APPLICATION FOR A STANDARD PATENT

We, FURUKAWA DENCHI KABUSHIKI KAISHA and HONDA GIKEN KOGYO KABUSHIKI KAISHA, of No. 2-16-1, Hoshikawa, Hodogaya-ku, Yokohama-shi, Kanagawa ken, Japan and No. 1-1, 2-chome, Minami-aoyama, Minato-ku, Tokyo, Japan, respectively,

hereby apply for the grant of a standard patent for an invention entitled: STORAGE BATTERY, which is described in the accompanying provisional/complete specification.

Details of basic application(s):

<table>
<thead>
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<th>Number of basic application</th>
<th>Name of Convention country in which basic application was filed</th>
<th>Date of basic application</th>
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APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 15-12-87

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, of 601 St. Kilda Road, Melbourne, in the State of Victoria, 3004, Australia.

DATED this 9th day of January, 1986.

FURUKAWA DENCHI KABUSHIKI KAISHA and HONDA GIKEN KOGYO KABUSHIKI KAISHA

To: The Commissioner of Patents.
In support of the application made by HONDA GIKEN KOGYO KABUSHIKI KAISHA & FURUKAWA DENCHI KABUSHIKI KAISHA for a patent for an invention entitled STORAGE BATTERY

I/We, KAZUO NAKAGAWA of 1-29-22 Akatsuka, Itabashi-ku, Tokyo Japan, and Ryuji Morimoto of 2-8-5, Kataseyama, Fujisawa-shi, Kanagawa-ken, Japan.
do solemnly and sincerely declare as follows:

1. I/We are the applicant(s) for the patent, or am are authorised by the abovementioned applicant respectively to make this declaration on their behalf.

2. The basic application(s) as defined by Section 141 of the Act were/were made in the following country or countries on the following date(s) by the following applicant(s) namely:

   in JAPAN on 17 JANUARY 1985 by HONDA GIKEN KOGYO KABUSHIKI KAISHA & FURUKAWA DENCHI KABUSHIKI KAISHA

   in JAPAN on 25 JANUARY 1985 by HONDA GIKEN KOGYO KABUSHIKI KAISHA & FURUKAWA DENCHI KABUSHIKI KAISHA

3. The said basic application(s) were/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

4. The actual inventor(s) of the said invention is/are TOMOKAZU SHIGA, ICHIRO SANO, AKIHIRO TSUBUKI, all of Furukawa Denchi Kabushiki Kaisha, 2-16-1 Hoshikawa, Hodogaya-ku, Yokohama-shi, Kanaqawa-ken and KIMIO SHINMURA, NORITAKA KOGA, SHOJI MOTODATE, all of Honda Giken Kogyo Kabushiki Kaisha, 1-1, 2-chome, Minami-aoyama, Minato-ku, Tokyo.

5. The facts upon which the applicant(s) are entitled to make this application are as follows:

   One of the applicants Furukawa Denchi Kabushiki Kaisha, would be entitled to have assigned to it a patent granted to the inventors, Tomokazu Shiga, Ichiro Sano, and Akihiro Tsubuki, and the other of the applicants Honda Giken Kogyo Kabushiki Kaisha, would be entitled to have assigned to it a patent granted to the inventors, Kimio Shinmura, Noritaka Koga and Shoji Motodate.

DECLARED at Tokyo, Japan this 13th day of October, 1986

HONDA GIKEN KOGYO KABUSHIKI KAISHA  FURUKAWA DENCHI KABUSHIKI KAISHA

Kazuo Nakagawa  Ryuji Morimoto

Senior Managing Director:  President: Ryuji Morimoto

This form may be completed and filed after the filing of a patent
1. A storage battery comprising a plurality of cell chambers formed by partitioning the interior of a battery container with partition walls, each cell chamber forming a cell which has a negative strap interconnecting a row of tabs protruding from upper edges of negative plates thereof and a positive strap interconnecting a row of tabs protruding from upper edges of positive plates thereof, the negative strap of the cell and the positive strap of adjacent cells being interconnected through intercell connecting conductors passing through a perforation hole made through the partition wall, and one of the negative straps used for a negative terminal being provided with a negative terminal post standing upright therefrom and one of the positive straps used for a positive terminal being
provided with a positive terminal post standing upright therefrom, and a box-like battery cover applied to the battery container so that a downward peripheral side wall extending downwards from a periphery of a top wall thereof and downward partition walls partitioning the inside space of the battery cover are brought into abutment and hermetically adered to a peripheral side wall and the partition walls, respectively, of the battery container, and an upper part of the negative terminal post extending through a negative terminal mounting hole made through the top wall of the battery cover and an upper part of the positive terminal post extending through a positive terminal mounting hole made through the top wall of the battery cover provide a negative terminal and a positive terminal on respective terminal mounting surface regions of the top wall of the battery cover, wherein respective wall parts of the battery container surrounding the negative terminal post and the positive terminal post in the battery container are formed into low-level wall parts of which horizontal upper edges are lower in level than such a horizontal upper edge of such a wall part of the partition wall of the container that is located just above the perforation hole of the partition wall, and the negative and positive terminal mounting surface regions of the top wall of the battery cover are so lowered in level according to the lowering of the foregoing wall parts of the battery container that, when the battery cover is applied to the battery container, the resultant low-level horizontal negative and positive terminal mounting surface regions of the top wall thereof are lower in level than the horizontal upper edge of the wall part of the partition wall of the battery container.
5. A storage battery claimed in any one of Claims 1 to 4 wherein the battery container is provided with slant wall parts having slant upper edges between each of the two L-shaped low-level horizontal upper edges of the two L-shaped corners of the battery container and a high-level horizontal upper edge of a high-level side wall part of the peripheral side wall of the container, and the battery cover is provided with slant downward wall parts having slant lower edges between each of the two L-shaped low-level horizontal lower edges of the two downward low-level wall parts and a high-level horizontal lower edge of a high-level wall part of a high-level downward wall part of the battery cover.

