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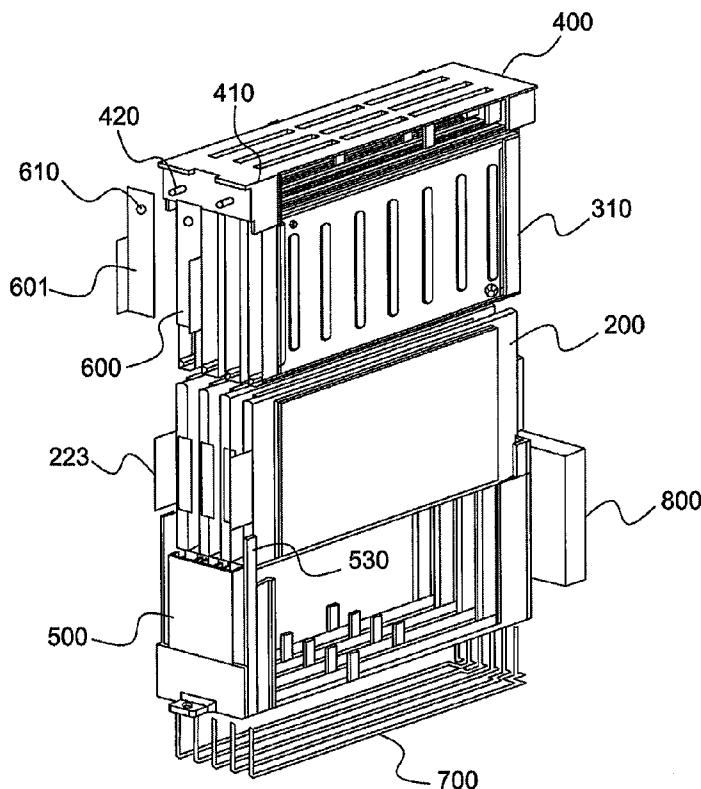
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(54) Title: MIDDLE OR LARGE-SIZED BATTERY MODULE



(57) Abstract: Disclosed herein is a middle- or large-sized battery module including two or more unit modules each having one or more plate-shaped battery cells, as unit cells, surrounded by a high-strength sheathing member made of synthetic resin or metal, and separable upper and lower frame members coupled with each other in an assembly-type coupling structure such that the unit modules are vertically mounted in the upper and lower frame members. The present invention has the effect of easily mounting a sensing unit that is capable of minimizing the weight and size of battery cells while effectively reinforcing the low mechanical strength of the battery cells and sensing the operation state of the battery cells to a middle- or large-sized battery module. In addition, the present invention has the effect of manufacturing the battery module by a simple assembly process without using a plurality of members for mechanical coupling and electrical connection, thereby decreasing the manufacturing costs of the battery module, and effectively preventing the battery module from being short-circuited or damaged during the manufacture or the operation of the battery module. Furthermore, the present invention has the effect of manufacturing a middle- or large-sized battery system having desired output and capacity using the battery module as a unit body.



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MIDDLE OR LARGE-SIZED BATTERY MODULE

FIELD OF THE INVENTION

5 The present invention relates to a middle- or large-sized battery module, and, more particularly, to a middle- or large-sized battery module including two or more unit modules each having one or more plate-shaped battery cells, as unit cells, surrounded by a high-strength sheathing member made of synthetic resin or metal, and separable upper and lower frame members coupled with each other in an assembly-type
10 coupling structure such that the unit modules are vertically mounted in the upper and lower frame members.

BACKGROUND OF THE INVENTION

 Recently, a secondary battery, which can be charged and discharged, has been widely used as an energy source for wireless mobile devices. Also, the secondary
15 battery has attracted considerable attention as an energy source for electric vehicles (EV) and hybrid electric vehicles (HEV), which have been developed to solve problems, such as air pollution, caused by existing gasoline and diesel vehicles using fossil fuel.

 Small-sized mobile devices use one or several small-sized battery cells for each device. On the other hand, middle- or large-sized devices, such as vehicles, use a
20 middle- or large-sized battery module having a plurality of battery cells electrically

connected with each other because high output and large capacity are necessary for the middle- or large-sized devices.

Preferably, the middle- or large-sized battery module is manufactured with small size and small weight if possible. For this reason, a prismatic battery or a pouch-shaped battery, which can be stacked with high integration and has a small weight to capacity ratio, is usually used as a battery cell of the middle- or large-sized battery module. Especially, much interest is currently generated in the pouch-shaped battery, which uses an aluminum laminate sheet as a sheathing member, because the weight of the pouch-shaped battery is small and the manufacturing costs of the pouch-shaped battery are low.

FIG. 1 is a perspective view typically illustrating a conventional representative pouch-shaped battery. The pouch-shaped battery 10 shown in FIG. 1 is constructed in a structure in which two electrode leads 11 and 12 protrude from the upper and lower ends of a battery body 13, respectively, while the electrode leads 11 and 12 are opposite to each other. A sheathing member 14 comprises upper and lower sheathing parts. That is, the sheathing member 14 is a two-unit member. An electrode assembly (not shown) is received in a receiving part which is defined between the upper and lower sheathing parts of the sheathing member 14. The opposite sides 14a and the upper and lower ends 14b and 14c, which are contact regions of the upper and lower sheathing parts of the sheathing member 14, are bonded to each other, whereby the pouch-shaped battery 10 is manufactured. The sheathing member 14 is constructed in a laminate structure of a resin layer/a metal film layer/a resin layer. Consequently, it is possible to bond the opposite sides 14a and the upper and lower ends 14b and 14c of the upper and lower sheathing parts of the sheathing member 14, which are in contact with each other, to each other by applying heat and pressure to the opposite

sides 14a and the upper and lower ends 14b and 14c of the upper and lower sheathing parts of the sheathing member 14 so as to weld the resin layers thereof to each other. According to circumstances, the opposite sides 14a and the upper and lower ends 14b and 14c of the upper and lower sheathing parts of the sheathing member 14 may be
5 bonded to each other using a bonding agent. For the opposite sides 14a of the sheathing member 14, the same resin layers of the upper and lower sheathing parts of the sheathing member 14 are in direct contact with each other, whereby uniform sealing at the opposite sides 14a of the sheathing member 14 is accomplished by welding. For the upper and lower ends 14b and 14c of the sheathing member 14, on
10 the other hand, the electrode leads 11 and 12 protrude from the upper and lower ends 14b and 14c of the sheathing member 14, respectively. For this reason, the upper and lower ends 14b and 14c of the upper and lower sheathing parts of the sheathing member 14 are thermally welded to each other, while a film-shaped sealing member 16 is interposed between the electrode leads 11 and 12 and the sheathing member 14,
15 in consideration of the thickness of the electrode leads 11 and 12 and the difference in material between the electrode leads 11 and 12 and the sheathing member 14, so as to increase sealability of the sheathing member 14.

