United States Patent

[11] 3,615,864

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[21] Appl. No. 883,552
[22] Filed Dec. 9, 1969
[45] Patented Oct. 26, 1971
[73] Assignee ESB Incorporated

[54] **BATTERY HAVING JOINT FOR PREVENTING CONTAINER DISTORTION**
2 Claims, 5 Drawing Figs.

[52] U.S. Cl. 136/134, 136/166
[51] Int. Cl. H01m 5/00, H01m 1/00
[50] Field of Search 136/79, 80, 81, 134, 166

[56] References Cited

UNITED STATES PATENTS

1,958,186	5/1934	Dietrich	136/134
2,205,992	6/1940	Phillips	136/81
3,364,076	1/1968	Buttke et al.	136/134
3,519,489	7/1970	Port	136/134

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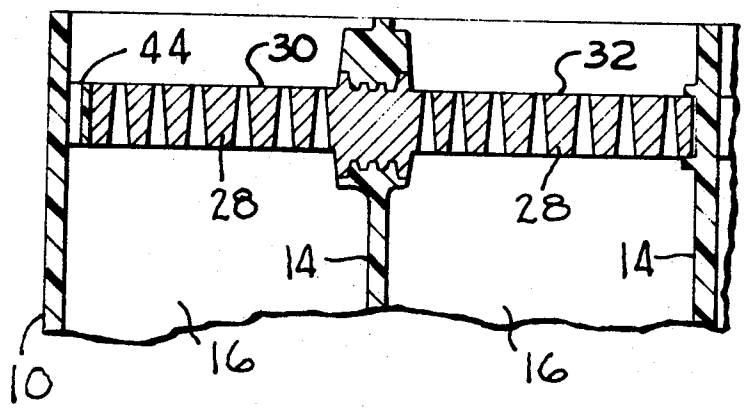
ABSTRACT: A multicell battery having intercell strap connectors around which the partitions are molded has joints integrally molded with and extending from the partitions and end walls of the container and also joined to the ends of the intercell strap connectors. The joints permit lateral movement of the ends of the intercell strap connectors with respect to the container, and thus prevent distortion of the container as the container and intercell strap connectors shrink or expand by unequal amounts.