6. A storage battery claimed in Claim 5, wherein the battery container is provided, in addition to the slant wall parts having the slant upper edges with a slant wall part having a slant upper edge between the low-level horizontal upper edge of the low-level wall part of the partition wall and a high-level horizontal upper edge of a high-level wall part of the same, and the battery cover is provided, in addition to the slant downward wall parts having the slant lower edges with a downward slant wall part having a slant lower edge between the low-level horizontal lower edge of the downward wall part of the partition wall and a high-level horizontal lower edge of a high-level downward wall part of the partition wall.
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Complete Specification for the invention entitled: STORAGE BATTERY.

The following statement is a full description of this invention, including the best method of performing it known to me:

PF/CPLF/2/80
This invention relates to a heat-sealed type monoblock storage battery suitably applicable to automobiles or the like.

Hitherto, there has been known a storage battery of such a type that each of the cells, that is, electrode plate assemblies are contained in cell chambers formed by partitioning the interior of a battery container by the partition walls, and each cell has a negative strap interconnecting a row of tabs protruding from upper edge of negative plates thereof. The negative strap of the cell and the positive strap of the cell contained in mutually adjacent cell chambers are interconnected through intercell connecting conductors passing through a perforation hole made through the partition wall. Each intercell connecting conductor being
composed of a horizontal base part and an ear part raised from
the horizontal base member and extending so as to face the
perforation hole of the partition wall, and the negative strap
used for a negative terminal is provided with a negative
terminal post standing upright therefrom and the positive
strap used for a positive terminal is provided with a positive
terminal post standing upright therefrom. A box-like battery
cover is applied to the battery container so that a downward
peripheral side wall extending downwards from a periphery of a
top wall thereof and downward partition walls partitioning the
inside space of the battery cover may be brought into
abuttment and be hermetically adhered to a peripheral side
wall and the partition walls, respectively, of the battery
container, and an upper part of the negative post passed
outside through a negative terminal settling hole made through
the top wall of the battery cover and an upper part of the
positive post passed outside through a positive terminal
settling hole made through the top wall thereof are formed
into a negative terminal and a positive terminal on respective
terminal settling surface regions of the top wall thereof. It
has been usual that the storage battery is provided with such
an interconnecting arrangement through the partition wall
that, as shown in Figure 1 and Figure 2, the negative strap G
and the positive strap H which interconnect respectively the
row of tabs E of the negative electrodes and the row of tabs F
of both the cells D, D contained in adjacent cells chambers C,
formed on both sides of the partition wall B partitioning
the interior of the battery container A and which are aligned
with one another on both sides of the partition wall B are
provided respectively with the respective horizontal base
parts I, I of the respective intercell connecting conductors
connected thereto so as to project therefrom horizontally and
sideways, for instance, inwards, and the respective ear parts
K, K of the intercell connecting conductors are raised
vertically upwards from the respective base parts I, I so as
to extend along and close to respective both surfaces of the
partition wall B and face each other through the perforation
hole M made in the partition wall B and are connected together through the partition hole by means of an electric welding gun apparatus is applied to the ear parts K, K, or by other desired connecting means. In the drawing, Q denotes the battery cover and R, R' denote the negative terminal and the positive terminal, respectively.

The foregoing intercell connecting arrangement is defective in that since the ear parts K, K are raised upright from the upper surfaces of the horizontal base parts I, I and the perforation hole M made in the partition wall B is located so that it is aligned with the upper portions of the ear parts K, K, standing upright from the horizontal base parts of the intercell connecting conductors, it often happens that, at the time of welding those ear parts K, K by the gun welding means, the forward ends of the welding gun P for applying to those ear parts K, K are brought into abuttment with the upper surfaces of the horizontal base parts I, I located just below. For preventing this, height h from the base part I to the perforation hole M could be increased. However, this preventive measure involves the disadvantage that the height h of the ear part K of each intercell connecting conductor from the horizontal base part I to the perforation hole M is increased, and the height of the partition wall B is liable to be increased with the increase in height h, and accordingly the height of the storage battery is liable to be increased. Therefore, the foregoing problems are desired to be solved.

Also with the foregoing type of storage battery, it has been usual that the battery container and the box-like battery cover are fused together at mutually abutted edges of their whole side peripheral walls on the same horizontal plate, and accordingly the position of the negative terminal post settling hole and that of the positive terminal post settling hole which are made in the top wall of the battery cover are located higher in level than the upper horizontal edges of the partition walls of the battery container, and accordingly such an inevitable disadvantage is resulted that a height space between each of the negative and positive
terminal straps and each of the negative and positive terminal mounting surface regions of the top wall of the battery cover is comparatively large and accordingly the height of each of the negative terminal post and the positive terminal post from each corresponding strap to each of the respective negative and positive terminal settling holes is comparatively long and consequently there is produced a comparatively large electric resistance when the electricity is taken out from the terminals thereof. Therefore the foregoing problems are desired to be solved. A purpose of this invention is to provide a storage battery free from the foregoing problems.

