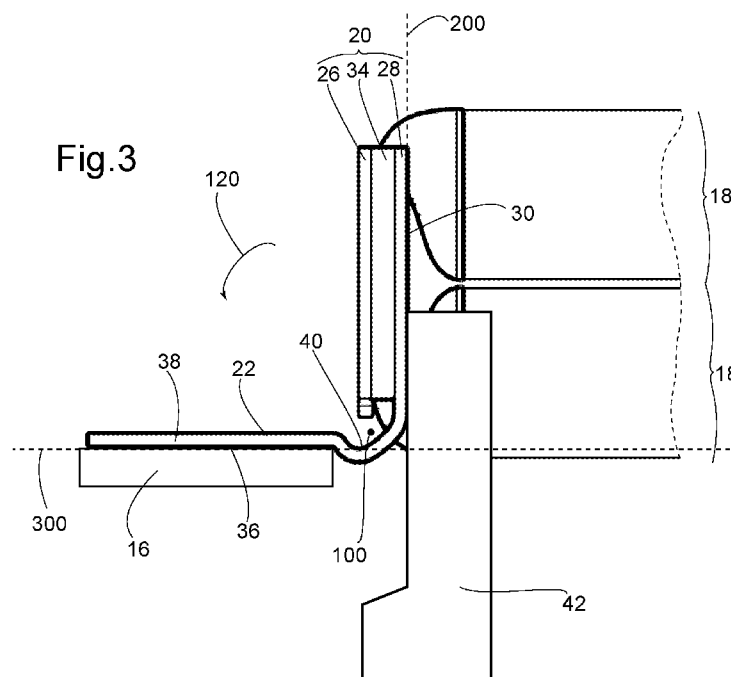
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(54) Title: FOLDABLE CURRENT COLLECTOR, BATTERY CELL SUBASSEMBLY AND METHOD OF ASSEMBLY



(57) Abstract: A current collector (12) for connecting two components (14, 16) of a battery cell, namely a set of electrode tabs (14) and a terminal foot (16), comprises a sheet metal piece having a first wing (20), a second wing (22) and at least one fold portion (24) linking the first wing (20) to the second wing (22). The first wing (20) has a first flat face (30) located in a first plane (200), the second wing (22) has a second flat face (36) located in a second plane (300), the fold portion (24) defines a fold axis (100) which is parallel to the first flat face (30) and to the second flat face (36), the first flat face (30) is oriented in a first rotation direction (110) about the fold axis (100) and the second flat face (36) is oriented in a second rotation direction (120) about the fold axis, opposed to the first rotation direction (110). The fold portion (24) is entirely located on one side of the first plane (200) oriented in the second rotation direction (120) and crosses the second plane twice (300).

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FOLDABLE CURRENT COLLECTOR, BATTERY CELL SUBASSEMBLY AND METHOD OF ASSEMBLY

TECHNICAL FIELD OF THE INVENTION

5 **[0001]** The present invention relates to a current collector that establishes an electrical connection between a terminal and a stack of electrodes of a battery cell, in particular a prismatic battery cell, and more specifically to a current collector which, during the manufacturing process of the battery cell, is folded from an assembly shape to a final shape.

10 BACKGROUND ART

15 **[0002]** A current collector for a battery cell subassembly of a prismatic battery cell is known from US2021384513A1. The current collector consists of an L-shaped piece of sheet metal having a first wing for welding the current collector to a set of tabs of the battery cell subassembly, a second wing for welding the current collector to a terminal foot of a terminal of the prismatic battery cell, and at least one fold portion linking the first wing to the second wing. The fold portion defines a fold axis which is parallel to a first flat face of the first wing and to a second flat face of the second wing. Initially, the first wing is at an initial angle of 90° relative to the second wing, in a position that facilitates the welding of a set of electrode tabs to the first wing and of a terminal foot to the second wing. The fold portion is subsequently plastically folded such that the first wing rotates relative to the second wing about the fold axis in the second rotation direction until the two wings become parallel. The initial cross-sectional shape of the fold portion is a quarter circle and becomes a semicircle at the end of the folding process. The distance between the two wings in the final position is equal to the diameter of the semicircle. The folding imposes significant plastic deformations and a high level of stress on the material. As the folding movement cannot go beyond this final position, the two wings tend to elastically spring back towards an intermediate position between the initial and final positions. It is therefore necessary to provide additional means to maintain the wings parallel to one another in their final position. The current collector is therefore mounted on a gasket, which is provided with a hook that maintains the two wings together in the folded position.

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[0003] There is a continuing trend towards increased energy density of prismatic battery cells, which involves increasing the compactness of all electrical connection components in order to maximise the space available for electrode stacks.

SUMMARY OF THE INVENTION

5 **[0004]** The invention aims to provide a design of the current collector that is more compact than the prior art, and easy to assemble.