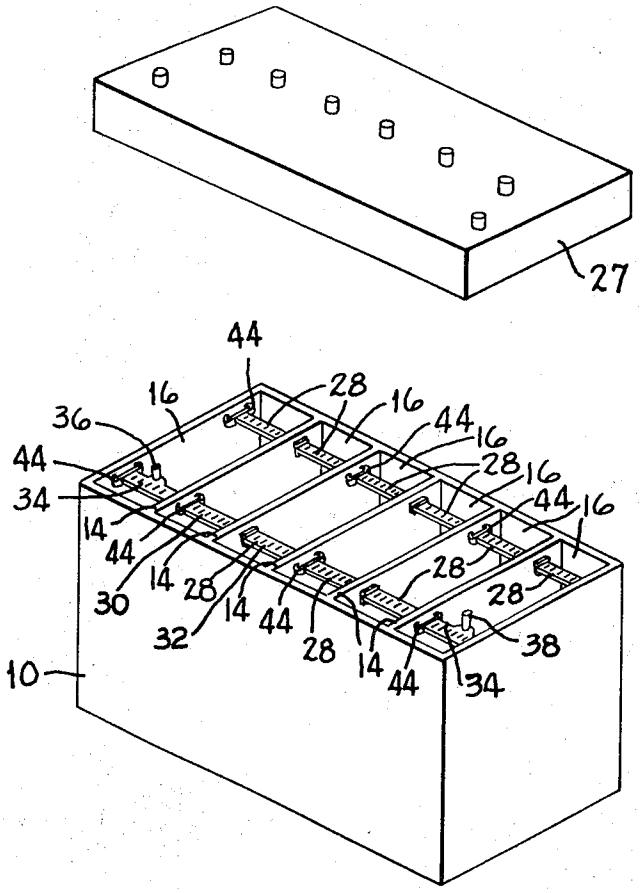


Fig.1

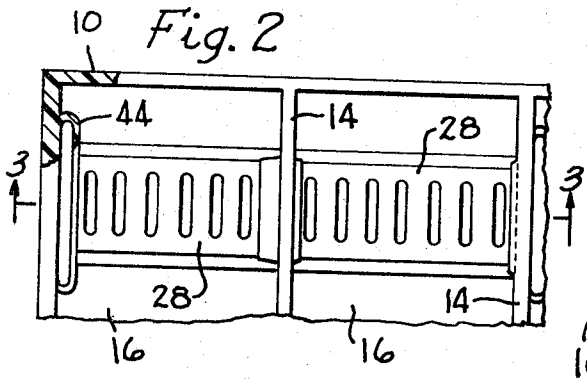


Fig. 2

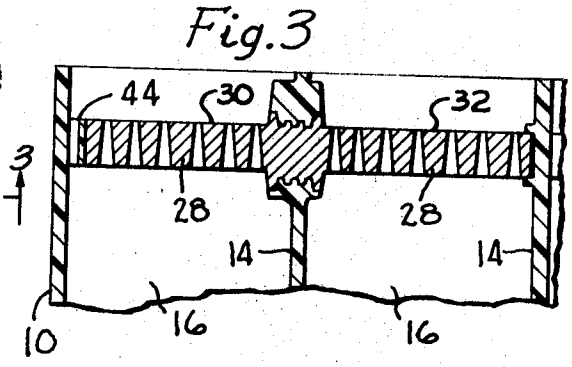


Fig.3

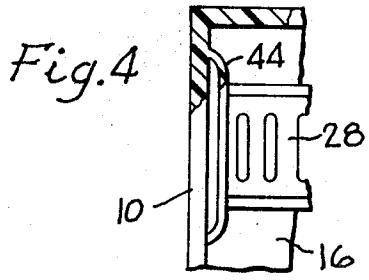


Fig.4

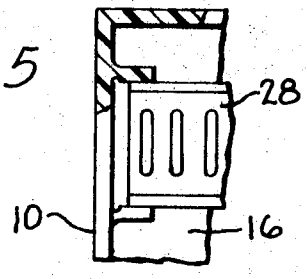


Fig.5

BATTERY HAVING JOINT FOR PREVENTING CONTAINER DISTORTION

"This application is related to inventions described in U.S. Pat. No. 3,519,489 and 3,514,342."

BACKGROUND OF THE INVENTION

The batteries described in the cross-referenced patents have intercell strap connectors around which the container partitions are molded. To increase vibration resistance the ends of the intercell strap connectors are preferably restrained by anchors in the container's partitions or end walls. When the hot containers are taken from the molds in which they were made and allowed to cool, the shrinkage in the container is by a greater amount than is the shrinkage in the intercell strap connectors. Because the anchors were fixed with respect to both the ends of the intercell strap connectors and the container, there could be no relative lateral movement of the ends of the intercell strap connectors with respect to the container, and the result was distortion in the container when the container was cooling.

SUMMARY OF THE INVENTION

With this invention the anchors also act as joints to permit relative lateral movement of the ends of the intercell strap connectors with respect to the containers. To achieve this the anchors are integrally molded with and extend from the partitions and end walls of the container and are also joined to the ends of the intercell connectors. The anchors may either be constructed so as to flex in the direction of the axis of the intercell strap connectors or to allow slipping of the end of the intercell strap connector in the anchor in that direction. The anchors prevent or restrict vertical movement of the intercell strap connectors.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of a six cell battery having joints made according to the present invention. The container partitions have been molded around the intercell strap connectors. A cover is shown separate from the container. The electrodes and separators which are a part of the battery have been omitted from FIG. 1 to simplify the figure and make it more understandable.

FIG. 2 is a top view of a portion of the battery container showing an intercell strap connector molded through the partition and showing a flexible joint integrally molded with and extending from a partition and being joined to one end of the intercell strap connector.

FIG. 3 is a sectional elevation taken along the line 3–3 of FIG. 2.

FIG. 4 shows a flexible joint which is an alternative to the one shown in FIG. 2.

FIG. 5 shows a slip joint integrally molded with and extending from a partition. The end of the intercell strap connector may slip laterally with respect to this joint.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a container 10 having partitions 14 which divide its interior space into cell compartments 16. The two cross-referenced patents listed above each describe a battery having a container in two portions, and the present FIG. 1 is representative of the container of either of the cross-referenced patents after its two portions have been sealed together. While a stack including alternately spaced positive electrodes and negative electrodes (and usually also including separators between adjacent electrodes) would be placed into each cell compartment 16 before the two portions of the container are sealed together, these components have been omitted from the drawings to simplify the drawings and to permit them to focus more clearly on the present invention. The electrodes and separators may be assumed to be present in the battery container shown in the drawings. Also shown in FIG. 1 is a cover 27 for the container.

As FIG. 1 shows, the battery also has two types of strap connectors to which the electrodes in the stacks are connected. The first is an intercell strap connector 28 which extends through the partitions 14 of the container and has a positive end 30 in one cell compartment 16 and a negative end 32 in the adjacent cell compartment. For purposes of this application the intercell strap connectors 28 will be assumed to be inserts around which the partitions 14 are molded. The other type of strap connector, to be referred to as an end cell strap connector 34, occurs only in the two end cell compartments; in one end cell compartment the strap connector 34 is connected to the positive electrodes in the stack in that compartment, while the strap connector 34 in the other cell compartment is connected to the negative electrodes.

FIG. 1 also shows positive and negative terminals 36 and 38 which in the finally assembled battery would extend from the positive and negative end cell strap connectors respectively to the exterior of the covered container.

FIGS. 2 and 3 also show an anchor 44 which is integrally molded with and extends from a partition. The anchors 44 may also be integrally molded with and extend from the end walls of the container as well as the partitions. The purpose of the anchors is to increase the vibration resistance of the battery by preventing the ends of the intercell strap connectors from vibrating vertically within the container.