According to the present invention there is provided a storage battery comprising a plurality of cell chambers formed by partitioning the interior of a battery container with partition walls, each cell chamber forming a cell which has a negative strap interconnecting a row of tabs protruding from upper edges of negative plates thereof and a positive strap interconnecting a row of tabs protruding from upper edges of positive plates thereof, the negative strap of the cell and the positive strap of adjacent cells being interconnected through intercell connecting conductors passing through a perforation hole made through the partition wall, and one of the negative straps used for a negative terminal being provided with a negative terminal post standing upright therefrom and one of the positive straps used for a positive terminal being provided with a positive terminal post standing upright therefrom, and a box-like battery cover applied to the battery container so that a downward peripheral side wall extending downwards from a periphery of a top wall thereof and downward partition walls partitioning the inside space of the battery cover are brought into
abutment and hermetically adered to a peripheral side wall and the partition walls, respectively, of the battery container, and an upper part of the negative terminal post extending through a negative terminal mounting hole made through the top wall of the battery cover and an upper part of the positive terminal post extending through a positive terminal mounting hole made through the top wall of the battery cover provide a negative terminal and a positive terminal on respective terminal mounting surface regions of the top wall of the battery cover, wherein respective wall parts of the battery container surrounding the negative terminal post and the positive terminal post in the battery container are formed into low-level wall parts of which horizontal upper edges are lower in level than such a horizontal upper edge of such a wall part of the partition wall of the container that is located just above the perforation hole of the partition wall, and the negative and positive terminal mounting surface regions of the top wall of the battery cover are so lowered in level according to the lowering of the foregoing wall parts of the battery container that, when the battery cover is applied to the battery container, the resultant low-level horizontal negative and positive terminal mounting surface regions of the top wall thereof are lower in level than the horizontal upper edge of the wall part of the partition wall of the battery container.

Here, in one case, the height of the raised electric conductor is that of the intercell connecting conductor extending upwards from the strap to the perforation hole of the partition wall of the container. In another case, the height of the raised electric conductor is that of the terminal post extending upwards from the strap to the terminal settling hole of the top
wall of the battery cover.

According to one embodiment of the invention, the improvement on the foregoing conventional storage battery is that the negative strap of the cell on one side of the partition wall and the positive strap of the cell on the other side thereof are arranged in a line through the partition wall and the perforation hole made in the partition wall is so positioned as to be deviated sideways from a position which is in alignment, in the vertical direction, with the horizontal base part of each of the intercell connecting conductors connecting at their horizontal base parts to the negative strap of the cell on one side and the positive strap of the cell on the other side, respectively, and the lined up negative strap and positive strap are interconnected by the intercell connecting conductors in such a manner that the respective negative and positive ear parts raised upwardly but obliquely from the base parts and facing each other through the perforation hole are connected together by welding such as by electric welding. According to another embodiment of the invention, respective wall parts of the battery container—
surrounding the negative terminal post and the positive terminal post in the battery container are formed into low-level ones of which horizontal upper edges are lower in level than such a horizontal upper edge of such a wall part of the partition wall of the container that is located just above the perforation hole of the partition wall, and in the meanwhile the negative and positive terminal settling surface regions of the top wall of the battery cover are so lowered in level according to the lowering of the foregoing wall parts of the battery container that, when the battery cover is applied to the battery container, the resultant low-level horizontal negative and positive terminal settling surface regions of the top wall thereof are brought to be so positioned as to be lower in level than the horizontal upper edge of such a wall part of the partition wall of the battery container that has the perforation hole.

Now, some embodying examples of this invention will be explained below with reference to the accompanying drawings in which:

Figure 1 is a top plan view, partly broken away, of a conventional storage battery;

Figure 2 is a sectional view taken along the line II-II in Figure 1;

Figures 3 to 6 show one embodying example of this invention: Figure 3 is a top plan view, partly broken away, of a storage battery thereof, Figure 4 is a sectional view taken along the line IV-IV in Figure 3, Figure 5 is a sectional view taken along the line V-V in Figure 3 and Figure 6 is a sectional side view taken along the line VI-VI in Figure 3;

Figures 7 to 12 show another embodying example of this invention: Figure 7 is a top plan view of another exemplified storage battery of this invention, Figure 8 is a sectional view taken along the line VIII-VIII in Figure 7, Figure 9 is a sectional view taken along the line IX-IX in Figure 7, Figure 10 is a perspective view of a battery container of the storage battery shown in Figure 7, Figure 11
is a perspective view of an important portion of the storage battery, Figure 12 is a perspective view of a battery cover, in its turned over condition, of the storage battery;

Figures 13 to 17 show another embodying example of this invention. Figure 13 is a top plan view of another exemplified storage battery, Figure 14 is a sectional view taken along the line XIV-XIV in Figure 13, Figure 15 is a sectional view taken along the line XV-XV in Figure 13, Figure 16 is a perspective view of a battery container of the storage battery, and Figure 17 is a perspective view of a battery cover, in its turned over condition, of the storage battery;

Figures 18 to 20 show another embodying example of this invention; Figure 18 is a perspective view of another exemplified storage battery, Figure 19 is a battery container thereof from which parts of the internal cell assemblies are omitted, and Figure 20 is a perspective view of a battery cover, in its turned over condition.

Figure 3 to Figure 6 show one example of this invention for providing a storage battery in which the height of the intercell connecting conductor from the strap to the perforation hole of the partition wall of the battery container is lowered, which facilitate the welding of the intercell connecting conductors by a welding machine such as a welding gun, and also makes it possible to lower the position of the perforation hole and, as desired, to lower the height of the partition wall, result in a lower height of the storage battery.