[0005] According to a first aspect of the invention, there is provided a current collector for connecting two components of a battery cell, in particular a prismatic battery cell, the two components being a set of electrode tabs and a terminal foot, the
10 current collector comprising a sheet metal piece, the sheet metal piece having: a first wing for mechanically and electrically connecting the current collector to a first of the two components, a second wing for mechanically and electrically connecting the current collector to a second of the two components, and at least one fold portion linking the first wing to the second wing. The first wing has a first flat face located in a
15 first plane, the second wing has a second flat face located in a second plane, the fold portion defines a fold axis which is parallel to the first flat face and to the second flat face, the first flat face is oriented in a first rotation direction about the fold axis and the second flat face is oriented in a second rotation direction about the fold axis, opposed to the first rotation direction. The fold portion is entirely located on one side of the first
20 plane oriented in the second rotation direction and crosses the second plane twice.

[0006] The overall asymmetric shape of the fold portion has two simultaneous effects. Firstly, it enables reaching a final position in which the two parallel wings are closer together than twice the inner radius of curvature of the fold portion without overstressing the material of the sheet metal piece. Secondly, it allows the use of a
25 folding tool applied to the first flat face and unimpeded by the fold portion, so that a better control of the folding is achieved.

[0007] The current collector can be intended for either the positive or negative pole of the battery cell, and the metal used can vary. A positive electrode current collector is preferably made of aluminium, an aluminium alloy, or the like, while a

negative electrode current collector is preferably made of copper, a copper alloy, or the like.

[0008] The first flat face is preferably not used as such for connecting the first component but rather as a surface for applying a folding tool.

5 **[0009]** In a preferred embodiment, the fold portion extends in a direction parallel to the fold axis along one edge of the first flat face and along one edge of the second flat face.

[0010] In an embodiment, the first wing has a first connection portion for mechanically and electrically connecting the current collector to a first of the two
10 components and an intermediate portion, which links the first connection portion to the fold portion, the first flat face being formed on the intermediate portion. The first connection portion is preferably spaced apart from the intermediate portion and from the fold portion along the fold axis. The first connection portion can be spaced apart from the first plane on said one side of the first plane and connected to the intermediate
15 portion by a step. The first connection portion is preferably parallel to the first flat face. The first connection portion has a flat connection face for directly connecting the first of the two components, and this flat connection face can be oriented in the first rotation direction or in the second rotation direction.

[0011] The structure of the current collector assigns various portions of the
20 current collector to various functions: the connection portions are devoted to the connection with the set of electrode tabs and with the terminal foot, the first face to the application of a folding tool, and the fold portion to the plastic deformation.

[0012] Similarly, the second wing has a second connection portion for mechanically and electrically connecting the current collector to a second of the two
25 components.

[0013] The first connection portion is preferably allocated to the set of electrode tabs and the second connection portion to the terminal foot. As the terminal foot is a massive component, there is no need to assign different portions of the second wing assigned to the connection with the terminal foot and to the transmission of forces to

effect the plastic deformation of the fold portion. Hence, the second flat face, to which force is applied during the folding operation, can also be a connection face for welding or otherwise fixing the terminal foot. The second connection portion can be coplanar with the second flat face.

5 **[0014]** The second wing is preferably entirely located on one side of the second plane oriented in the first rotation direction. The first wing is preferably entirely located on said one side of the first plane oriented in the second rotation direction.

10 **[0015]** To facilitate plastic deformation, the fold portion may be divided in several parts. In one embodiment, the fold portion comprises at least a first fold portion and a second fold portion spaced apart from one another along the fold axis and separated by a hole.

15 **[0016]** The geometric features of the current collector discussed above can relate:

- to the current collector in an assembly shape, i.e. before the two components of the battery cell are connected to one another through the current collector and/or
- to the current collector in a final assembled shape, in which the two components of the battery cell are each connected to the current collector.

20 **[0017]** In one embodiment, the current collector is in an assembly shape in which the first wing is at an initial angle relative to the second wing, and the fold portion is plastically foldable such as to allow the first wing to rotate relative to the second wing about the fold axis in the second rotation direction to a final shape of the current collector, in which the first flat face and the second flat face are parallel or substantially parallel to one another and face away from one another. The initial angle is preferably

25 in the range of 60° to 120°, preferably in the range of 80° to 100°, preferably 90° or substantially 90°.

[0018] In one embodiment, the current collector is in a final shape in which the first flat face and the second flat face are parallel to one another and face away from one

another and the fold portion is plastically folded. The fold portion has a concave side, which faces a gap between the first wing and the second wing. To avoid excessive stress, the concave side of the fold portion has a radius of curvature, measured in a plane perpendicular to the fold axis at any point of the concave side, which is preferably greater than 2 mm.

[0019] According to another aspect of the invention, there is provided a battery cell subassembly comprising a stack of electrodes provided with a set of electrode tabs, a terminal provided with a terminal foot, and the current collector described above connecting two components of the battery cell subassembly, namely the set of electrode tabs and the terminal foot, wherein the first wing of the current collector is directly connected to a first of the two components and the second wing is directly connected to a second of the two components.

