

**TITLE OF INVENTION: BATTERY MODULE AND METHOD FOR MANUFACTURING**

**BATTERY MODULE**

**TECHNICAL FIELD**

[0001] The present disclosure relates to a battery module and a method for manufacturing a battery module, and more particular, to a battery module having an improved structure for a cooling performance, and a method for manufacturing a battery module.

**BACKGROUND**

[0002] A battery module including a plurality of cells generates heat in a process of using it. Heat generated in the battery module badly influences a safety and a performance of the battery module, and thus it is general to provide units for cooling the battery module together.

[0003] According to a conventional technology, as a scheme for cooling the battery module, a scheme of transferring thermal energy of the battery module to a cooling fluid through exchange of heat between the cooling fluid and the battery module is widely used. As an example, a scheme of indirectly cooling the cells in the battery module is used by recovering thermal energy from a housing while a cooling fluid flows around the housing of the battery module.

[0004] However, according to the conventional technology,

because the cooling fluid and the cells do not directly exchange heat, a cooling efficiency of the cells that directly generate heat in the battery cell is degraded.

[0005] In addition, according to the conventional technology, because the cooling efficiency of the cells in the battery module is degraded, a size of the usable battery module is restricted.

#### **SUMMARY**

[0006] The present disclosure has been made to solve the above-mentioned problems occurring in the prior art while advantages achieved by the prior art are maintained intact.

[0007] An aspect of the present disclosure is to provide a battery module having a structure, in which a cooling fluid may directly exchange heat with cells.

[0008] Another aspect of the present disclosure is to make a size of a battery module large by enhancing a capacity of cells that may be mounted in a battery module.

[0009] The technical problems to be solved by the present disclosure are not limited to the aforementioned problems, and any other technical problems not mentioned herein will be clearly understood from the following description by those skilled in the art to which the present disclosure pertains.

[0010] According to an aspect of the present disclosure, a battery module includes a cell assembly including a plurality

of cells stacked in an upward/downward direction "H", a lower cover that faces a lower surface of the cell assembly and that presses the lower surface of the cell assembly upwards, an upper cover that faces an upper surface of the cell assembly and that presses the upper surface of the cell assembly downwards, a housing accommodating the cell assembly, the lower cover, and the upper cover, an introduction cover coupled to one side of the housing and through which a cooling fluid is introduced into an interior of the housing, and a discharge member coupled to one side of the housing and through which the cooling fluid is discharged from the interior of the housing.

**[0011]** The housing may include a lower housing, an upper area of which is opened, and in which an interior space accommodating the cell assembly, the lower cover, and the upper cover is formed, and an upper housing coupled to the upper area of the lower housing and that closes the interior space from an outside.

**[0012]** The cell assembly may include a first cell assembly, and a second cell assembly provided on one side of the first assembly in a leftward/rightward direction "W", and the battery module may further include a panel member inserted between the first cell assembly and the second cell assembly.

**[0013]** A groove having a shape recessed in the leftward/rightward direction "W" may be formed in an end area of the panel member in a forward/rearward direction "F".

**[0014]** A circumference of the groove may have a shape surrounded by the panel member.

**[0015]** The battery module may further include one or more bar members, lower ends of which are coupled to the lower cover and upper ends of which are coupled to the upper cover.

**[0016]** The bar members may be provided in a front area and a rear area of the cell assembly, respectively, to face opposite ends of the cell assembly in the forward/rearward direction "F".

**[0017]** The lower cover may include a lower cover body defining a body of the lower cover, and a lower coupling area protruding upwards from the lower cover body and coupled to the bar members.

**[0018]** The upper cover may include an upper cover body defining a body of the upper cover, and an upper coupling area protruding downwards from the upper cover body and coupled to the bar members.

**[0019]** Each of the cells may include a cell body, a front cell lead protruding forwards from the cell body, and a front sensing assembly provided on a front side of the cell assembly and joined to the front cell lead.

**[0020]** Each of the cells may further include a rear cell lead protruding rearwards from the cell body, and the battery module may further include a rear sensing assembly provided on a rear side of the cell assembly and joined to the rear cell lead.

**[0021]** The battery module may further include a wire assembly provided in the housing, one side of which is coupled to an upper surface of the upper cover, and an opposite side of which is electrically connected to the cell assembly.