The cooling which occurs after the hot containers are removed from the molds in which they were made produces a shrinkage in the container which may, for example, be approximately 0.016 inch. Over the length of a battery container approximately 10 inches long, this means a shrinkage of about 0.16 inch, or about five thirty-seconds inch. The intercell strap connectors are typically made from lead or an alloy thereof and do not shrink nearly so much. The result, if the ends of the intercell strap connectors are fixed with respect to the container, is a distortion in the container which, among other disadvantages, makes it difficult to seal an undistorted cover onto the container.

The present invention consists of constructing the anchors 44 in such a way that they will permit lateral movement of the ends of the intercell strap connectors with respect to the partitions (i.e., permit movement of the ends in a direction parallel to the axis of the intercell strap connector). This construction will permit expansion or shrinkage of the container without resulting in excessive distortion in the container. This desired result may be achieved by constructing the anchors so that they either flex or permit the ends of the intercell strap connectors to slip within the joints.

FIG. 2 and 4 show alternative constructions of joints or anchors which flex; the ends of the intercell strap connectors are fixed with respect to the portions of the anchors or joints in immediate contact with them, but are moveable with respect to the container's partition and end walls. FIG. 5 shows a joint or anchor in which the anchors or joints do not flex but instead permit slippage of the ends of the intercell strap connectors. Any of these constructions will achieve the desired result of eliminating container distortion resulting from unequal shrinkage or expansion of the container and intercell strap connectors.

The anchors or joints 44 may be provided at both ends of an intercell strap connector if desired, and such a construction minimizes the container distortion. However, since it is common to include one more negative electrode than positive electrode in each stack, the end of the strap connector to which the negative electrodes are connected may require one more connecting slot than the opposite end of the strap connector in the adjacent cell compartment, with the result that the scarcity of space at the negative end of the strap connector may preclude a joint there. In such a case a joint may be provided only at the positive end of the strap connector; such a construction is shown in FIG. 2 and 3.

The end cell strap connectors in the two end cells may also be provided with joints, and the joints may be at either one or both ends of an end cell strap connector. While the joints

joined to the end cell strap connectors must be integrally molded with and extend from the battery's container, they may be connected to and extend from either the partitions or the inside surface of the end wall, or both.

While the unequal changes in lengths of the container and intercell strap connector resulting from temperature changes are usually greatest when the freshly molded container is cooling, similar if lesser unequal changes may also occur at other times, such as when the electrodes are joined to the intercell strap connectors (an event which may produce more expansion in the strap connectors than in the container) as well as in ordinary use of the battery in an automobile. Also, by removing the ends of the intercell strap connectors from immediate contact with the main portion of the container partitions or end walls there is less likelihood for damage by heat transfer to the container when the electrodes are connected to the straps.

I claim:

1. A multicell battery comprising:

a. a covered container having at least one partition dividing the space inside the container into multiple cell compartments,

b. an intercell strap connector extending through each partition, the partition being molded around the intercell strap connector,

c. a stack including alternately spaced positive and negative electrodes in each cell compartment, one end of each intercell strap connector being connected to the positive electrodes in the stack in one cell compartment and the other end of each intercell strap connector being connected to the negative electrodes in the stack in the adjacent cell compartment,

d. an end-cell-connecting strap in each end cell compartment, one end-cell-connecting strap being connected to the positive electrodes of the stack in its end cell compartment and the other end-cell-connecting strap being connected to the negative electrodes of the stack in its end cell compartment, and

e. a pair of terminals, one extending from the positive end cell strap connector in one end cell to the exterior of the covered container and the other extending from the negative end cell strap connector in the other end cell to the exterior of the covered container, wherein the improvement comprises a joint integrally molded with the container, the joint having a first portion which is in contact with and is fixed with respect to the end of the intercell strap connector, the joint also having means between the first portion and the container which means flex and permit relative lateral movement of the end of the intercell strap connector with respect to the container.

2. A multicell battery comprising

a. a covered container having at least one partition dividing the space inside the container into multiple cell compartments,

b. an intercell strap connector extending through each partition, the partition being molded around the intercell strap connector,

c. a stack including alternately spaced positive and negative electrodes in each cell compartment, one end of each intercell strap connector being connected to the positive electrodes in the stack in one cell compartment and the other end of each intercell strap connector being connected to the negative electrodes in the stack in the adjacent cell compartment,

d. an end-cell-connecting strap in each end cell compartment, one end-cell-connecting strap being connected to the positive electrodes of the stack in its end cell compartment and the other end-cell-connecting strap being connected to the negative electrodes of the stack and its end cell compartment, and

e. a pair of terminals, one extending from the positive end cell strap connector in one end cell to the exterior of the covered container and the other extending from the negative end cell strap connector in the other end cell to the exterior of the covered container, wherein the improvement comprises a joint integrally molded with the container and being joined to one end of an intercell strap connector, the joint having means which project outwardly from the container and which permit relative lateral movement of the end of the intercell strap connector with respect to the container.

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