[0020] The stack of electrodes comprises multiple layers of cathodes, separators, and anodes, and the set of electrode tabs are protruding portions of either the cathodes or the anodes. The first wing is preferably connected to the set of electrode tabs and while the second wing is connected to the terminal foot.

[0021] In all the specification, the terminal foot can be an integral part or region of a one-piece terminal or one part of a terminal made of several parts.

[0022] In one embodiment, the first of the two components is welded to the first wing. In one embodiment, the second of the two components is welded to the second wing.

[0023] According to another aspect of the invention, there is provided a method of manufacturing the battery cell subassembly defined above, comprising:

- providing the current collector described above in the assembly shape;
- connecting the first of the two components of the battery cell subassembly to the first wing;
- connecting the second of the two components of the battery cell subassembly to the second wing; and

- subsequently plastically folding the fold portion such as to rotate the first wing relative to the second wing about the fold axis in the second rotation direction to a final shape of the current collector, in which the first flat face and the second flat face are parallel to one another and face away from one another.

[0024] The step of connecting the first component of the battery cell subassembly to the first wing may include welding the first component to the first wing. Similarly, the step of connecting the second component to the second wing of the current collector may include welding the second component to the second wing.

10 **[0025]** To avoid excessive stress, the step of folding is carried out such that the final shape of the current collector, the fold portion has a concave side, which faces a gap between the first wing and the second wing, and the concave side of the fold portion has a radius of curvature, measured in a plane perpendicular to the fold axis at any point of the concave side, which is greater than 2 mm.

15 **[0026]** In one embodiment, plastically folding the fold portion includes applying a folding force to the first flat face in the second rotation direction with a flat tool.

[0027] In one embodiment, the flat tool rotates about an instantaneous axis of rotation parallel to the fold axis from an initial position, in which the flat tool is applied to the first flat face in the assembly shape, to a final position, in which the flat tool is applied to the first flat face in the final shape. The instantaneous axis of rotation can be spaced apart from the fold axis and is not necessarily fixed relative to the fold axis.

[0028] Before plastically folding the fold portion, the flat tool is moved from a retracted position to the initial position. In the retracted position, the flat tool is preferably located on one side of the second plane opposed to the second wing.

25 **[0029]** In a preferred embodiment, the flat tool has a contact area with the first flat face, which extends in the direct vicinity of the fold portion, to ensure better control of the folding operation. The flat tool in the initial position preferably extends on both sides of the second plane.

[0030] If necessary, and to achieve better control of the plastic deformation of the fold portion, the method may comprise applying a cylindrical guide onto a concave side of the fold portion during folding of the fold portion, the concave side of the fold portion being opposed to the first flat face and second flat face.

5 **[0031]** According to another aspect of the invention, there is provided a method of manufacturing a current collector for connecting two components of a battery cell, the two components being a set of electrode tabs and a terminal foot, the method being preferably suitable for manufacturing the current collector of the first aspect of the invention, the method comprising:

- 10 - providing a sheet metal piece having a first wing to be connected to a first of the two components, a second wing to be connected to a second of the two components and at least one fold portion linking the first wing to the second wing, wherein the first wing has a first flat face located in a first plane, the second wing has a second flat face located in a second plane,
- 15 the fold portion defines a fold axis which is parallel to the first flat face and to the second flat face, the first flat face faces a first rotation direction about the fold axis and the second flat face faces a second rotation direction about the fold axis, opposed to the first rotation direction, and
- 20 - shaping the sheet metal piece into an assembly shape such that the fold portion forms at least one fold portion that is entirely located on said one side of the first plane and crosses the second plane twice.

BRIEF DESCRIPTION OF THE FIGURES

[0032] Other advantages and features of the invention will then become more clearly apparent from the following description of a specific embodiments of the invention given as non-restrictive examples only and represented in the accompanying drawings in which:

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- Figure 1 is a partial schematic isometric view of a battery cell subassembly according to one embodiment of the invention in an assembly position;

- Figure 2 is a schematic side view of the battery cell subassembly of Figure 1, before a set of electrode tabs is welded to a current collector;
- Figure 3 is a schematic side view of an initial stage of a folding operation during which a current collector of the battery cell subassembly of Figure 1 is folded from the assembly shape into a final shape;
- Figure 4 is a schematic side view of a final stage of the folding operation initiated in Figure 3, during which the current collector of Figure 1 is folded from the assembly shape into a final shape.

[0033] Corresponding reference numerals refer to the same or corresponding parts in each of the Figures.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0034] With reference to Figure 1, a battery cell subassembly 10 for a prismatic battery cell, comprises a current collector 12 and two components, namely a set of electrode tabs 14 and a terminal foot 16, which are electrically connected to each other through the current collector 12. The set of electrode tabs 14 can include one or two subsets 140 of electrode tabs, each of which can be bent as illustrated in Figure 2, or not. The set electrode tabs 14 protrudes from one or two stacks of electrodes 18. As is well known in the art, each stack of electrodes 18 includes multiple layers of cathodes, separators, and anodes. The set of electrode tabs 14 are protruding portions of either the cathodes or the anodes and have all the same polarity.