Referring to the drawings, numeral 1 denotes a square battery container made of thermoplastic synthetic resin, and number 2 denotes a peripheral side wall, and the interior of the battery container 1 is partitioned by partition walls 4 to be formed into six cell chambers 3, and in each chamber 3 there is container a cell 5, that is, an electrode plate assembly 5 comprising negative electrode plates, positive electrode plates and separators each interposed between the adjacent negative and positive
electrode plates. On both lateral sides of the upper surface of each of the cells negative tabs 6 and positive tabs 7 projecting upwards from the upper edges of the respective negative and positive plates thereof are arranged in a row on a right side and on a left side, respectively. The row of the negative tabs 6 and the row of the positive tabs 7 are provided respectively with a negative strap 8 and a positive strap 9 interconnecting those negative tabs 6 and those positive tabs 7, respectively, and thus on both sides of each partition wall 4 the negative strap 8 and the positive strap 9 are in alignment with each other, and the negative strap 8 and the positive strap 9 which are positioned opposite to one another through each partition wall 4 are interconnected according to this embodiment in such a manner as described below.

For the sake of convenience of explanation of this invention, the manner of interconnection of only a pair of the negative strap and the positive strap will be explained as follows.

Namely, plate-shaped conductive horizontal base members 11b, 11b are so connected respectively to the negative strap 8 and the positive strap 9 on both sides of the partition wall 4 as to project horizontally sideways, for instance, inwards from the inner side of each of the straps 8, 9. According to this embodiment, a perforation hole 10 is so made through the partition wall 4 at a position which is deviated laterally inwards from a forward end of each horizontal base member 11b so that the position of the perforation hole 10 may not be in alignment with the position of the horizontal base
part 11b in the vertical direction, and plate-shaped ear parts 11a, 11a connected at their lower ends to the respective conductive base members 11b, 11b are so extended inwardly and upwardly, but obliquely, along and close to respective surface of the partition wall 4 so as to reach and face each other through the perforation hole 10. Thus, both the resultant intercell connecting conductors 11, 11 each composed of the raised ear parts 11a, 11a and the horizontal base parts 11b, 11b on both surfaces of the partition wall 4
are applied with forward end portions of an electric gun in an ordinary manner, and are pressed from outside so as to come together and be welded together through the perforation hole 10 by the electric welding thereof, and at the same time be tightened hermetically to such peripheral surface regions of the partition wall 4 that surround the perforation hole 10.

In this welding operation, due to the fact that the ear parts Ila, Ila are not extended upright just above the horizontal base parts Ilb, Ilb, the forward ends of the welding gun never contact the upper surface of the base parts Ilb, Ilb and consequently smooth and good welding work for interconnecting the cells 5, 5 through the intercell connecting conductors 11, 11 can be carried out. Another advantage is that since the perforation hole 10 is not located to be aligned with the base members Ilb, Ilb, and is deviated sideways therefrom, the vertical distance, that is the height h between the perforation hole 10 and the base member Ilb can be shortened, and by that amount the height of the partition wall 4 can be lowered, so that there can be achieved a small-sized storage battery which is smaller in height than the conventional storage battery.

Number 12 denotes a negative terminal post, number 13 denotes a positive terminal post, and number 14 denotes a square box-shaped battery cover comprising a flat top wall 15 and a downward peripheral wall 16, with the flat top wall having each short downward partition wall 17 extending from the rear surface thereof, and the battery cover 14 is fused by heating to be adhered hermetically to the battery container 1 by a conventional process, so that an upper horizontal edge of the peripheral side wall 2 thereof and the respective partition walls 4 are fused to lower edges of the downward peripheral wall 16 and the respective downward partition walls 17 of the battery cover 14. It is preferable that the horizontal base member Ilb and the ear member Ila are prepared into an integral molded intercell connecting conductor 11.
Thus, according to this embodiment in a battery of such a type that a negative strap and a positive strap are interconnected by the intercell connecting conductors through the perforation hole made in the partition wall, the perforation hole is made at a position which is deviated sideways from the forward ends of the intercell connecting conductors connected to the respective negative and positive straps so as to be in nonalignment therewith, and ear parts thereof are extended from the horizontal base parts upwardly and obliquely so as to reach the perforation hole, so that when the respective ear parts thereof on both sides of the partition wall are interconnected through the partition hole by applying an electric gun or any other welding means thereto, the forward portions of the welding means is never brought into abuttment with those horizontal base members, and a good and sufficient interconnecting of the mutually opposite straps, that is, the cells, can be achieved.

In addition, if desired, when the position of the perforation hole is lowered, the height of the partition wall can be lowered by that amount, and it is possible to make a storage battery which is shorter in height than the conventional one.

Figure 7 to Figure 12 show another embodying example of this invention in which a space between each of the negative and positive terminal settling surface regions of the top wall of the battery cover and each of the negative and positive terminal straps is shortened and accordingly the height of each of the negative and positive terminal posts from the respective straps and the respective terminal settling hole made in the top wall of the battery cover is shortened.

Namely, this embodying example is applied to the same monoblock type storage battery as that exemplified in the foregoing first embodying example, in which the square battery container 1 is made of thermoplastic synthetic resin such as polypropylene, etc, and the six cells 5 contained therein are connected in series and the negative post 12 and the positive
post 13 are located on the same one side in the respective cell chambers 3, 3, and the box-like battery cover 14 is also made of thermoplastic synthetic resin such as polypropylene, etc.

According to this embodiment, in the foregoing heat-sealed type storage battery, the battery container 1 and the battery cover 14 are constructed as described below.