However, the mechanical strength of the sheathing member 14 is low. In order to solve this problem, there has been proposed a method of mounting battery cells (unit
20 cells) in a pack case, such as a cartridge, so as to manufacture a battery module having a stable structure. However, a device or a vehicle, in which a middle- or large-sized battery module is installed, has a limited installation space. Consequently, when the size of the battery module is increased due to the use of the pack case, such as the cartridge, the spatial utilization is lowered. Also, due to the low mechanical strength, the battery
25 cells repeatedly expand and contract during the charge and the discharge of the battery

cells. As a result, the thermally welded regions of the sheathing member may be easily separated from each other.

Also, since a battery module is a structural body including a plurality of battery cells which are combined with each other, the safety and the operating efficiency of the battery module are lowered when overvoltage, overcurrent, and overheat occurs in some of the battery cells. Consequently, a sensing unit for sensing the overvoltage, overcurrent, and overheat is needed. Specifically, a voltage or temperature sensor is connected to the battery cells so as to sense and control the operation of the battery cells in real time or at predetermined time intervals. However, the attachment or the connection of the sensing unit complicates the assembly process of the battery module. In addition, short circuits may occur due to the provision of a plurality of wires necessary for the attachment or the connection of the sensing unit.

In addition, when a middle- or large-sized battery module is constructed using a plurality of battery cells or a plurality of unit modules each of which includes a predetermined number of battery cells, a plurality of members for mechanical coupling and electrical connection between the battery cells or the unit modules are needed, and a process for assembling the mechanical coupling and electrical connection members is very complicated. Furthermore, there is needed a space for coupling, welding, or soldering the mechanical coupling and electrical connection members with the result that the total size of the system is increased. The increase in size of the system is not preferred in the above-described aspect. Consequently, there is high necessity for a middle- or large-sized battery module that is compact and structurally stable.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made to solve the above problems, and other technical problems that have yet to be resolved.

Specifically, it is an object of the present invention to provide a middle- or large-sized battery module to which a sensing unit that is capable of minimizing the weight and size of battery cells while effectively reinforcing the low mechanical strength of the battery cells and sensing the operation state of the battery cells is easily mounted.

It is another object of the present invention to provide a middle- or large-sized battery module that is manufactured by a simple assembly process without using a plurality of members for mechanical coupling and electrical connection, whereby the manufacturing costs of the middle- or large-sized battery module are lowered, and that is effectively prevented from being short-circuited or damaged during the manufacture or the operation of the middle- or large-sized battery module.

It is a further object of the present invention to provide a middle- or large-sized battery system that is manufactured using the middle- or large-sized battery module as a unit body such that the middle- or large-sized battery system has desired output and capacity.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a middle- or large-sized battery module comprising: two or more unit modules each having one or more plate-shaped battery cells, as unit cells, surrounded by a high-strength sheathing member made of synthetic resin or metal; and separable upper and lower frame members coupled with

each other in an assembly-type coupling structure such that the unit modules are vertically mounted in the upper and lower frame members.

The plate-shaped battery cells are secondary batteries having a small thickness and a relatively large width and length, such that the total size of the secondary batteries is minimized when the secondary batteries are stacked to construct a battery module. In a preferred embodiment, each plate-shaped battery cell is a secondary battery constructed in a structure in which an electrode assembly is mounted in a battery case made of a laminate sheet including a resin layer and a metal layer, and electrode terminals protrude from upper and lower ends of the battery case. Specifically, each battery cell is constructed in a structure in which the electrode assembly is mounted in a pouch-shaped battery case made of an aluminum laminate sheet. Hereinafter, the secondary battery with the above-stated construction will be referred to as a pouch-shaped battery cell.

The case of the pouch-shaped battery cell may be constructed in various structures. For example, the sheathing member of the pouch-shaped battery may be constructed in a structure in which the electrode assembly is received in a receiving part formed at the upper inner surface and/or the lower inner surface of a two-unit member, and the upper and lower contact regions are sealed. A pouch-shaped battery cell with the above-described construction is disclosed in PCT International Application No. PCT/KR2004/003312, which has been filed in the name of the applicant of the present patent application. The disclosure of the above-mentioned patent application is hereby incorporated by reference as if fully set forth herein.

The electrode assembly comprises cathodes and anodes, by which the charge and the discharge of the battery are possible. The electrode assembly may be

constructed in a structure in which the cathodes and the anodes are stacked while separators are disposed respectively between the cathodes and the anodes. For example, the electrode assembly may be constructed in a folding (jelly-roll) type structure, a stacking type structure, or a stacking/folding type structure. The cathodes
5 and the anodes of the electrode assembly may be constructed such that electrode taps of the cathodes and electrode taps of the anodes directly protrude outward from the battery. Alternatively, the cathodes and the anodes of the electrode assembly may be constructed such that the electrode taps of the cathodes and the electrode taps of the anodes are connected to additional leads, and the leads protrude outward from the
10 battery.

The battery cells are surrounded, one by one or two by two, by the high-strength sheathing member made of synthetic resin or metal so as to constitute a unit module. The high-strength sheathing member restrains the repetitive expansion and contraction change of the battery cells during the charge and discharge of the battery
15 cells while protecting the battery cells having low mechanical strength, thereby preventing separation between sealing regions of the battery cells.

The battery cells are connected in series and/or parallel with each other in one unit module, or the battery cells of one unit module are connected in series and/or parallel with the battery cells of another unit module. In a preferred embodiment, a
20 plurality of unit modules are manufactured by coupling electrode terminals of the battery cells to each other, while arranging the battery cells in series in the longitudinal direction, such that the electrode terminals of the battery cells are successively adjacent to each other, bending the battery cells by twos or more such that the battery cells are stacked while being in tight contact with each other, and

surrounding the stacked battery cells by predetermined numbers with the sheathing members.

The coupling between the electrode terminals is accomplished in various manners, such as welding, soldering, and mechanical coupling. Preferably, the
5 coupling between the electrode terminals is accomplished by welding.

The unit modules, which are stacked in high integration while the electrode terminals are connected with each other, are vertically mounted in the separable upper and lower frame members that are coupled with each other in the assembly-type coupling structure.