[0035] The current collector 12 consists of a sheet metal piece, with a first wing 20, a second wing 22 and at least one fold portion 24 linking the first wing 20 to the second wing 22 along a fold axis 100, which is a reference axis of the current collector and of the battery cell assembly.

[0036] The first wing 20 includes a first connection portion 26 for mechanically and electrically connecting the current collector 12 to a first of the two components, namely a set of electrode tabs, and an intermediate portion 28 connecting the first connection portion 26 to the fold portion 24. The intermediate portion 28 is directly adjacent to the fold portion 24 along the fold axis 100 and has a flat face 30 that faces

a first rotation direction **110** about the fold axis **100** and is located in a first plane **200** parallel to the fold axis **100**. The first connection portion **26** has a flat connection face **32**, which, in this embodiment, is oriented in the first rotation direction **110** and is preferably recessed relative to the first flat face **30** of the intermediate portion **28**. The distance between the flat connection face **32** and the first plane **200** is preferably greater than the thickness of the sheet metal piece that constitutes the current collector **12**. A step **34**, which extends in plane perpendicular to the fold axis **100**, connects the intermediate portion **28** to the first connection portion **26**.

[0037] In Figure 2, the set of electrode tabs **14** has been illustrated at some distance from the flat connection face **32** of the connection portion **26**, before it has been welded or otherwise fixed to the flat connection face **32** of the connection portion **26**.

[0038] The second wing **22** is directly adjacent to the fold portion **24** and extends along the fold axis **100**. The second wing **22** has a second flat face **36**, which is located in a second plane **300** parallel to the fold axis **100** and faces a second rotation direction **120** about the fold axis **100**, opposed to the first rotation direction **110**. The second wing **22** forms a second connection portion of the current collector **12**, and the second flat face **36** constitutes a second connection face to which the terminal foot **16** is directly welded or otherwise directly fixed.

[0039] In the assembly state illustrated in Figures 1 and 2, the first wing **20** is at an angle of 90° relative to the second wing **22** (i.e. the first plane **200** is perpendicular to the second plane **300**), giving direct access to an upper face **38** of the second wing **22** opposed to the second flat face **36**. As a result, a tool or device for fixing the terminal foot **16** to the second wing **22**, e.g. a laser welding head, can easily access the upper face **38** to weld or otherwise fix the terminal foot **16** to the second wing **22** through the thickness of the second wing **22**.

[0040] In the state of Figures 1 and 2, the first wing **20** and the second wing **22** are preferably entirely located on one side of the first plane **200**, which is oriented in the second rotation direction **110**. The first wing **20** and the second wing **22** are preferably entirely located on one side of the second plane **300**, which is oriented in the first direction.

[0041] As best illustrated in Figure 2, the fold portion 24, viewed in cross-section, is asymmetrical. More specifically, the fold portion 24 is entirely located on one side of the first plane 200 but crosses the second plane 300 twice. The fold portion 24, viewed in cross-section, may consist of a series of arcs of circles or a series of arcs of circles and of straight portions. The fold portion 24, viewed in cross-section, has a concave side 40 with a radius of curvature greater than 2 mm at any point of the concave side 40.

[0042] Thanks to this asymmetrical shape, it is easy, once the set of electrode tabs 14 and the terminal foot 16 have been attached to the current collector 12, to move the intermediate portion 28 of the first wing 20 close to the second wing 22 without overstressing the material of the current collector 12.

[0043] To this end, a flat tool 42 is applied to the first flat face 32 of the intermediate portion 28 of the first wing 20 in the initial assembly state of Figure 3, with a contact area that extends to the boundary with the fold portion 24, as shown in Figure 3. The flat tool 42 is pivoted in the second rotation direction 120 about an instantaneous axis of rotation, which is parallel to the fold axis 100 and preferably spaced apart from the fold axis 100, until a final state of the battery cell subassembly 10 is reached, in which the current collector 12 is plastically deformed to a final shape (see Figure 4). In Figures 3 and 4, the set of electrode tabs 14 and the stack(s) of electrodes 18 have been omitted. The flat tool 42 is not to scale with the battery cell subassembly 10.

[0044] In this final state, the intermediate portion 28 of the first wing 20 is parallel or substantially parallel to the second wing 22 and the radius of curvature at any point of the concave side 40 of the fold portion, measured in a plane perpendicular to the fold axis, is still greater than 2 mm.

[0045] During the folding operation, the fold portion 24 of the current collector 12 is plastically deformed. The pressure is applied by the flat tool 42 to an area of the first flat face 30 in the direct vicinity of the fold portion 24, such that the deformation of the fold portion 24 is precisely controlled.

