

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Battery Assemblies

We, UNION CARBIDE CORPORATION, of 270, Park Avenue, New York, State of New York, United States of America, a Corporation organised under the laws of the State of New York, United States of America, (Assignee of ROBERT DALE SIMONTON), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to battery assemblies, and more particularly, it relates to a battery having a wrapper or jacket which offers marked economies in production and provides improved volumetric efficiency.

The present invention seeks to provide an economically packaged battery assembly exhibiting improved volumetric efficiency which can withstand abusive handling and is particularly well adapted for manual or mechanized production and is capable of accommodating the tolerance variation in cell diameters of the battery cells.

The invention also seeks to provide a battery assembly having means for providing an intermediate voltage.

Accordingly, the present invention provides a battery assembly which comprises at least one cylindrical cell disposed within a longitudinally slit tubular resilient jacket having a diameter smaller than the diameter of the cylindrical cell.

The present invention also provides a method for producing the battery assembly, which comprises cutting the jacket to size from a flat sheet material, shaping the flat cut sheet into a longitudinally slit tubular jacket having a diameter smaller than the diameter of the cell or cells, disposing said cell or cells within the slit tubular jacket while maintaining said slit jacket in the open position, and releasing the jacket which maintains the cell or cells under a radial pressure.

The present invention will be further de-

scribed by way of example with reference to the accompanying drawings in which:

Figure 1 is a vertical partially sectioned view of a battery assembly utilizing the principles of the invention;

Figure 2 is a perspective view of parts of the battery of Figure 1, showing details of the construction;

Figure 3 is an enlarged fragmentary detailed sectional view taken along plane 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary detailed view of the end terminal closure of the battery; and

Figure 5 is a perspective view of a modification of the battery assembly shown in Figures 1 and 2.

Referring now to the accompanying drawings, and particularly to Figures 1, 2, 3 and 4, there is shown one form of the battery assembly according to the invention. A plurality of cells 10, suitably alkaline cells and having negative electrodes 12, are encased within a jacket 14 having a longitudinal slit or gap 16. The upper end 18 of the jacket 14 is suitably closed with a positive terminal cover 20 and the lower end 22 is suitably closed with a negative terminal cover 24. A contact spring 26 is preferably located between the negative electrode 12 of an adjacent cell 10 and the negative terminal cover 24. An insulating washer 27 is positioned between the same cell 10 and the negative terminal cover 24.

As best shown in Figures 3 and 4, an insulator 28 is suitably provided between the inside wall 30 of the jacket 14 and the cells 10. The ends 18 and 22 of the jacket 14 are curled over the end terminal covers 20 and 24 as at 32 in Figures 1 and 4. The peripheral portion 34 of each end terminal cover 20 and 24 is preferably bent back on itself 180 degrees in the form of an inverted U so that no sharp rim or edge is in contact with the insulator 28 and precludes the raw edge 36 of the cover from cutting through the insulator

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28 and shorting out the battery.

In the fabrication of a battery in accordance with the present invention, the jacket 14 is cut to size from sheet material, such as a synthetic plastic material or a metal such as steel, copper, aluminium or their alloys. The jacket 14 is formed into a tubular shape by any of numerous manufacturing methods such as by forcing it against a rubber covered roller or mandrel. The original jacket inside diameter for a particular battery of cells should be smaller than the outside diameter of the individual cells. This is suitably accomplished by permitting the jacket edges to overlap after forming.

Prior to forming the jacket 14, the insulator 28 is suitably laminated thereon by an adhesive or by heatsealing in such a manner that it juts beyond one edge 38 of the jacket slit by a small portion of its width. The insulator 28, it will be noted, does not cover the entire inner surface area of the jacket 14 and a strip 40 of the jacket 14 is left exposed on the opposite edge 42 as best shown in Figure 2. The jutting or extending portion 44 of the insulator 28 conceals the cells 10 and the gap 16 between the opposite edges 38 and 42 of the jacket 14 as best shown in Figure 3. By using a colored insulator 28 and longitudinal color bands of the same color on the outside surface of the jacket 14 alongside the opposite edges 38 and 42 the gap 16 is rendered practically imperceptible.