10 Preferably, the upper and lower frame members are constructed in a structure to surround the edges of the unit modules and expose the outer surfaces of the unit modules to the outside so as to accomplish easy heat dissipation of the unit modules when the upper and lower frame members are coupled with each other after the unit modules are mounted in the upper and lower frame members. Specifically, the upper
15 and lower frame members are open in the lateral direction such that the edges of the unit modules are fixed to the upper and lower frame members.

In a preferred embodiment, the upper and lower frame members are provided at the insides thereof with pluralities of partitions for guiding the vertical mounting operation of the respective unit modules. The partitions may include grooves formed
20 in the inside of the upper and lower frame member such that the edges of the unit modules are inserted into the grooves and/or partition walls for assisting the edges of the unit modules to be stably mounted in the grooves.

The upper and lower frame members are coupled with each other by mounting the unit modules to one of the upper and lower frame members (for example, the lower frame member) and coupling the other frame member (for example, the upper frame member) to the frame member in which the unit modules are mounted. The coupling between the upper and lower frame members may be accomplished in various manners. For example, a hook may be formed at one of the frame members, and a coupling hole corresponding to the hook may be formed in the other frame member, whereby the coupling between the upper and lower frame members is accomplished without using an additional coupling member.

In a battery module including a plurality of battery cells, it is necessary to measure and control the voltage and temperature of the battery cells in consideration of the safety and operational efficiency of the battery module. Especially, it is necessary to measure the voltage of the respective battery cells or the respective electrical connection regions of the battery cells. For this reason, the attachment of a sensing member for measuring the voltage or temperature of the battery cells is one of the principal factors further complicating the construction of the battery module.

The above-mentioned problem may be solved by the provision of a sensing unit mounted along one of the frame members for sensing the voltage and/or temperature of the battery cells in accordance with the present invention.

The electrode terminals of the outermost unit modules among the unit modules mounted in the upper and lower frame members are electrically connected to external circuits or electrode terminals of neighboring battery modules. To this end, input and output terminal bus bars are connected to the electrode terminals of the outermost unit modules. In a preferred embodiment, the bus bars are provided with

coupling holes, and at least one of the frame members is provided at the outside thereof with coupling protrusions corresponding to the coupling holes, whereby the bus bars are easily and stably mounted to the electrode terminals.

The battery module according to the present invention further comprises a
5 device (a so-called battery management system) for controlling the operation of the battery module. Preferably, the battery management system (BMS) is mounted at the opposite side (the rear of the battery module) to the side where the input and output terminal bus bars are located. When a plurality of battery modules are used to construct a middle- or large-sized battery system, as will be described below, BMSs
10 mounted to the respective battery modules may be said to be 'slave BMSs.'

The middle- or large-sized battery module according to the present invention is constructed in a compact structure, and the mechanical coupling and electrical connection of the middle- or large-sized battery module are stably accomplished without using a plurality of members. Also, it is possible to construct a battery module
15 using a predetermined number of battery cells, for example, four, six, eight, or ten battery cells, thereby effectively mounting a necessary number of battery modules in a limited space.

In accordance with another aspect of the present invention, there is provided a middle- or large-sized battery system having high output and large capacity, the
20 battery system being constructed by connecting a plurality of battery modules.

The middle- or large-sized battery system according to the present invention may be manufactured by combining unit modules based on desired output and capacity. The battery system according to the present invention is preferably used in electric vehicles, hybrid electric vehicles, electric motorcycles, or electric bicycles that

have a limit installation space and are exposed to frequent vibration and strong impact in consideration of the installation efficiency and structural stability of the battery system.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating a conventional representative pouch-shaped battery;

10 FIG. 2 is an exploded perspective view illustrating a middle- or large-sized battery module according to a preferred embodiment of the present invention;

FIGS. 3 to 8 are typical views illustrating a process for assembling the middle- or large-sized battery module shown in FIG. 2; and

15 FIG. 9 is a typical view illustrating a middle- or large-sized battery system manufactured by stacking a plurality of battery modules, one of which is illustrated in FIG. 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Now, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. It should be noted, however, that
20 the scope of the present invention is not limited by the illustrated embodiments.

FIG. 2 is an exploded perspective view illustrating a middle- or large-sized battery module according to a preferred embodiment of the present invention, and FIGS. 3 to 8 are typical views illustrating a process for assembling the middle- or large-sized battery module.

5 Referring first to FIG. 2, the middle- or large-sized battery module 100 includes a plurality of pouch-shaped battery cells 200, cell covers 310, which are metal sheathing members, for surrounding the battery cells 200 two by two, and upper and lower frame members 400 and 500 coupled with each other in an assembly-type coupling structure.

10 As shown in FIG. 3, electrode terminals 210, 220, 211, and 221 of battery cells 200 and 201 are coupled to each other by welding while the battery cells 200 and 201 are arranged in series in the longitudinal direction such that the electrode terminals 210, 220, 211, and 221 of battery cells 200 and 201 are successively adjacent to each other. Subsequently, the battery cells 200 and 201 are bent in
15 directions indicated by arrows such that the coupling regions of the electrode terminals 210, 220, 211, and 221 are located at the outside. As a result, the battery cells 200 and 201 are stacked while being in tight contact with each other. Subsequently, the stacked battery cells 200 and 201 are surrounded, two by two, by the cell covers 310, as shown in FIG. 2. As a result, unit modules 300 having a
20 structure shown in FIG. 4 are constructed.

Referring to FIG. 4, each battery cell 200 has low mechanical strength because the outer surface of each battery cell 200 is constituted by a pouch-shaped case; however, the battery cells 200 are surrounded by the high-strength cell covers 310 with the result that the battery cells 200 are safe from external impacts. Also, the

change in volume of the battery cells 200 is restrained by the cell covers 300 during the charge and discharge of the battery cells. Consequently, it is possible to effectively prevent the separation between electrodes of an electrode assembly mounted in each battery cell 200 and to separation between sealing parts of the pouch-shaped case.

5 The electrode terminals 220 and 211 of the battery cells 200 and 201 are connected with each other by welding. Consequently, the electrical connection between the battery cells 200 and 201 is stably accomplished without using an additional coupling member. In opposite major sides of each cell cover 310 are formed pluralities of grooves 320 which are spaced from each other at predetermined intervals.

10 Consequently, a coolant channel is naturally formed while the battery cells 200 and 201 are stacked, whereby effective heat dissipation is accomplished.

Electrode terminals 210 of the outermost unit modules 300 and 303, which are not coupled with each other, will be connected to an external circuit afterward.