Namely, a dead space S between the top wall 15, especially, each of the negative and positive terminal surface regions 15a, 15a of the top wall 15 are each of the negative and positive terminal straps 8, 9 located therebelow in the battery container 1 is shortened, and accordingly the length of each of the negative and positive terminal posts 12, 13 from their strap to those surface regions 15a, 15a is shortened, and there is produced a storage battery which is economically manufactured and has a comparatively high output as compared with the conventional one.

Namely, in more detail, for obtaining the foregoing characteristic featured storage battery, wall parts surrounding respectively negative terminal post 12 and the positive terminal post 13 are provided with cut outs which from low-level wall parts 19 of which horizontal upper edges are lower in level than horizontal upper edge 4b of the partition wall 4 that has the perforation hole 10. In the case of the illustrated storage battery in which the negative terminal post 12 and the positive terminal post 13 are so disposed in the respective cell chambers 3, 3 located at both the extreme ends of the battery container as to be biased toward both the same side corners of the battery container 1, the foregoing low-level wall parts 19 each comprise a generally L-shaped corner wall part 2a, of the square peripheral side wall 2 of the battery container 1 and end wall part 4a of the partition wall 4 located nearest to the L-shaped corner wall part 2a.
Thus, according to this embodiment the battery container 1 is provided with the low-level wall parts 19, 19 surrounding respectively the negative and positive terminal posts 12, 13 on the two corner sides thereof. In the meanwhile, the respective negative and positive terminal mounting surface regions 15a, 15a around the respective holes 18, 18 for passing through the respective terminal post 12, 13 made in respective corner portions on one side of the top wall 15 of the battery cover 14 are recessed so as to be lowered in level to match the low-level wall parts 19, 19 formed on one side of the battery container 1, to form flat horizontal low-level terminal mounting surface regions 15a, 15a. In addition, the parts of the battery cover 14 that are to face the foregoing low-level wall parts 19, 19 of the battery container 1, are extended downwards to form low-level downward wall parts 20, 20 comprising respective low-level downward corner wall parts 16a, 16a having low-level horizontal lower edges 16a₁, 16a₁ and respective low-level downward partition wall parts 17a, 17a having low-level horizontal lower edges 17a₁, 17a₁. When the battery cover 14 is applied to the battery container 1, the low-level horizontal lower edges 16a₁, 16a₁ and the low-level horizontal lower edges 17a₁, 17a₁ of the low-level downward wall parts 20, 20 abut with the correspondingly shaped upper edges 2a₁, 2a₁ and 4a₁, 4a₁ of the low-level wall parts 19, 19 of the battery container 1 at a lower level than the high-level horizontal upper edges 4b, of the partition walls 4 of the battery container.

Thus, when the foregoing battery cover 14 is applied to the foregoing battery container 1, the low-level downward wall parts 20, 20 thereof are brought into abuttment with the low-level wall parts 19, 19 of the battery container 1 and are fused together by
heating, and consequently the respective low-level terminal mounting surface regions 15a, 15a of the battery cover 14 are set at a position lower than the high-level horizontal upper edges 4b of the high-level wall parts 4b of the partition walls 4 of the battery container, so that the dead space S between the upper surface of the cell 5 and each of
the terminal settling sur.- regions 15a, 15a of the battery cover 14 can be narrowed and accordingly the height of each of the negative and positive terminal posts 12, 13 from their respective straps 8, 9 and the respective terminal settling holes 18, 18 can be shortened, and by the amount shorter terminal posts can be used, and at the same time the amount of cast lead used to form the posts can be reduced and in addition the electric resistance thereof can be decreased, while an output of the storage battery can be increased.

In general, it is designed that the positions of the holes 18, 18 may be located at almost the same level as the perforation hole 10 of the partition wall 4 or lower than the same. The perforation hole 10 is made in the partition wall 4 at such a position that is located in non-alignment with the base part 11b in the vertical direction, as explained in detail in the case of the first embodying example shown in Fig. 1 - Fig. 6, the perforation hole 10 is deviated sideways from the horizontal base part 11b, so as not to be in alignment therewith in the vertical direction, so that the foregoing various advantages can be obtained.

Numerals 12a, 13a denote respectively a negative terminal and a positive terminal formed out of the upper end portions of the terminal posts 12, 13 passing through the respective holes 18, 18 and protruding upwards outside beyond the lower-level terminal mounting surface regions 15a, 15a.

In this case, further, according to this embodiment in order to effect good and reliable heat-sealing between the battery container 1 and the battery cover 14 when they are fused together by heating under pressure,
the following arrangement is advantageous. Namely, as shown in the illustrated example, there is formed, between the low-level horizontal upper edges of each of the respective low-level wall parts 19, 19 of the battery container 1 and a high-level horizontal upper edge 2b, of the high-level peripheral side wall part 2b and the high-level horizontal upper edge 4b₁
located above the perforation hole 10 made in the high-level wall part 4b of the partition wall 4, a slant peripheral side wall part 2c and a slant partition wall part 4c which have respective slant upper edges 21, 21 connecting between the 5 low-level horizontal upper edges of the low-level wall parts 19 and respective high-level horizontal upper edges 2b, 4b. In the meanwhile, at such wall parts of the battery cover that face those slant wall parts 2c, 4c, there is formed, between the low-level horizontal lower edges of each 10 of the respective low-level downward wall parts 20, 20 each of which comprises the low-level L-shaped corner part 16a and the low-level downward partition wall part 17a, of the battery cover 14 and a high-level horizontal lower edge 16b of a high-level downward peripheral side wall part 16b and a 15 high-level horizontal lower edge 17b of a high-level downward partition wall part 17b, a slant downward peripheral side wall part 16c and a slant downward partition wall part 17c which have respectively slant lower edges 22, 22. Thus, the top wall 15 of the battery cover 14 is so formed as to have 20 respective slant wall surface regions 15c, 15c each overlying the foregoing slant downward peripheral side wall part 16c and the foregoing slant downward partition wall part 17c, between the low-level horizontal terminal settling wall surface regions 15a, 15a and high-level wall surface regions 15b 25 overlying the high-level downward partition wall 17b which are to be in abuttment with the high-level horizontal upper edges 4b of the high-level partition walls 4b of the battery container.