[0046] Optionally, the fold portion can be provided with a hole **44** which separates a first portion of the fold portion and a second portion of the fold portion along the fold axis.

[0047] As an alternative, the flat connection face **32** of the connection portion **26**
5 of the first wing **20** can be oriented in the second rotation direction **120**, the first wing **20** can be flat, without the step **34**.

CLAIMS

1. A current collector (12) for connecting two components (14, 16) of a battery cell, the two components (14, 16) being a set of electrode tabs (14) and a terminal foot
5 (16), the current collector (12) consisting of a sheet metal piece, the sheet metal piece having:

- a first wing (20) provided for mechanically and electrically connecting the current collector (12) to a first of the two components (14, 16),

10 - a second wing (22) provided with a second connection portion for mechanically and electrically connecting the current collector (12) to a second of the two components (14, 16), and

- at least one fold portion (24) linking the first wing (20) to the second wing (22),

15 wherein the first wing (20) has a first flat face (30) located in a first plane (200), the second wing (22) has a second flat face (36) located in a second plane (300), the fold portion (24) defines a fold axis (100) which is parallel to the first flat face (30) and to the second flat face (36), the first flat face (30) is oriented in a first rotation direction (110) about the fold axis (100) and the second flat face (36) is oriented in a second rotation direction (120) about the fold axis, opposed to the first rotation direction (110),

20 characterised in that the fold portion (24) is entirely located on one side of the first plane (200) oriented in the second rotation direction (120) and crosses the second plane twice (300).

2. The current collector (12) of claim 1, wherein the first wing (20) has a first connection portion (26) for mechanically and electrically connecting the current
25 collector (12) to a first of the two components (14, 16) and an intermediate portion (28), which links the first connection portion (26) to the fold portion (24), the first flat face (30) being formed on the intermediate portion (28).

3. The current collector (12) of claim 2, wherein:

- the first connection portion (26) is spaced apart from the intermediate portion (28) and from the fold portion (24) along the fold axis; and/or
 - the first connection portion (26) is spaced apart from the first plane (200) on said one side of the first plane (200) and connected to the intermediate portion (28) by a step (34); and/or
 - the first connection portion (26) is parallel to the first flat face (30); and/or
 - the first connection portion (26) has a flat connection face (32) that is oriented in the first rotation direction or in the second rotation direction.
4. The current collector (12) of any one of the preceding claims, wherein
- the second wing (22) is entirely located on one side of the second plane (300) oriented in the first rotation direction (110); and/or
 - the first wing (20) is entirely located on said one side of the first plane (200) oriented in the second rotation direction (120).
5. The current collector (12) of any one of the preceding claims, wherein the fold portion (24) comprises at least a first fold portion and a second fold portion spaced apart from one another along the fold axis and separated by a hole (44).
6. The current collector (12) of any one of claims 1 to 5, wherein the current collector (12) is in an assembly shape in which the first wing (20) is at an initial angle relative to the second wing (22), and the fold portion (24) is plastically foldable such as to allow the first wing (20) to rotate relative to the second wing (22) about the fold axis (100) in the second rotation direction (120) to a final shape of the current collector (12), in which the first flat face (30) and the second flat face (36) are parallel or substantially parallel to one another and face away from one another.
7. The current collector (12) of any one of claims 1 to 5, wherein the current collector (12) is in a final shape in which the first flat face (30) and the second flat