15 The unit modules stacked as described above are fitted vertically into a lower frame member 500 having partitions formed at the inside thereof with the result that the unit modules are securely mounted in the lower frame member 500. The partitions are defined by grooves 510 formed in the inside of the upper end (the front part in the drawing) and the inside of the lower end (the rear part in the drawing) of the lower frame member 500 such that the grooves 510 have a size corresponding to the upper and

20 lower ends of the unit modules 300 and partition walls 520 protruding from the inside of the lateral side (the bottom part in the drawing) of the lower frame member 500 such that the partition walls 520 are interposed between the lateral sides of the unit modules. The lower frame member 500 is constructed approximately in a “[”-shaped structure. Consequently, most of the opposite major sides of the unit modules 300 mounted in the

lower frame member 500 are exposed to the outside, whereby the dissipation of heat from the unit modules 300 is accomplished.

Referring back to FIG. 2, the lower frame member 500 is provided at one side thereof with a hook 530, which is inserted into a coupling hole 410 formed in the upper frame member 400 such that the lower frame member 500 is coupled with the upper frame member 400. Consequently, the stable coupling between the lower frame member 500 and the upper frame member 400 is easily accomplished without using an additional coupling member.

FIG. 6 is a perspective view illustrating the coupling between the lower frame member 500, in which the unit modules 300 are mounted, and the upper frame member 400. The upper frame member 400 is also provided at the inside thereof with partition walls (not shown), which are interposed between the lateral sides of the unit modules 300.

One-side electrode terminals 210 and 223 of the outermost unit modules 300 and 303 protrude forward. To these electrode terminals 210 and 223 are coupled bus bars 600 and 601, which are shown in FIG. 2. Each of the bus bars 600 and 601 is bent at one side thereof such that the bus bars 600 and 601 can be coupled to the electrode terminals 210 and 223 without bending the electrode terminals 210 and 223. Also, the bus bars 600 and 601 are provided with coupling holes 610, through which coupling protrusions 420 formed at the upper frame member 400 are inserted such that the bus bars 600 and 601 are securely mounted to the upper frame member 400 while the bus bars 600 and 601 are coupled to the electrode terminals 210 and 223.

FIG. 7 is a perspective view typically illustrating the coupling between the bus bars and the electrode terminals. Referring to FIG. 7, the electrode terminal 210 of the

unit module 300 is in tight contact with the vertically bent side 620 of the bus bar 600, and therefore, resistance welding can be easily carried out. At the same time, the bus bar 600 is coupled to the upper frame member 400 through the insertion of the coupling protrusions 420 into the coupling holes 610. Consequently, the stably mounted state of
5 the bus bar 600 is maintained although vibration or impact is applied to the bus bar 600.

Referring back to FIG. 2, sensing wires 700 for sensing the voltage and temperature of the battery cells 200 and 201 are connected to the lower frame member 500. Specifically, the sensing wires 700 are connected to the electrode terminal coupling regions at the upper and lower ends of the lower frame member 500 for
10 sensing the voltage of the unit modules 300 in approximately the same shape as the lower frame member 500. Consequently, the battery module is constructed in a simple structure.

The sensing wires 700 are connected to a battery management system (BMS) 800 located at the bottom of the lower frame member 500. FIG. 8 is a perspective view
15 typically illustrating the rear of the middle- or large-sized battery module 100 to which the BMS 800 is mounted.

A plurality of battery modules may be stacked, as shown in FIG. 9, to construct a middle- or large-sized battery system having desired output and capacity.

Referring to FIG. 9, the middle- or large-sized battery system is manufactured
20 by stacking a plurality of battery modules 100 and 101. The bus bars 600 and 601 are located at the front of the middle- or large-sized battery system, and the BMSs 800 and 801 are located at the rear of the middle- or large-sized battery system.

The bus bars 600 and 601 may be electrically connected to each other via connection members (not shown), such as wires, metal plates, printed circuit boards (PCBs), flexible PCBs. In addition, an additional BMS (not shown) may be mounted to the middle- or large-sized battery system for controlling the overall operation of the battery system. In this case, the BMSs 800 and 801 mounted to the respective battery modules 100 and 101 serve as slave BMSs.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

INDUSTRIAL APPLICABILITY

As apparent from the above description, the present invention has the effect of easily mounting a sensing unit that is capable of minimizing the weight and size of battery cells while effectively reinforcing the low mechanical strength of the battery cells and sensing the operation state of the battery cells to a middle- or large-sized battery module. In addition, the present invention has the effect of manufacturing the battery module by a simple assembly process without using a plurality of members for mechanical coupling and electrical connection, thereby decreasing the manufacturing costs of the battery module, and effectively preventing the battery module from being short-circuited or damaged during the manufacture or the operation of the battery module. Furthermore, the present invention has the effect of manufacturing a middle- or large-sized battery system having desired output and capacity using the battery module as a unit body.

WHAT IS CLAIMED IS:

1. A middle- or large-sized battery module comprising:

two or more unit modules each having one or more plate-shaped battery cells,
as unit cells, surrounded by a high-strength sheathing member made of synthetic resin
5 or metal; and

separable upper and lower frame members coupled with each other in an
assembly-type coupling structure such that the unit modules are vertically mounted in
the upper and lower frame members.

2. The battery module according to claim 1, wherein each plate-shaped battery
10 cell is a secondary battery constructed in a structure in which an electrode assembly is
mounted in a battery case made of a laminate sheet including a resin layer and a metal
layer, and electrode terminals protrude from upper and lower ends of the battery case.

3. The battery module according to claim 2, wherein each battery cell is a pouch-
shaped battery cell constructed in a structure in which the electrode assembly is
15 mounted in a pouch-shaped battery case made of an aluminum laminate sheet.

4. The battery module according to claim 1, wherein the unit modules are
manufactured by coupling electrode terminals of the battery cells to each other while
arranging the battery cells in series in the longitudinal direction such that the electrode
terminals of the battery cells are successively adjacent to each other, bending the
20 battery cells by twos or more such that the battery cells are stacked while being in
tight contact with each other, and surrounding the stacked battery cells by
predetermined numbers with the sheathing members.

5. The battery module according to claim 1, wherein the upper and lower frame members are open in the lateral direction such that the edges of the unit modules are fixed to the upper and lower frame members.

6. The battery module according to claim 1, wherein the upper and lower frame members are provided at the insides thereof with pluralities of partitions for guiding the vertical mounting operation of the respective unit modules.

7. The battery module according to claim 6, wherein the partitions include grooves formed in the inside of the upper and lower frame member such that the edges of the unit modules are inserted into the grooves and/or partition walls for assisting the edges of the unit modules to be stably mounted in the grooves.

8. The battery module according to claim 6, wherein the assembly-type coupling structure is a structure including a hook formed at one of the frame members and a coupling hole formed in the other frame member such that the coupling hole corresponds to the hook.