Thus, when the battery container 1 and the battery 30 cover 14 thus constructed as above are brought together under pressure and are fused by heating, there can be effected a strong connection between the slant upper edge 21 and the slant lower edge 22 together with the lower-level and high-level horizontal upper and lower edges, so that a good 35 and reliable heat-sealed storage battery can be obtained. In general the slant upper edges and slant lower edges are formed at the time of molding of the battery container 1 and the
battery cover 14, but those slant upper edges and slant lower edges may be formed at the time of fusion adhesion between the battery container 1 and the battery cover 14 by applying a heating plate having slant surfaces for forming those slant upper edges and slant lower edges, to the upper surface of the battery container 1 and the lower surface of the battery cover 14. The practical and effective inclination degrees of the slant upper edge or the slant lower edge is at the maximum up to 85 degrees in relation to the horizontal plane. In addition, a straight, stepped, curved, such as, arc or other desired shape, can be used for the shape of the slant upper or lower edge.

In addition, in the illustrated example, there is formed a protecting annular rib 23 integrally about the whole of the periphery of the upper portion of the peripheral side wall 2 of the battery container 1 and, there is formed, by integral molding, around and outside the whole of the periphery of the downward peripheral side wall 16 of the battery cover 14, a downward extended peripheral protecting outer wall 24 which extending downwards beyond the lower end of the downward peripheral side wall 16 and faces the foregoing annular rib 23 of the battery container 1, and thus, by the downward extended peripheral outer wall 24 the peripheral heat-sealed region formed between the upper edge of the peripheral side wall 2 of the container 1 and the lower edge of the downward peripheral side wall 16 of the cover 14 can be protected and covered, and thereby there can be obtained the storage battery which is good in appearance.

Numeral 25 denotes a tubular filling opening for each cell chamber, which is made in the middle region of the top wall 15 of the battery cover 14, and a filling plug 27 having a vent opening 26 in the center thereof is applied thereto, so that the storage battery is formed into an open-type storage battery.

Figure 13 to Figure 17 show a further another embodying example of this invention. In this example, also, the basic construction thereof is the same as that of the
foregoing examples and the battery container 1 is provided with the low-level wall parts 19, 19 enclosing respective terminal post 12, 13 and, in the meanwhile, the battery cover 14 is provided with the low-level terminal mounting surface regions 15a, 15a, the low-level downward parts 20, 20 the high-level surface region 15b and the slant surface regions 15c, 15c. This modified example, however, is different from the foregoing examples in such a construction that the peripheral wall 2 of the battery container 1 does not include the slant peripheral side wall parts 2c, 2c having the slant upper edges 21, 21 and the high level peripheral wall parts 2b, which are provided in the foregoing examples, so that the whole of the peripheral side wall 2 thereof is formed into a low-level peripheral side wall part 2a' having a low-level horizontal upper edge 2a that is continued to and on a level with the low-level horizontal upper edges 2a of the low-level corner wall parts 2a, 2a of the low-level wall parts 19, 19 and thus the whole peripheral inside wall 2 is formed as a wholly low-level peripheral side wall 2' having a wholly low-level horizontal upper edge 2a'. In addition, every partition wall 4 is so formed that both end wall parts thereof may be low-level end wall parts 4d, 4d having low-level horizontal upper edges 4d, 4d which are on a level with the wholly low-level peripheral side wall 2', and thereby welding work by the welding gun or the like can be facilitated at the time of such a welding operation that the ear parts 11a, 11a of the intercell connecting conductors 11, 11 are interconnected through the perforation hole 10 made in every partition wall 4 by means of applying
the welding gun or the like to those ear parts 11a, 11a. In addition, every partition wall 4 is provided with slant wall parts 4c, 4c having slant upper edges 21, 21 between the high-level wall part 4b having the perforation hole 10 and each of both the end wall parts 4d, 4d in order to carry out the same effect as mentioned above.
In the meanwhile, the basic construction of the battery cover 14 of the modified example is the same as that of the foregoing example in that the cover 14 is provided with the low-level downward wall parts 20, 20 but the modified example is different from the foregoing examples in such a construction that, in order to face the upper edges of the wholly low-level peripheral side wall of the foregoing battery container 1, the whole of the downward peripheral side wall 16 is lowered to be formed into such a wholly low-level downward peripheral side wall 16' that comprises low-level downward corner wall parts 16a, 16a having low-level horizontal lower edges 16a1, 16a1 continued to and on a level with the low-level lower edges 16a1, 16a1 of those lower-level downward corner wall parts 16a, 16a so that the wholly low-level downward peripheral side wall 16' may be brought into abuttment with the wholly low-level horizontal upper edges 2a1, 2a1 and 2a1 of the wholly low-level peripheral side wall 2' of the battery container 1 and may be fused by heating and, in addition, each of the downward partition walls 17 is so formed at its both end wall parts as to be provided with such low-level downward both end wall parts 17d, 17d having low-level horizontal lower edges 17d1, 17d1 that are to be brought into abuttment with the low-level both end wall parts 4d, 4d of each corresponding partition wall 4 of the battery container 1 and are to be fused by heating to be adhered together. In addition, each of the downward partition walls 17 is so provided with slant downward wall parts 17c, 17c having slant lower edges 22, 22 between the high-level horizontal lower edges 17b1 of the high-level downward partition wall parts 17b and each of the low-level horizontal lower edges 17d1, 17d1 of the low-level both end partition wall parts 17d, 17d so that those slant downward wall parts 17c, 17c may be brought into abuttment with those slant upper edges 21, 21 of the slant wall parts 4c, 4c of each corresponding partition wall 4 of the battery container 1.
Further, each of the low-level downward both end wall parts 17a, 17a on either one side of each of the downward partition walls 17 of the battery cover 14 is provided with such a pair of communication walls 29 having a U-shaped groove 28 therebetween that extend downwardly from the rear surface of the battery cover 14 and at right angles with the end wall part 17d, and a single common vent tube 30 which is in communication with the outside of the storage battery is so provided on the inside of the intermediate cell chamber 3 as to be located at the rear surface of the top wall 15 of the battery cover 14 and on the other side opposite to the place where a row of the U-shaped grooves 28 is located.