**[0022]** The battery module may further include a connection bus bar electrically connecting the plurality of cells provided in the cell assembly, the connection bus bar may be provided on a front side or a rear side of the cell assembly.

**[0023]** The introduction member and the discharge member may be provided separately from the housing.

**[0024]** The introduction member and the discharge member may be coupled to a front surface of the housing.

**[0025]** According to an aspect of the present disclosure, a method for manufacturing a battery module includes a cell assembly preparing operation of preparing a first cell assembly and a second cell assembly each having a structure, in which a plurality of cells are stacked, a first disposition operation of disposing the second cell assembly on one side of the first cell assembly and disposing a panel member in a space between the first cell assembly and the second cell assembly, a support bar coupling operation of coupling a support bar having a bar shape to the panel member, a second disposition operation of disposing a sensing assembly on one side of a cell lead provided in the cell, a pressing operation of pressing the cell lead and the sensing assembly with a pressing jig while the

cell lead and the sensing assembly are disposed between the pressing jig and the support bar, and a welding operation of welding the cell lead and the sensing assembly.

[0026] A groove having a recessed shape may be formed in the panel member, and in the support bar coupling operation, the support bar may be inserted into the groove.

[0027] In the first disposition operation, the second cell assembly may be disposed on one side of the first cell assembly in a leftward/rightward direction "W", and in the support bar coupling operation, the support bar may be coupled to the panel member to extend in the leftward/rightward direction "W".

[0028] In the support bar coupling operation, a first support bar may be coupled to one side of the panel member in the leftward/rightward direction "W", and a second support bar may be coupled to an opposite side of the panel member in the leftward/rightward direction "W".

[0029] The method may further include a jig removing operation of spacing the pressing jig apart from the cell assembly, and a support bar removing operation of removing the support bar from the panel member.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0030] The above and other objects, features and advantages of the present disclosure will be more apparent from the following detailed description taken in conjunction with the accompanying

drawings:

[0031] FIG. 1 is a perspective view illustrating a battery module according to the present disclosure;

[0032] FIG. 2 is an exploded perspective view illustrating a battery module according to the present disclosure;

[0033] FIG. 3 is a perspective view illustrating a sub assembly provided in a housing of a battery module according to the present disclosure;

[0034] FIG. 4 is an exploded perspective view illustrating a sub assembly provided in a housing of a battery module according to the present disclosure;

[0035] FIG. 5 is an enlarged view illustrating a front area of FIG. 4;

[0036] FIG. 6 is a view schematically illustrating a state, in which a support bar is supported in a method for manufacturing a battery module according to the present disclosure; and

[0037] FIG. 7 is a cross-sectional view schematically illustrating relative locations of a support bar, a pressing jig, a cell lead, and a sensing assembly in a pressing operation of a method for manufacturing a battery module according to the present disclosure.

#### **DETAILED DESCRIPTION**

[0038] Hereinafter, a battery module and a method for manufacturing a battery module according to the present

disclosure will be described with reference to the drawings.

**[0039]** Battery Module

**[0040]** FIG. 1 is a perspective view illustrating a battery module according to the present disclosure, and FIG. 2 is an exploded perspective view illustrating the battery module according to the present disclosure. FIG. 3 is a perspective view illustrating a sub assembly provided in a housing of the battery module according to the present disclosure, and FIG. 4 is an exploded perspective view illustrating the sub assembly provided in the housing of the battery module according to the present disclosure. FIG. 5 is an enlarged view illustrating a front area of FIG. 4.

**[0041]** Referring to FIGS. 1 to 5, a battery module 10 according to the present disclosure may include a cell assembly 100 including a plurality of cells 110 that are stacked in an upward/downward direction "H". The cells 110 provided in the cell assembly 100 may be angular cells, but the present disclosure is not limited thereto and the cells may be pouch cells.

**[0042]** Each of the cells 110 provided in the cell assembly 100 may include a cell body 112 that defines a body of the cell 110, a front cell lead 114 that protrudes forwards from the cell body 112, and a rear cell lead 116 that protrudes rearwards from the cell body 112. The front cell lead 114 and the rear cell lead 116 may be a configuration for electrically



connecting the cell 110 to an outside.

**[0043]** A plurality of cell assemblies may be provided in the battery module 10. For example, as illustrated in FIG. 4 and the like, the cell assembly 100 may include a first cell assembly 110a, and a second cell assembly 110b that is provided on one side of the first cell assembly 100a. As described above, another configuration may be inserted between the first cell assembly 100a and the second cell assembly 100b, and to achieve this, a specific gap may be formed between the first cell assembly 100a and the second cell assembly 100b.