9. The battery module according to claim 1, further comprising:

a sensing unit mounted along one of the frame members for sensing the voltage and/or temperature of the battery cells.

10. The battery module according to claim 1, further comprising:

bus bars coupled to electrode terminals of the outermost unit modules for electrically connecting the electrode terminals to external circuits or electrode terminals of neighboring battery modules, wherein

the bus bars are provided with coupling holes, and one of the frame members corresponding to the bus bars is provided at the outside thereof with coupling protrusions corresponding to the coupling holes.

11. The battery module according to claim 10, further comprising:

5 a battery management system (BMS) mounted at the opposite side (the rear of the battery module) to the side where the input and output terminal bus bars are located for controlling the operation of the battery module.

12. A middle- or large-sized battery system having high output and large capacity, the battery system being constructed by connecting a plurality of battery
10 modules according to any one of claim 1 to 11.

13. The battery system according to claim 12, wherein the battery system is used as a power source for electric vehicles, hybrid electric vehicles, electric motorcycles, or electric bicycles.

FIG. 1

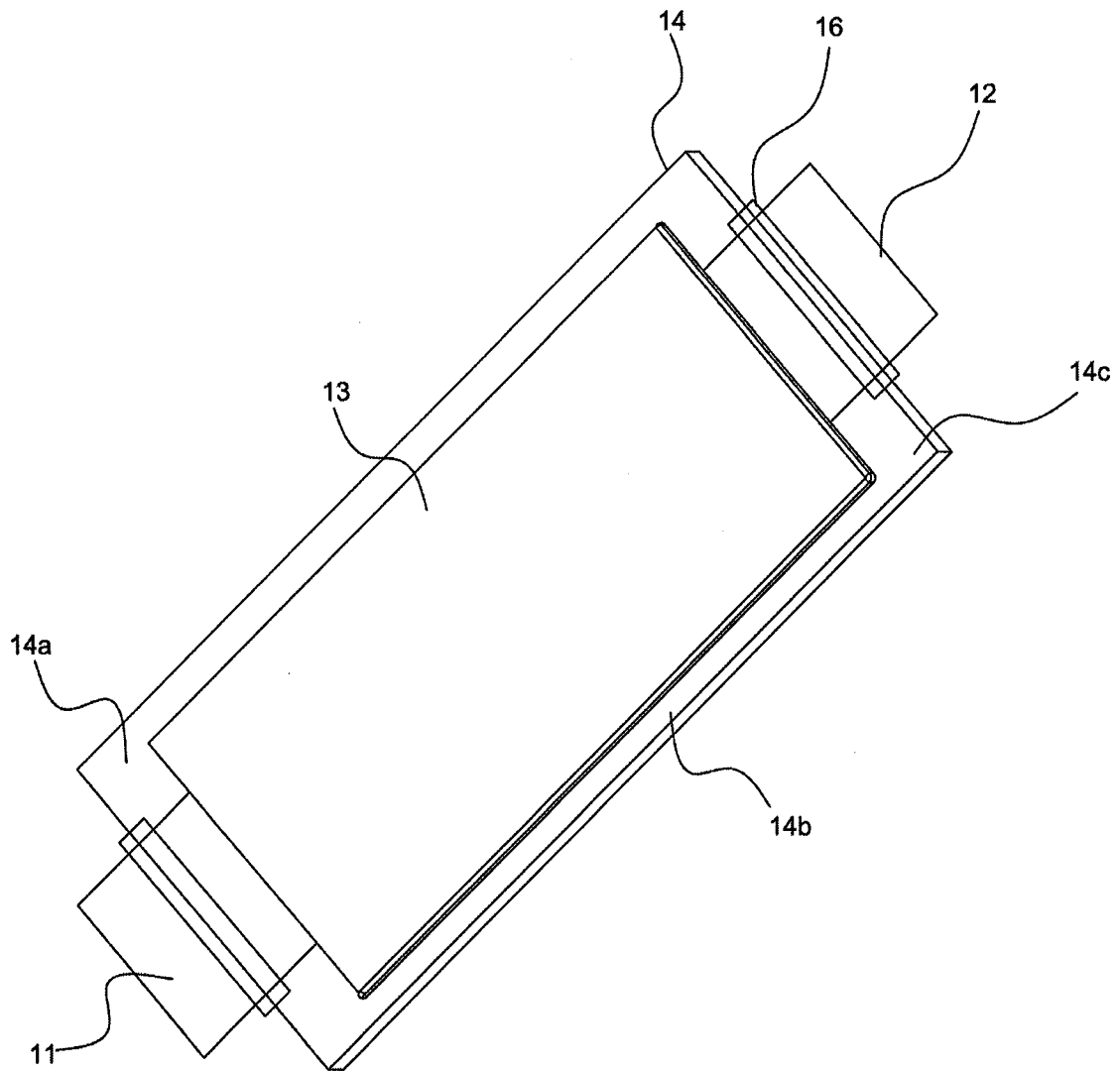


FIG. 2