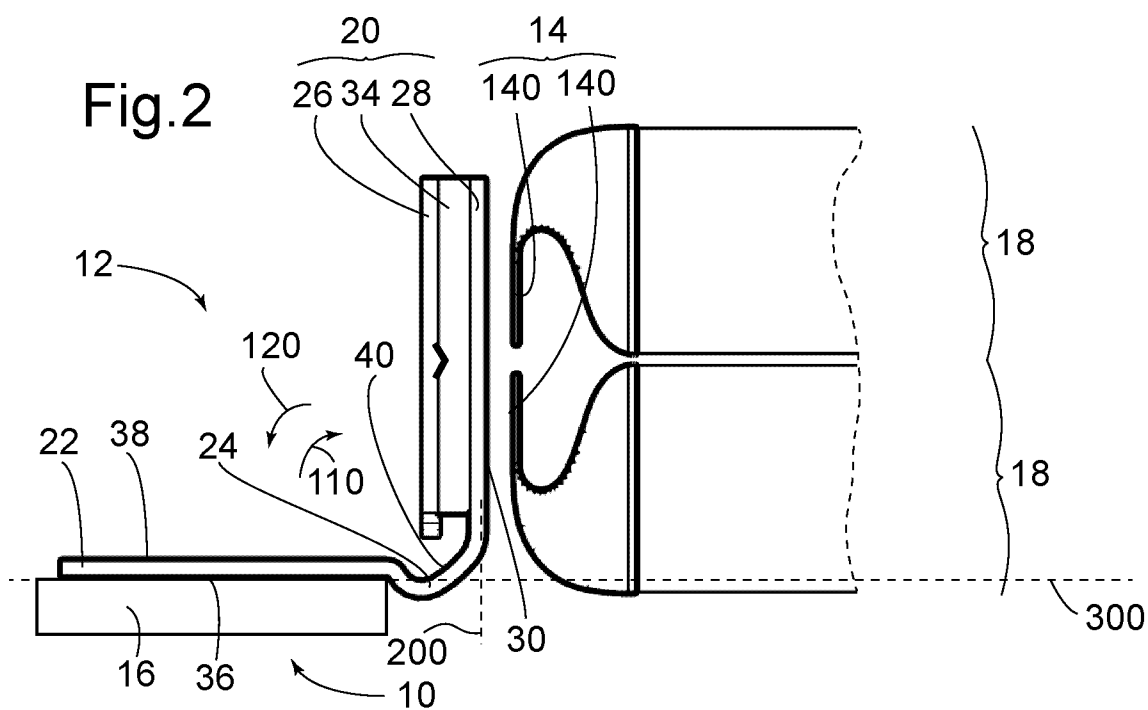
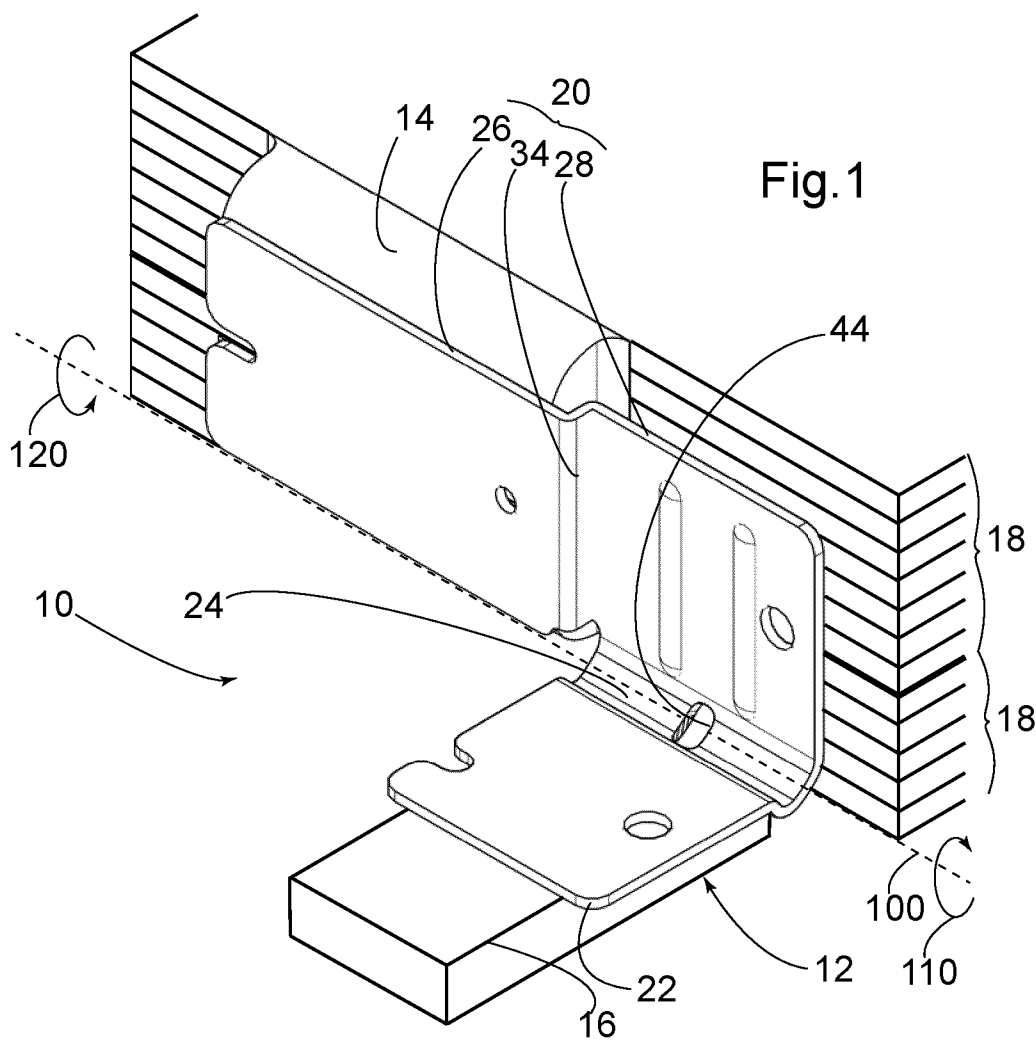
face (36) are parallel to one another and face away from one another and the fold portion (24) is plastically folded.