**[0044]** Meanwhile, the battery module 10 may further include a lower cover 150 that is configured to face a lower surface of the cell assembly 100 and is configured to press the lower surface of the cell assembly 100 upwards, and an upper cover 200 that is configured to face an upper surface of the cell assembly 100 and is configured to press the upper surface of the cell assembly 100 downwards. The lower cover 150 and the upper cover 200 may be configurations for preventing the cells 110 from swollen, by pressing the cell assembly 100.

**[0045]** Referring to FIG. 1 again, the battery module 10 may further include a housing 250 that accommodates the cell assembly 100, the lower cover 150, and the upper cover 200. The housing 250 may be a configuration for preventing foreign substances, except for a cooling fluid that will be described below, from being introduced into an interior, by closing the

interior space from the outside.

**[0046]** As an example, the housing 250 may include a lower housing 252, an upper area of which is opened, and in which an interior space accommodating the cell assembly 100, the lower cover 150, and the upper cover 250 is formed, and an upper housing 254 coupled to the upper area of the lower housing 252 and configured to close the interior space from an outside. To secure a sealing performance of the housing 150, the lower housing 252 and the upper housing 254 may be welded to each other, and may be coupled in an assembling scheme after a gasket is disposed between the lower housing 252 and the upper housing 254.

**[0047]** The cell assembly 100 provided in the battery module 10 according to the present disclosure may be cooled in a scheme of directly connecting the cooling fluid. In particular, unlike the conventional technology, according to the battery module 10 according to the present disclosure, the cooling fluid may directly contact the cells 110 in the cell assembly 100 to absorb heat from the cells 110. Accordingly, the battery module 10 may have a structure, through which the cooling fluid may be supplied and discharged.

**[0048]** To achieve the above-described object, the battery module 10 may include an introduction cover 300 coupled to one side of the housing 2250 and through which a cooling fluid is introduced into an interior of the housing 250, and a discharge

member 350 coupled to one side of the housing 250 and through which the cooling fluid is discharged from the interior of the housing 250. Although not illustrated, the introduction member 300 and the discharge member 350 may be connected to a hose member that provides a path, in which the cooling fluid flows.

**[0049]** Meanwhile, according to the present disclosure, the introduction member 300 and the discharge member 350, which have been described above, may be provided separately from the housing 250. An aspect that the introduction member 300 and the discharge member 350 are provided separately from the housing 250 may be understood that the introduction member 300 and the discharge member 350 are coupled to the housing 250 after being separately manufactured. As compared with a case, in which the housing, the introduction member, and the discharge member are integrally manufactured, when the introduction member 300 and the discharge member 350 are manufactured separately, it is much easier to manage qualities of the introduction member 300 and the discharge member 350, including roughness of surfaces thereof, and manufacturing costs may be reduced. As an example, as illustrated in FIG. 1, the introduction member 300 and the discharge member 350 may be coupled to a front surface of the housing. However, locations of the introduction member 300 and the discharge member 350 are not limited to the above-described contents.

**[0050]** Meanwhile, referring to FIGS. 4 and 5, the battery

module 10 according to the present disclosure may further include a panel member 400 that is inserted between the first cell assembly 100a and the second cell assembly 100b.

**[0051]** As will be described below, in a process of manufacturing the battery module 10, a process of joining the sensing assembly and the cell leads 114 and 116 is necessary. In more detail, the sensing assembly and the cell leads 114 and 116 may be joined to each other through welding, and it is necessary to weld the sensing assembly and the cell leads 114 and 116 while they are adhered to each other to guarantee the quality of welding. Accordingly, in a process of welding the sensing assembly and the cell leads 114 and 116, a pressing jig 30 (see FIG. 7) presses the sensing assembly and the cell leads while the sensing assembly and the cell leads 114 and 116 face each other. However, because the sensing assembly and the cell leads 114 and 116 are moved in a direction, in which the pressing jig presses them when the pressing jig 30 presses the sensing assembly and the cell leads 114 and 116 while the sensing assembly and the cell leads 114 and 116 are not fixed, it is difficult to properly adhere the sensing assembly and the cell leads 114 and 116.