During the assembly of a battery of the invention, the jacket 14 must be sprung open so that the cells 10 may be readily inserted. Once the cells 10, spring 26, insulating washer 27 and covers 20 and 24 are assembled into the jacket 14, the sprung jacket 14 is then released and thus springs back around the cells 10. The cells 10 which are larger in diameter than the original inside jacket diameter impart resiliency to the jacket 14 when they are stacked therein. Thus, the assembly inherently causes the jacket 14 to exert a radial force or pressure on the cells 10 which holds them in axial alignment.

Figure 5 illustrates a modification of the battery of Figures 1 and 2 in that it is provided with an intermediate voltage tap 46 which causes a jacket 48 to become polarized when the cells 10 are stacked therein. The tap 46 is made to contact an appropriate intermediate cell 10 by virtue of the indentation in the surface of the jacket 48 and by a cut-away portion of an insulator 50 as at 52. Any desired voltage level within the limitations of the battery may be obtained by indenting the jacket in an appropriate position thus making it a third terminal of the battery.

The battery jacket can be composed of synthetic plastic unless it is to be subjected to high temperature conditions. For higher temperature environments or rugged usage the jacket is suitably composed of steel, alumin-

ium, copper or their alloys.

It will be appreciated that other methods of applying an insulator to the battery jacket can be used in the manufacture of batteries of the invention. For example, the insulating material can be sprayed onto the jacket prior to forming it to a desired diameter. Another method is to provide an insulating wrapper around each individual cell of the battery, thereby eliminating the need to insulate the battery jacket itself. It is also desirable for the insulating material to be somewhat absorbent. If minute creepage or caustic leakage occurs in any of the cells, the insulator would therefore readily absorb it before it proceeds to leak out of the battery jacket by way of the gap.

The jacket of the invention is sprung open by separating the overlapping parallel edges slightly thereby allowing sufficient radial clearance for assembling the stack of cells therein. The sprung jacket is released around the cells which are of a larger diameter than the original jacket inside diameter; thus sufficient resiliency is imparted to the jacket thereby causing a radial force or pressure on the high diameter cells and a slightly lower pressure on the lower diameter cells. In the battery of the invention no radial clearance exists between the cells and the walls of the jacket and thus a higher volumetric efficiency is achieved.

The battery wrapper or jacket disclosed herein has a further advantage over an identical size battery container of a seamless or seamed tube-type construction in that the gap of the subject jacket can be adjusted. Thus, the opposite edges of the jacket can be adapted to be edge to edge or up to 0.025 inch apart after forming. This adjustment feature provides greater latitude in the manufacturing tolerances particularly the diameters of the cells which are to be stacked in the sprung jacket and obviates the need for expensive gaging or special matched tolerance selection of cells which would be necessary when making a seamless or seamed tube-type battery.

It will also be appreciated that large production savings are achieved in fabricating the battery jacket of the invention. The sheet material from which the jackets are cut can be lithographed as large sheets prior to cutting and forming the jackets, whereas with formed tubing the printing must be done individually on a cylindrical surface for each battery container.

While the battery of the invention has been described herein as incorporating both a contact spring and end terminal covers, it will be understood that they are not altogether necessary. For example, in a single cell unit, neither the spring nor the end terminal covers are a necessity. Of course with a single cell unit the decorative jacket can be made from a thinner sheet material and need not have as

much resiliency as the multi-cell battery jacket.

However, it is preferable to use a spring in all other batteries of the invention since the spring exerts an axial force on the cell stack thus maintaining the cells in position and keeping good electrical contact between the electrodes of adjacent cells especially when the battery is subjected to very severe use such as vibrations, impact or shock and acceleration forces. When a spring is used in the battery of the invention, its spring rate must be such that it overcomes the frictional forces between the cells and the jacket and the radial pressures exerted on the walls of the cells by the resilient jacket otherwise the electrical contact between the electrodes of the cells could be interrupted.

WHAT WE CLAIM IS:—

1. A battery assembly which comprises at least one cylindrical cell disposed within a longitudinally slit tubular resilient jacket having a diameter smaller than the diameter of the cylindrical cell.