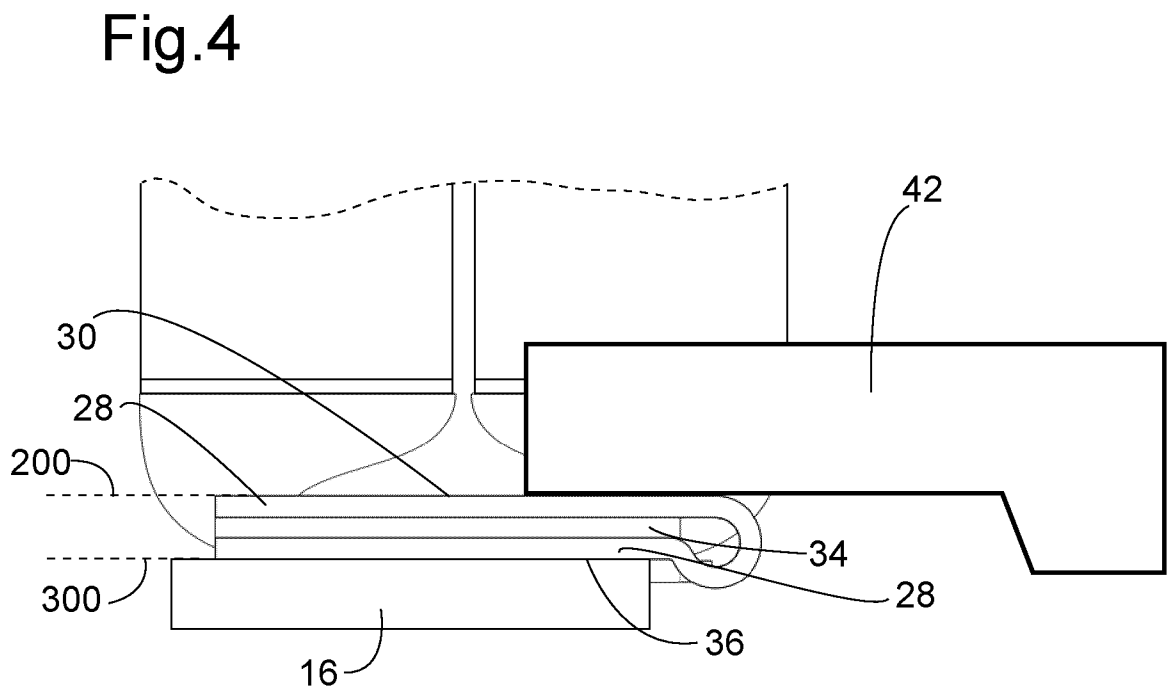
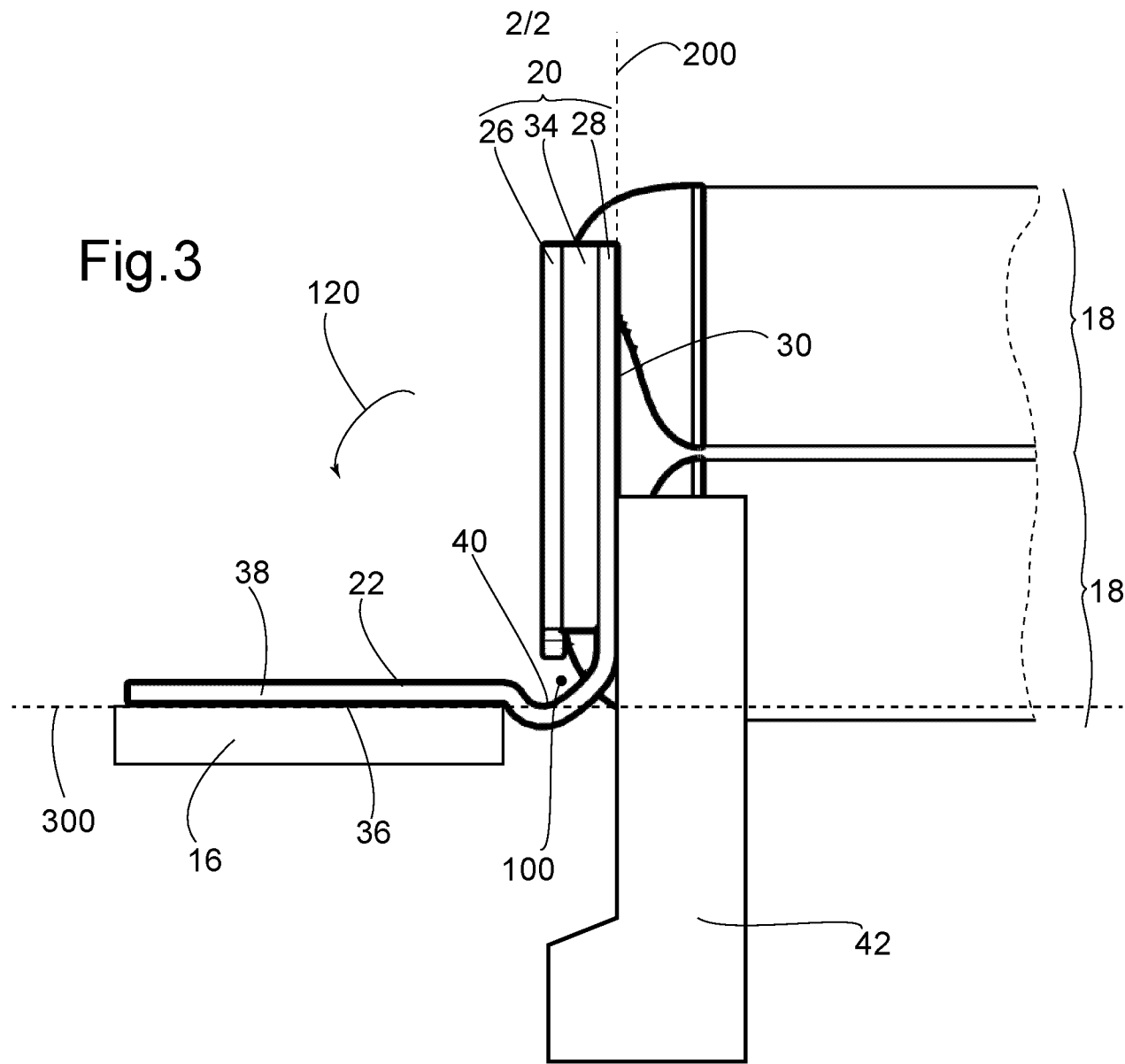
8. The current collector (12) of claim 7, wherein the fold portion (24) has a concave side (40), which faces a gap between the first wing (20) and the second wing (22), and the concave side (40) of the fold portion (24) has a radius of curvature, measured in a plane perpendicular to the fold axis at any point of the concave side (40), which is greater than 2 mm.
9. A battery cell subassembly (10), comprising a stack of electrodes (18) provided with a set of electrode tabs (14), a terminal provided with a terminal foot (16), and the current collector (12) of any one of the preceding claims connecting two components (14, 16) of the battery cell subassembly, namely the set of electrode tabs (14) and the terminal foot (16), wherein the first wing (20) is directly connected to a first of the two components (14, 16) and the second wing (22) is directly connected to a second of the two components (14, 16).
10. A method of manufacturing the battery cell subassembly (10) of claim 9, comprising:
- providing the current collector (12) of claim 6;
 - connecting the first of the two components (14, 16) of the battery cell subassembly (10) to the first wing (20);
 - connecting the second of the two components (14, 16) of the battery cell subassembly (10) to the second wing (22); and
 - subsequently plastically folding the fold portion (24) such as to rotate the first wing (20) relative to the second wing (22) about the fold axis (100) in the second rotation direction (120) to a final shape of the current collector (12), in which the first flat face (30) and the second flat face (36) are parallel to one another and face away from one another.
11. The method of claim 10, wherein in the final shape of the current collector (12), the fold portion (24) has a concave side, which faces a gap between the first wing