**[0052]** Accordingly, as will be described below, a support bar 20 (see FIG. 6 and the like) that supports the sensing assembly and the cell leads 114 and 116 may be disposed on an opposite side of the pressing jig 30 (see FIG. 7) while the sensing

assembly and the cell leads 114 and 116 are interposed therebetween. Then, the panel member 400 may be a configuration for fixing one side of the above-described support bar 20 (see FIG. 6 and the like). That is, one side of the support bar may be fixed to the panel member 400, and an opposite side of the support bar may be fixed to an external fixing jig (not illustrated). Accordingly, when compared with a case, in which the panel member 400 is not provided, when the battery module 10 according to the present disclosure is provided with the panel member 400, a length of the support bar 20 may be reduced. That is, because both opposite sides of the support have to be fixed by the above-described fixing jig when the panel member 400 is not provided, the support bar needs to be extended in the leftward/rightward direction "W", but because one side of the support bar is fixed to the panel member 400 and only an opposite side thereof is fixed to the fixing jig when the panel member 400 is provided, the length of the support bar may be reduced.

**[0053]** Meanwhile, as illustrated in FIG. 5, the panel member 400 may have a plate shape. Furthermore, a groove "G" having a shape that is recessed in the leftward/rightward direction "W" may be formed in an end area of the panel member 400 in the forward/rearward direction "F". Accordingly, the above-described support bar may be inserted into the panel member 400 through the groove "G".

**[0054]** As an example, as illustrated in FIG. 5, the groove "G" may have a shape that is surrounded by the panel member 400. However, unlike this, the groove "G" may be shaped such that a portion of a circumference thereof is surrounded by the panel member 400 and another portion thereof is opened to a front side (when the groove is formed in a front end area of the panel member) or a rear side (when the groove is formed in a rear end area of the panel member). Meanwhile, the grooves "G" may be formed on a left side surface and a right side surface of the panel member 400, respectively, and the above-described support bars may be inserted into the left side surface and the right side surface of the panel member 400, respectively.

**[0055]** Meanwhile, as illustrated in FIGS. 2 to 4, the battery module 10 may further include one or more bar members 450, lower ends of which are coupled to the lower cover 150 and upper ends of which are coupled to the upper cover 200. As described above, the lower cover 150 and the upper cover 200 may be configurations for pressing the cell assembly 100, and the bar members 450 may be configurations for effectively pressing the cell assembly 100 by fixing relative locations of the lower cover 150 and the upper cover 200.

**[0056]** As an example, referring to FIGS. 2 to 4, the bar members 450 may be provided in a front area and a rear area of the cell assembly 100 to face opposite ends of the cell assembly 100 in the forward/rearward direction "F".

**[0057]** Meanwhile, the lower cover 150 may include a lower cover body 152 that defines a body of the lower cover 150, and a lower coupling area 154 that protrudes upwards from the lower cover body 152 and is coupled to the bar members 450. Furthermore, the upper cover 200 may include an upper cover body 202 that defines a body of the upper cover 200, and an upper coupling area 204 that protrudes downwards from the upper cover body 202 and is coupled to the bar members 450.

**[0058]** Referring to FIG. 4 and the like again, the battery module 10 may further include a front sensing assembly 500 that is provided on a front side of the cell assembly 100 and is joined to the front cell lead 114 and a rear sensing assembly 550 that is provided on a rear side of the cell assembly 100 and is joined to the rear cell lead 116. The front sensing assembly 500 and the rear sensing assembly 550 may be configurations for sensing a voltage of the cell assembly 100.

**[0059]** Meanwhile, referring to FIGS. 2, 3, and the like, the battery module 10 may further include a wire assembly 600 that is provided in the housing 250, one side of which is coupled to an upper surface of the upper cover 200, and an opposite side of which is electrically connected to the cell assembly 100. The wire assembly 600 may be a configuration for delivering information (for example, a voltage) on the cell assembly 100 to an outside. The wire assembly 600, for example, may be a wire harness.

**[0060]** Furthermore, as illustrated in FIGS. 2 and 3, the battery module 10 may further include a connection bus bar 650 that is electrically connecting the plurality of cells 110 provided in the cell assembly 100. For example, the connection bus bar 650 may be provided on a front side or a rear side of the cell assembly 100.