Numeral 31 denotes a ceramic filter interposed in the vent tube 30. Each of respective tubular filling opening 25 which are made open to the center of the interview of each of the respective cell chambers 3 of the battery cover 14 has such a closure 32 mounted therein that is applied thereto after electrolyte has been poured into each of the cell chambers 3 of the storage battery. Thus, the illustrated storage battery is constructed into a maintenance-free sealed storage battery in which the electrode assembly, that is, the cell 5 in each of the cell chambers 3 holds a predetermined amount of the electrolyte impregnated therein.

Figure 18 to Figure 20 show a further embodying example of this invention. The interior of the battery container 1 is divided by the partition walls 4 crossed with each other longitudinally and laterally so that two rows of three cell chambers 3 may be formed in parallel to each other, and the electrode assemblies, that is, the cells 5 contained in the respective cell chambers 3 are connected with each other in series, and the negative terminal post 12 and the positive terminal post 13 are protruded upwards from the two cell chambers 3, 3, arranged side by side in the lateral direction, that is, along the lateral side wall of the battery container 1. And, this invention is applied to the maintenance-free sealed storage battery of the foregoing arrangement type. In this embodying example, only the
L-shaped corner wall parts surrounding the negative terminal post 12 and the positive terminal post 13 respectively, are formed into low-level wall parts 19 having L-shaped horizontal upper edges 2a₁, 2a₁ which are so low as to be on a level with the level of the perforation hole 10 of the partition wall 4. Each partition wall 4 comprises a wholly high-level partition wall 4b' having a high-level horizontal upper edge 4b₁' along the whole length of the partition wall 4. The height of level of the wholly high-level partition wall 4b' is the same as that of the high-level horizontal upper edge 2b₁ of the high-level peripheral side wall part 2b of the battery container 1. In the meanwhile, the battery cover 14 is so formed that each of all the downward partition walls 17 which are to face all of the high-level partition walls 4 may be formed into a wholly high-level downward partition wall 17b' having a high-level horizontal upper edge 17b₁' along the whole length of the downward partition wall 17, and that two L-shaped corner wall parts of the downward peripheral wall 16 thereof which are to face the two L-shaped low-level wall parts 19 of the battery container 1 are formed into low-level downward wall parts 20. The battery container 1 is, in addition, provided with slant upper edges 21, 21 formed between the high-level horizontal upper edge 2b₁ of the high-level peripheral side wall parts 2b and each of the low-level horizontal upper edges 2a₁, 2a₁ of the L-shaped low-level wall parts 19 thereof, in order to interconnect those. In the meanwhile, the battery cover 14 is provided with slant downward peripheral wall parts 16c having slant downward edges 22 formed between the L-shaped low-level horizontal lower edge 16a₁ of each of the low-level
downward wall parts 15a, 16a and the high-level horizontal lower edge 16b₁ of each of the high-level downward wall parts 16b.

The intermediate surface regions 15c, 15c interconnecting the high-level horizontal surface region 15b and each of the lower-level horizontal negative and positive terminal mounting surface regions 15a, 15a are not always slant ones, but may be vertical ones as clearly
shown in Figures 18 and 20. Thus, according to this embodiment wall parts of the battery container which surround respectively the negative terminal post and the positive terminal post which stand upright in the cell chambers of the battery container are lowered in level to be formed into low-level wall parts edges 21 formed between each end of the low-level horizontal upper edges 2a₁ of the L-shaped lower-level wall parts 19 of the peripheral side wall 2 thereof and a high-level horizontal upper edges 2b₁ of a high-level wall parts 2b thereof, and, in the meanwhile, the battery cover 14 is provided with slant downward wall parts 16c having slant edges 22, which are to be in abuttment with the foregoing slant edges 21 of the battery container 1, between the each of low-level horizontal lower edges 16a₁ of the low-level wall parts 16a of the downward peripheral side wall 16 thereof and high-level horizontal lower edges 16b₁ of high-level downward wall parts 16b thereof, and thereby the abuttment and heat sealing between the battery container 1 and the battery cover 14 can be obtained in good hermetical sealed condition, and production of a good heat-sealed storage battery can be assured.

Thus, according to the preferred embodiments a position of a perforation hole made in a partition wall of a battery container is so deviated sideways from each of horizontal base parts of a intercell connecting conductors connected to respective negative and positive straps of the cells on both sides of the partition wall as not be to in alignment therewith in the vertical direction, a welding operation for interconnecting the adjacent cells through their interconnecting conductors passing through the perforation hole can be carried out smoothly and without any fear that the forward ends of a welding apparatus does not contact the upper surfaces of the horizontal base parts of the intercell conductors, and also the level of the perforation hole can be lowered without necessity of heightening the partition wall,
so that the height of the storage battery can be kept comparative low or lower than the conventional storage battery.