2. A battery assembly as claimed in claim 1, which comprises a stack of cylindrical cells disposed within the longitudinally slit tubular resilient jacket, a terminal cover member closing each end of the jacket, and a resilient contact member interposed between one of the terminal cover members and an electrode of the cell adjacent thereto.

3. A battery assembly as claimed in claims 1 or 2 in which the inside wall surface of the jacket is provided with a film or sheet of insulating material, said film or sheet being in an offset position with respect to the width of the jacket surface in such a manner that a narrow strip of said jacket is left uncovered along one edge of the longitudinal slit therein while a narrow strip of the film or sheet correspondingly extends beyond the other edge of the slit.

4. A battery assembly as claimed in any one of claims 1 to 3, in which the jacket is made of a synthetic plastic material or of steel, copper, aluminium or alloys thereof.

5. A battery assembly as claimed in any one of claims 2 to 4, in which the jacket is provided with an intermediate voltage tap extending therethrough for contact with a cell of the stack.

6. A battery assembly as claimed in any one of claims 2 to 5 in which the peripheral edge of the terminal cover member is flanged and secured in position by a peripheral edge of the jacket curled thereover.

7. A method for producing a battery assembly as claimed in any one of the preceding claims, which comprises cutting the jacket to size from a flat sheet material, shaping the flat cut sheet into a longitudinally slit tubular jacket having a diameter smaller than the diameter of the cell or cells, disposing said cell or cells within the slit tubular jacket while maintaining said slit jacket in the open position, and releasing the jacket which maintains the cell or cells under a radial pressure.

8. A method as claimed in claim 7, which comprises laminating on one surface of the flat cut sheet a film or sheet of insulating material in such a manner that a narrow strip of the flat cut sheet is left uncovered along one edge thereof while a corresponding narrow strip of insulating material extends beyond the opposite edge of said flat cut sheet.

9. A battery assembly substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 4 or as modified by Fig. 5 of the accompanying drawings.

10. A method for producing a battery assembly substantially as hereinbefore described and claimed in claims 7 or 8.

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1. A battery assembly which comprises at least one cylindrical cell disposed within a longitudinally slit tubular resilient jacket having a diameter smaller than the diameter of the cylindrical cell.
2. A battery assembly as claimed in claim 1, which comprises a stack of cylindrical cells disposed within the longitudinally slit tubular resilient jacket, a terminal cover member closing each end of the jacket, and a resilient contact member interposed between one of the terminal cover members and an electrode of the cell adjacent thereto.
3. A battery assembly as claimed in claims 1 or 2 in which the inside wall surface of the jacket is provided with a film or sheet of insulating material, said film or sheet being in an offset position with respect to the width of the jacket surface in such a manner that a narrow strip of said jacket is left uncovered along one edge of the longitudinal slit therein while a narrow strip of the film or sheet correspondingly extends beyond the other edge of the slit.

4. A battery assembly as claimed in any one of claims 1 to 3, in which the jacket is made of a synthetic plastic material or of steel, copper, aluminium or alloys thereof.

5. A battery assembly as claimed in any one of claims 2 to 4, in which the jacket is provided with an intermediate voltage tap extending therethrough for contact with a cell of the stack.

6. A battery assembly as claimed in any one of claims 2 to 5 in which the peripheral edge of the terminal cover member is flanged and secured in position by a peripheral edge of the jacket curled thereover.

7. A method for producing a battery assembly as claimed in any one of the preceding claims, which comprises cutting the jacket to size from a flat sheet material, shaping the flat cut sheet into a longitudinally slit tubular jacket having a diameter smaller than the diameter of the cell or cells, disposing said cell or cells within the slit tubular jacket while maintaining said slit jacket in the open position, and releasing the jacket which maintains the cell or cells under a radial pressure.

8. A method as claimed in claim 7, which comprises laminating on one surface of the flat cut sheet a film or sheet of insulating material in such a manner that a narrow strip of the flat cut sheet is left uncovered along one edge thereof while a corresponding narrow strip of insulating material extends beyond the opposite edge of said flat cut sheet.

9. A battery assembly substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 4 or as modified by Fig. 5 of the accompanying drawings.

10. A method for producing a battery assembly substantially as hereinbefore described and claimed in claims 7 or 8.

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