**[0061]** Method for Manufacturing Battery Module

**[0062]** FIG. 6 is a view schematically illustrating a state, in which the support bar is supported in a method for manufacturing a battery module according to the present disclosure, and FIG. 7 is a cross-sectional view schematically illustrating relative locations of the support bar, the pressing jig, the cell lead, and the sensing assembly in a pressing operation of a method for manufacturing a battery module according to the present disclosure.

**[0063]** In a description based on FIGS. 1 to 7 and the above-described contents, the method for manufacturing a battery module according to the present disclosure may include a cell assembly preparing operation of preparing the first cell assembly 100a and the second cell assembly 100b each having a structure, in which the plurality of cells 110 are stacked, a first disposition operation of disposing the second cell assembly 100b on one side of the first cell assembly 100a and disposing the panel member 400 in a space between the first cell assembly 100a and the second cell assembly 100b, a support



bar coupling operation of coupling the support bar 20 having a bar shape to the panel member 400, a second disposition operation of disposing the sensing assembly 500 and 550 on one side of the cell lead 114 and 116 provided in the cell 110, a pressing operation of pressing the cell lead 114 and 116 and the sensing assembly 500 and 550 with the pressing jig 30 while the cell lead 114 and 116 and the sensing assembly 500 and 550 are disposed between the pressing jig 30 and the support bar 20, and a welding operation of welding the cell lead 114 and 116 and the sensing assembly 500 and 550. In the welding operation, the cell leads 114 and 116 and the sensing assemblies 500 and 550 may be joined to each other.

**[0064]** In more detail, the groove having the recessed shape may be formed in the panel member 400, and in the support bar coupling operation, the support bar 20 may be inserted into the groove "G".

**[0065]** Furthermore, in the first disposition operation, the second cell assembly 100b may be disposed on one side of the first cell assembly 100a in the leftward/rightward direction "W", and in the support bar coupling operation, the support bar 20 may be coupled to the panel member 400 to extend in the leftward/rightward direction "W".

**[0066]** In more detail, referring to FIGS. 4 to 6, in the support coupling operation, the first support bar 20a may be coupled to one side of the panel member 400 in the

leftward/rightward direction "W" and the second support bar 20b may be coupled to an opposite side of the panel member 400 in the leftward/rightward direction "W". Accordingly, according to the present disclosure, a size of the battery module 10 may be increased by a length, by which the first support bar 20a and the second support bar 20b extend in the leftward/rightward direction "W", and thus a capacity of the battery module 10 may be increased. In addition, according to the present disclosure, because the length of the support bar 20 in the leftward/rightward direction "W" may be reduced, shaking of the support bar 20 may be minimized in the process of manufacturing the battery module whereby a damage to the cell assembly 100 may be prevented in the following welding operation.

**[0067]** Furthermore, the method for manufacturing a battery module according to the present disclosure may further include a jig removing operation of spacing the pressing jig 30 apart from the cell assembly 100, and a support bar removing operation of removing the support bar 20 from the panel member 400. Meanwhile, the panel member 400 also may maintain a state, in which it is not removed from the battery module 10, after the manufacturing of the battery module 10 is finished.

**[0068]** Meanwhile, the above-described contents of the battery module according to the present disclosure may be applied to the method for manufacturing a battery module according to the

present disclosure in the same way, and an opposite case may be possible.

**[0069]** According to the present disclosure, a battery module having a structure, in which a cooling fluid may directly exchange heat with cells, may be provided.

**[0070]** In addition, according to the present disclosure, a battery module, by which make a size of a battery module large by enhancing a capacity of cells that may be mounted in a battery module, may be provided.

**[0071]** Although the present disclosure has been described above with reference to the limited embodiments and drawings, the present disclosure is not limited thereto, and it is apparent that various embodiments may be made within the technical spirits of the present disclosure and an equivalent range of the claims, which will be described below.

**WHAT IS CLAIMED IS:**

[Claim 1] A battery module comprising:

- a cell assembly including a plurality of cells stacked in an upward/downward direction (H);
- a lower cover configured to face a lower surface of the cell assembly and configured to press the lower surface of the cell assembly upwards;
- an upper cover configured to face an upper surface of the cell assembly and configured to press the upper surface of the cell assembly downwards;
- a housing accommodating the cell assembly, the lower cover, and the upper cover;
- an introduction cover coupled to one side of the housing and through which a cooling fluid is introduced into an interior of the housing; and
- a discharge member coupled to one side of the housing and through which the cooling fluid is discharged from the interior of the housing.