Further, according to the preferred embodiments, the container is lowered in level and according to this lowering thereof a battery cover is partly or wholly lowered at least wall parts thereof surrounding the negative terminal post and the positive terminal post, respective terminal settling wall area regions of a top wall of the battery cover applied to the battery container can be lowered, and the height of those terminal posts from their straps to the terminal settling holes made in the top wall can be shortened, so that shorter terminal posts having less electric resistance can be used and a better storage battery can be obtained at a reduced manufacturing cost.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A storage battery comprising a plurality of cell chambers formed by partitioning the interior of a battery container with partition walls, each cell chamber forming a cell which has a negative strap interconnecting a row of tabs protruding from upper edges of negative plates thereof and a positive strap interconnecting a row of tabs protruding from upper edges of positive plates thereof, the negative strap of the cell and the positive strap of adjacent cells being interconnected through intercell connecting conductors passing through a perforation hole made through the partition wall, and one of the negative straps used for a negative terminal being provided with a negative terminal post standing upright therefrom and one of the positive straps used for a positive terminal being provided with a positive terminal post standing upright therefrom, and a box-like battery cover applied to the battery container so that a downward peripheral side wall extending downwards from a periphery of a top wall thereof and downward partition walls partitioning the inside space of the battery cover are brought into abutment and hermetically adhered to a peripheral side wall and the partition walls, respectively, of the battery container, and an upper part of the negative terminal post extending through a negative terminal mounting hole made through the top wall of the battery cover and an upper part of the positive terminal post extending through a positive terminal mounting hole made through the top wall of the battery cover provide a negative terminal and a positive terminal on respective terminal mounting surface regions of the top wall of the battery cover, wherein respective wall parts of the battery container surrounding the negative
terminal post and the positive terminal post in the battery container are formed into low-level wall parts of which horizontal upper edges are lower in level than such a horizontal upper edge of such a wall part of the partition wall of the container that is located just above the perforation hole of the partition wall, and the negative and positive terminal mounting surface regions of the top wall of the battery cover are so lowered in level according to the lowering of the foregoing wall parts of the battery container that, when the battery cover is applied to the battery container, the resultant low-level horizontal negative and positive terminal mounting surface regions of the top wall thereof are lower in level than the horizontal upper edge of the wall part of the partition wall of the battery container.

2. A storage battery claimed in Claim 1, wherein the battery cover is provided with low-level downward wall parts which surround respectively the negative terminal post and the positive terminal post when the cover is applied to the container, so that low-level horizontal lower edges of the low-level downward wall parts are brought into abutment with and hermetically adhered to low-level horizontal upper edges of the low-level wall parts of the battery container.

3. A storage battery claimed in Claim 1, wherein the low-level wall parts comprise two L-shaped corner parts of the battery container.

4. A storage battery claimed in Claim 2, wherein the low-level downward wall parts of the battery cover comprise two L-shaped corners of the downward peripheral side wall of the battery cover.
5. A storage battery claimed in any one of Claims 1 to 4 wherein the battery container is provided with slant wall parts having slant upper edges between each of the two L-shaped low-level horizontal upper edges of the two L-shaped corners of the battery container and a high-level horizontal upper edge of a high-level side wall part of the peripheral side wall of the container, and the battery cover is provided with slant downward wall parts having slant lower edges between each of the two L-shaped low-level horizontal lower edges of the two downward low-level wall parts and a high-level horizontal lower edge of a high-level wall part of a high-level downward wall part of the battery cover.

6. A storage battery claimed in Claim 5, wherein the battery container is provided, in addition to the slant wall parts having the slant upper edges with a slant wall part having a slant upper edge between the low-level horizontal upper edge of the low-level wall part of the partition wall and a high-level horizontal upper edge of a high-level wall part of the same, and the battery cover is provided, in addition to the slant downward wall parts having the slant lower edges with a downward slant wall part having a slant lower edge between the low-level horizontal lower edge of the downward wall part of the partition wall and a high-level horizontal lower edge of a high-level downward wall part of the partition wall.

7. A storage battery claimed in Claim 1, wherein the peripheral wall of the battery container is formed into a wholly low-level peripheral wall which is wholly lower in level than a high-level horizontal upper edge of a high-level wall part of the partition wall that is provided with the perforation hole, and each of the
partition walls of the battery container is so formed that both end wall parts thereof have such low-level horizontal upper edges that are as low in level as the low level horizontal upper edge of the wholly low-level peripheral wall, and each partition wall is provided with slant wall parts having slant upper edges connecting between the high-level horizontal upper edge of the high-level middle wall part thereof and each of the low-level horizontal upper edges of the low-level end wall parts thereof, a downward peripheral wall of the batter cover is formed into a wholly low-level downward peripheral wall having a wholly low-level horizontal lower edge which is to be abutted with the wholly low-level upper edge of the peripheral wall of the battery container, and each of the downward partition walls of the battery cover is formed into a high-level middle wall part having a high-level horizontal lower edge, low-level end wall parts having low-level horizontal lower edges and slant wall parts having slant lower edges each connecting between the high-level horizontal lower edge of the high-level middle wall part and the low-level horizontal lower edge of the low-level end wall parts of each partition wall.

8. A storage battery substantially as hereinbefore described with reference to Figures 3 to 6, or 7 to 12 or 13 to 17 or 18 to 20 of the accompanying drawings.

Dated this 4th day of December, 1987
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