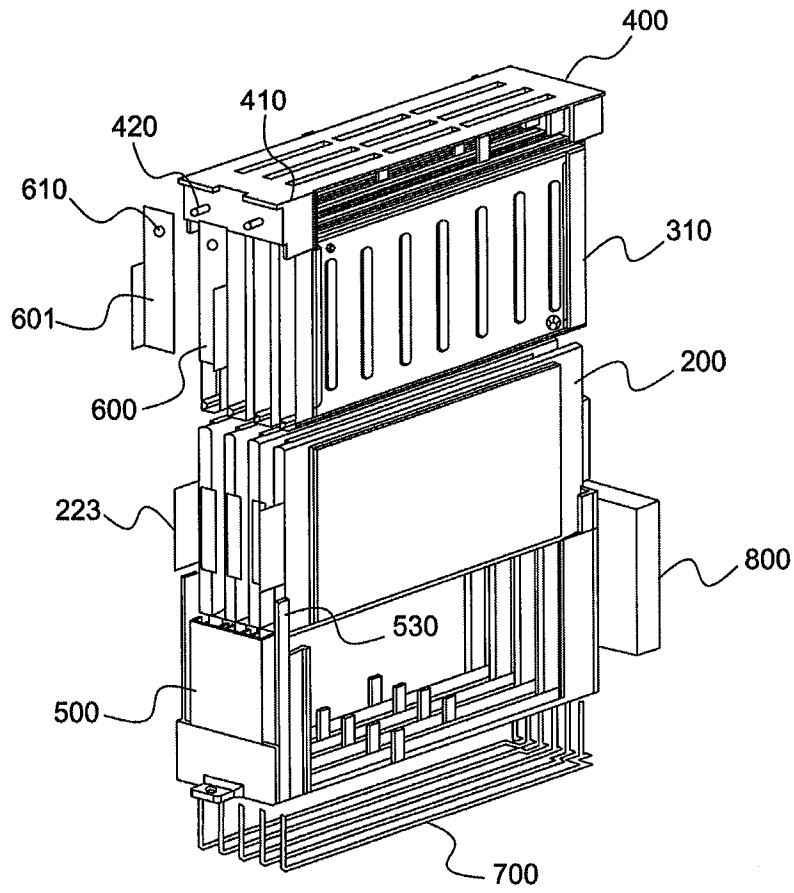


FIG. 3

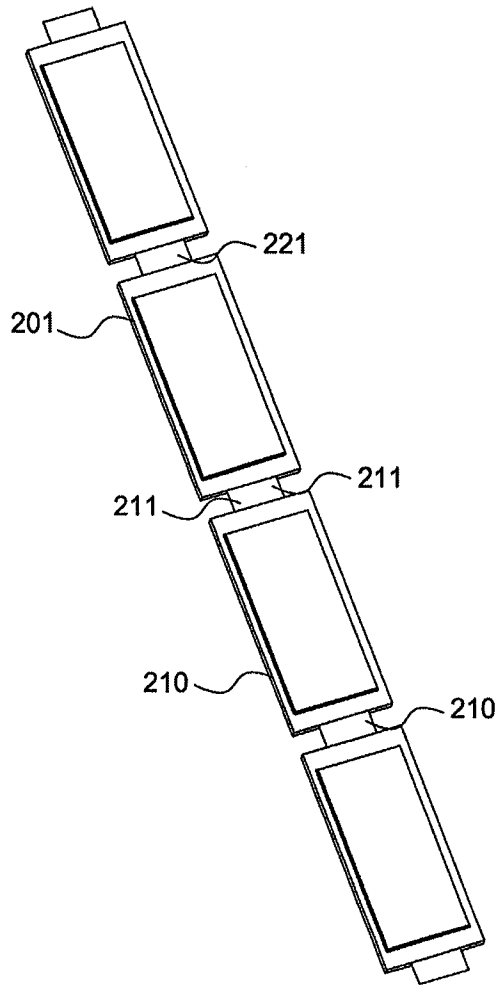


FIG. 4

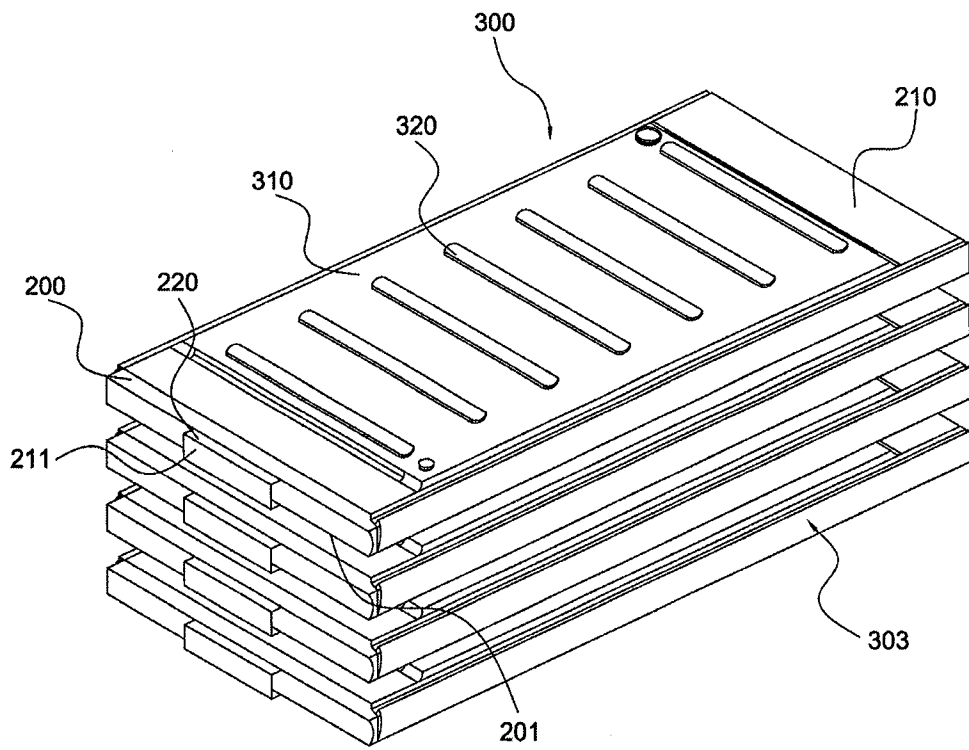


FIG. 5

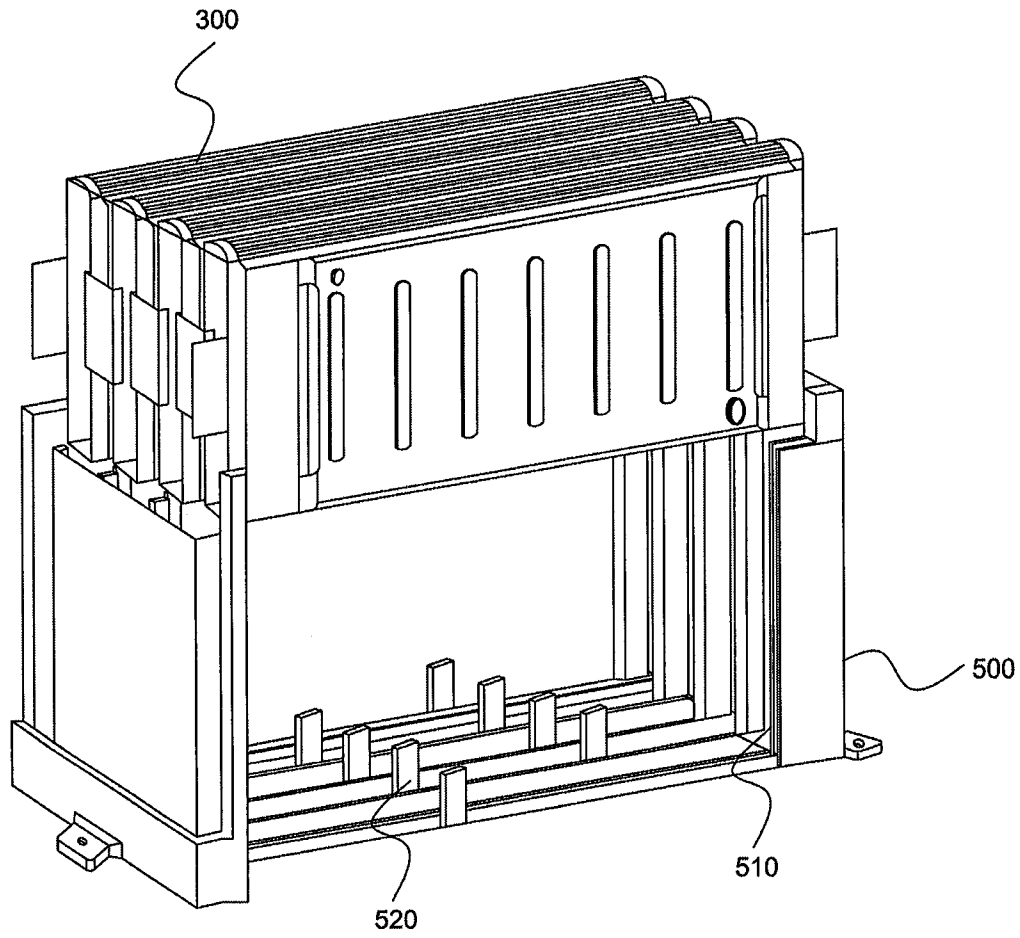


FIG. 6

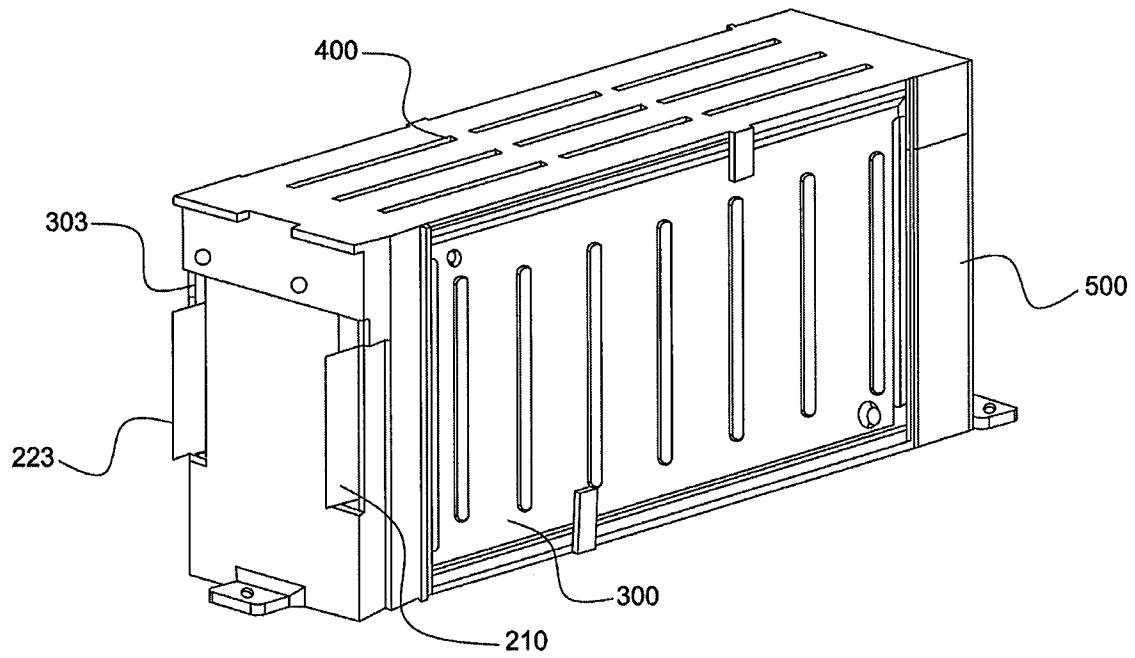


FIG. 7

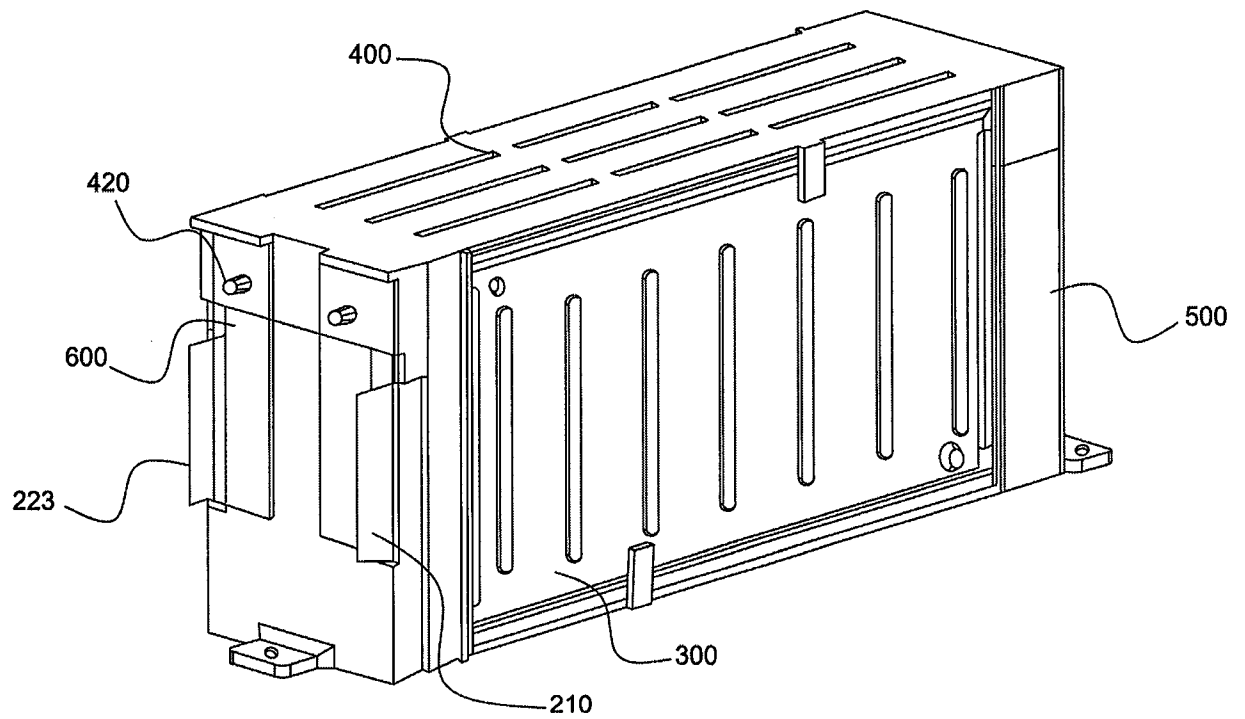


FIG. 8

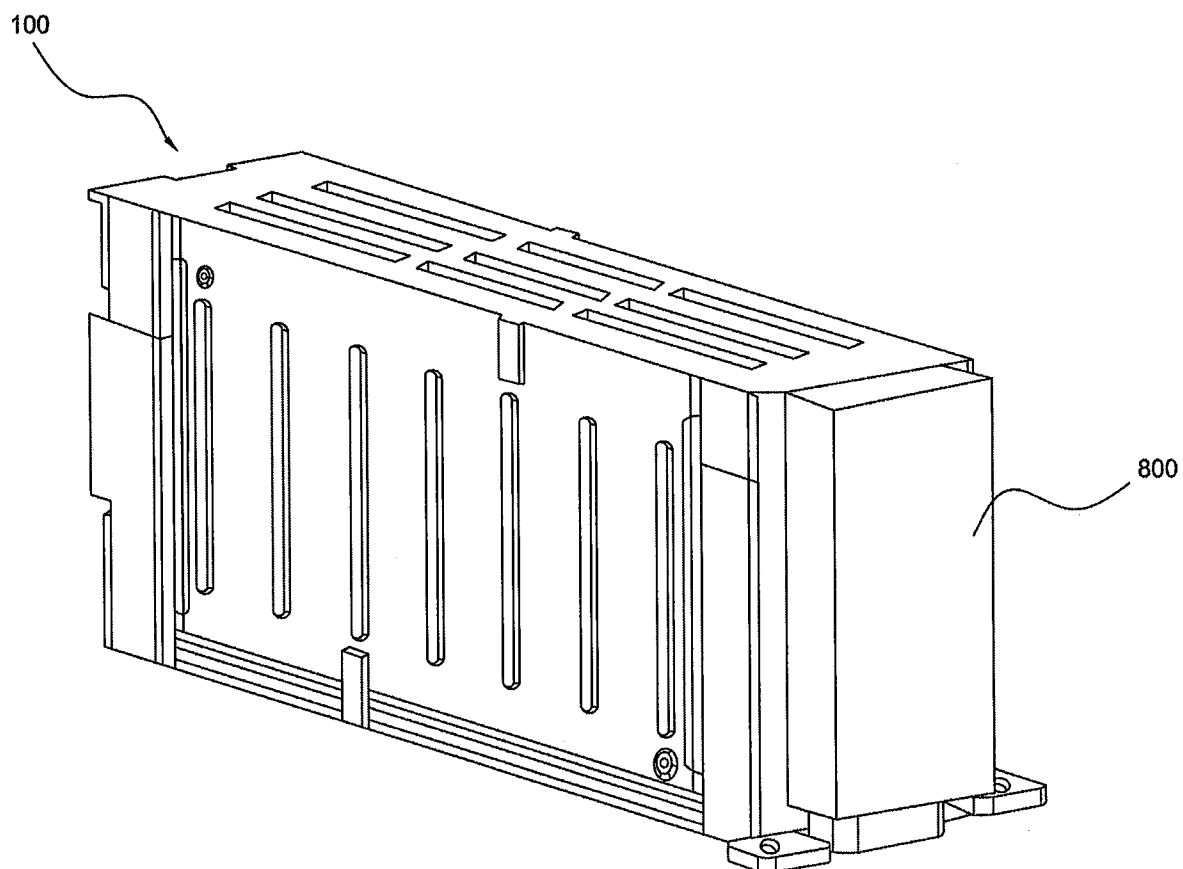
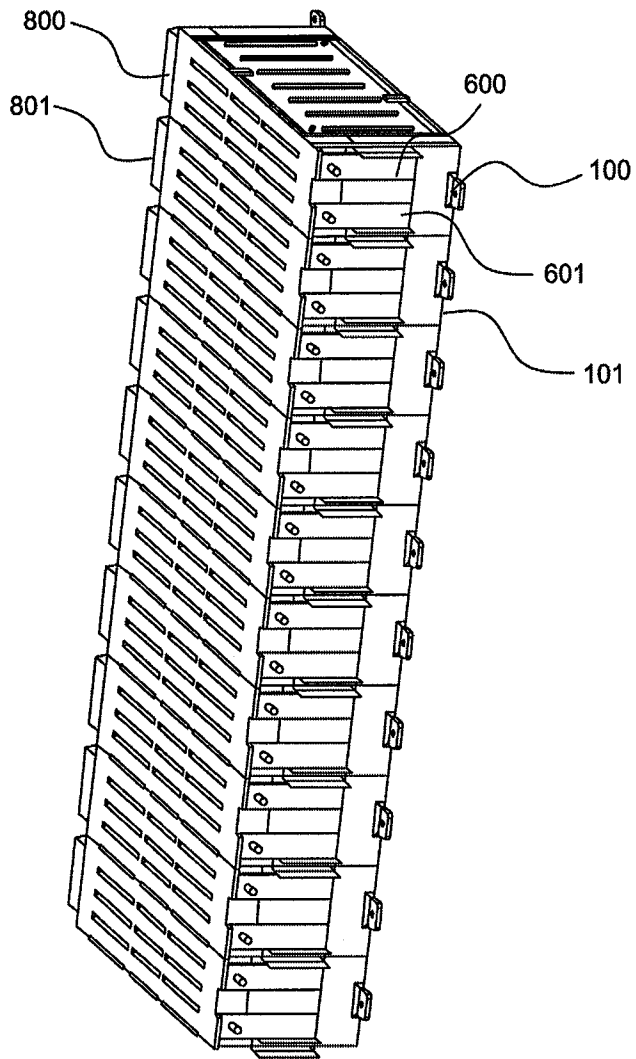


FIG. 9



A. CLASSIFICATION OF SUBJECT MATTER**H01M 2/10(2006.01)i**

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)

IPC 8 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

KR.JP : classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS (KIPO internal)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 04957829 A, (AT&T Bell Laboratories), 18 September 1990 (18.09.1990) see the abstract, figures 1 - 3, column 2 : line 5 ~ column 3 : line 31, claims 1 and 7.	1 - 13
A	US 05558950 A, (Ovonix Battery Company, Inc.), 24 September 1996 (24.09.1996) see the figures 10 ~ 12, column 9 : line 12 ~ column 9 : line 38, claim 16.	1 - 13
A	JP 17-209365 A2, (Matsushita Electric Industrial CO LTD), 04 August 2005 (04.08.2005) see the abstract, figures 2 ~ 4, 5A and 5B, paragraphs [13] ~ [18], claims 1 ~ 4.	1 - 13



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

26 JUNE 2007 (26.06.2007)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2007/001016

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