[Claim 2] The battery module of claim 1, wherein the housing includes:

- a lower housing, an upper area of which is opened, and in which an interior space accommodating the cell assembly, the lower cover, and the upper cover is formed; and

an upper housing coupled to the upper area of the lower housing and configured to close the interior space from an outside.

[Claim 3] The battery module of claim 1, wherein the cell assembly includes:

a first cell assembly; and

a second cell assembly provided on one side of the first assembly in a leftward/rightward direction (W), and

wherein the battery module further comprises a panel member inserted between the first cell assembly and the second cell assembly.

[Claim 4] The battery module of claim 3, wherein a groove having a shape recessed in the leftward/rightward direction (W) is formed in an end area of the panel member in a forward/rearward direction (F).

[Claim 5] The battery module of claim 4, wherein a circumference of the groove has a shape surrounded by the panel member.

[Claim 6] The battery module of claim 1, further comprising:

one or more bar members, lower ends of which are coupled to the lower cover and upper ends of which are coupled to the upper cover.

[Claim 7] The battery module of claim 6, wherein the bar members are provided in a front area and a rear area of the cell assembly, respectively, to face opposite ends of the cell assembly in the forward/rearward direction (F).

[Claim 8] The battery module of claim 7, wherein the lower cover includes:

- a lower cover body defining a body of the lower cover; and
- a lower coupling area protruding upwards from the lower cover body and coupled to the bar members.

[Claim 9] The battery module of claim 7, wherein the upper cover includes:

- an upper cover body defining a body of the upper cover;
- and
- an upper coupling area protruding downwards from the upper cover body and coupled to the bar members.

[Claim 10] The battery module of claim 6, wherein each of the cells includes;

- a cell body; and

a front cell lead protruding forwards from the cell body,  
and

wherein a front sensing assembly provided on a front side  
of the cell assembly and joined to the front cell lead.

[Claim 11] The battery module of claim 10, wherein each of  
the cells further includes:

a rear cell lead protruding rearwards from the cell body,  
and

wherein the battery module further comprises a rear  
sensing assembly provided on a rear side of the cell assembly  
and joined to the rear cell lead.

[Claim 12] The battery module of claim 1, further  
comprising:

a wire assembly provided in the housing, one side of which  
is coupled to an upper surface of the upper cover, and an  
opposite side of which is electrically connected to the cell  
assembly.

[Claim 13] The battery module of claim 1, further  
comprising:

a connection bus bar electrically connecting the plurality  
of cells provided in the cell assembly,

wherein the connection bus bar is provided on a front side or a rear side of the cell assembly.

[Claim 14] The battery module of claim 1, wherein the introduction member and the discharge member are provided separately from the housing.

[Claim 15] The battery module of claim 1, wherein the introduction member and the discharge member are coupled to a front surface of the housing.

[Claim 16] A method for manufacturing a battery module, the method comprising:

a cell assembly preparing operation of preparing a first cell assembly and a second cell assembly each having a structure, in which a plurality of cells are stacked;

a first disposition operation of disposing the second cell assembly on one side of the first cell assembly and disposing a panel member in a space between the first cell assembly and the second cell assembly;

a support bar coupling operation of coupling a support bar having a bar shape to the panel member;

a second disposition operation of disposing a sensing assembly on one side of a cell lead provided in the cell;



a pressing operation of pressing the cell lead and the sensing assembly with a pressing jig while the cell lead and the sensing assembly are disposed between the pressing jig and the support bar; and

a welding operation of welding the cell lead and the sensing assembly.

[Claim 17] The method of claim 16, wherein a groove having a recessed shape is formed in the panel member, and wherein in the support bar coupling operation, the support bar is inserted into the groove.

[Claim 18] The method of claim 17, wherein in the first disposition operation, the second cell assembly is disposed on one side of the first cell assembly in a leftward/rightward direction (W), and wherein in the support bar coupling operation, the support bar is coupled to the panel member to extend in the leftward/rightward direction (W).

[Claim 19] The method of claim 18, wherein in the support bar coupling operation,

a first support bar is coupled to one side of the panel member in the leftward/rightward direction (W), and a second

support bar is coupled to an opposite side of the panel member in the leftward/rightward direction (W).

[Claim 20] The method of claim 16, further comprising:  
a jig removing operation of spacing the pressing jig apart from the cell assembly; and  
a support bar removing operation of removing the support bar from the panel member.