(20) and the second wing (22), and the concave side (40) of the fold portion (24) has a radius of curvature, measured in a plane perpendicular to the fold axis (100) at any point of the concave side, which is greater than 2 mm.

- 5 12. The method of any one of claims 10 to 11, wherein plastically folding the fold portion (24) includes applying a folding force to the first flat face (30) in the second rotation direction (120) with a flat tool (42).
- 10 13. The method of claim 12, wherein the flat tool (42) rotates about an instantaneous axis of rotation parallel to the fold axis (100) from an initial position, in which the flat tool (42) is applied to the first flat face (30) in the assembly shape, to a final position, in which the flat tool (42) is applied to the first flat face in the final shape.
14. The method of claim 13, wherein
- before plastically folding the fold portion, the flat tool (42) is moved from a retracted position to the initial position, and the flat tool (42) in the retracted position is located on one side of the second plane (300) opposed to the second wing (22); and/or
 - the flat tool (42) in the initial position extends on both sides of the second plane (300).
- 15 15. The method of any one of claims 12 to 14, wherein the flat tool (42) has a contact area with the first flat face (30), which extends in the direct vicinity of the fold portion (24).
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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER INV. H01M50/528 H01M50/533 H01M50/54 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01M Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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X	FR 3 125 172 A1 (ACCUMULATEURS FIXES [FR]) 13 January 2023 (2023-01-13) paragraph [0039] paragraph [0041] paragraph [0044] paragraph [0047] - paragraph [0051] paragraph [0056] - paragraph [0057] paragraph [0059] - paragraph [0062] figures 1-10 -----	1 - 15
A	WO 2018/126439 A1 (CONTEMPORARY AMPEREX TECHNOLOGY CO LTD [CN]) 12 July 2018 (2018-07-12) figures 1-32 paragraph [0130] paragraph [0142] - paragraph [0143] ----- - / - -	1 - 15
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 10 October 2024		Date of mailing of the international search report 31/10/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Bossa, Christina

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2024/069687

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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