

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN CELLS

(71) We, UNION CARBIDE CORPORATION, a corporation organized and existing under the laws of the State of New York, United States of America, of 270 Park Avenue, New York, State of New York 10017, United States of America, (assignee of RICHARD BERNARD AFFELDT), 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 a cell such as a sealed galvanic dry cell, and more particularly to a seal closure for the open end of a cylindrical container used in such a dry cell.

Conventional galvanic dry cells for use in flashlights, toys or other sundry devices generally comprise a cylindrical container, such as a zinc anode can, a depolarizer mix filling most of the container and a carbon rod in the centre of the container which functions as the current collector for the depolarizer mix. The cells are generally sealed by inserting a support washer over the cathode depolarizer mix and then dispensing hot molten asphalt onto the washer thereby providing an asphalt seal for the cells while also providing an airspace above the depolarizer mix and below the asphalt seal to accommodate the discharge gases and exudate of the cells.

Although asphalt seals have been employed with some success in sealing galvanic dry cells, they do have a number of drawbacks or disadvantages. For example, several assembly procedures are required such as placing a support washer down into the cell, pouring an asphaltic pitch onto the support washer, placing a vent washer on top of the asphaltic pitch and then finally placing a cap on top of the cell and locking it in place. The vent washer is usually required to prevent the cap from becoming

embedded in the pitch which could possibly result in forming a gastight seal which prevents venting. In addition, it is possible that the inside surface of the container could become dirty due to mercury contamination, prior to dispensing the asphaltic pitch. This could result in a pseudo-seal which, over a period of time, could eventually lead to moisture loss from the cell and/or oxygen ingress to the cell because of insufficient adhesion of the pitch to the can or container. It is also possible that during the heating of the asphalt pitch to cause a meniscus to form at the can-asphalt interface, pin holes may form in the pitch as a result of expansion of the air in the void volume below the support washer which would allow moisture loss and/or oxygen ingress to the cell. Another disadvantage in the use of asphalt seals is that they physically take up a relatively large space in the cell thereby limiting the size of the airspace into which the reaction products of the cells can discharge. In addition, asphalt seals are not particularly suited for high temperature environments since the seal at the asphalt-can interface is subject to degradation at high temperatures which could possibly cause paths through which moisture and/or oxygen could travel.

In the above-described cells, the venting of the gases from within the cell can take place through a porous current collector such as a carbon rod or the like. Although a properly prepared asphalt seal will effectively minimize electrolyte or moisture loss through evaporation and minimize air or oxygen ingress to the cells, the assembly and quality control techniques required to insure good seals are rather expensive and time consuming. The finished cells that do not meet the minimum quality standards for one reason or another are usually disassembled so that the raw cell components can be reused. However, in constructions where the

container is adhered by asphalt or the like to the outer finish, recovery of the raw cell components is messy and expensive.

A feature of the present invention is to provide a one piece closure for a dry cell wherein the closure replaces several components of the conventional cell described above and is capable of sealing the cell.

Another feature of the invention is to provide a closure for galvanic dry cells which can easily and inexpensively be assembled on such cells.

The present invention provides a galvanic cell comprising a cylindrical container having an open end, an electrode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix and a closure covering the open end of said container, said closure having a tubular neck at its centre and a tubular skirt at its periphery and being disposed such that the current collector passes through said tubular neck and such that the peripheral tubular skirt contacts the exterior of the rim at the open end of said container, the current collector being adhesively secured to said tubular neck and the peripheral tubular skirt being adhesively secured to said exterior of the rim thereby providing a closure seal for said cell.

The invention also provides a galvanic dry cell comprising a cylindrical container having an open end, an electrode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix, a cap seated on the top of said current collector and having a radially outwardly projecting flange, and a closure covering the open end of said container, said closure having an opening at its centre and a tubular skirt at its periphery and being disposed such that the current collector and the cap pass through said opening, the cap flange being seated against and adhesively secured to the inner surface of the closure adjacent the centre opening therein, and such that the peripheral tubular skirt of the closure contacts the exterior of the rim at the open end of said container, the skirt being adhesively secured to the exterior of said rim, thereby providing a closure seal for said cell.

The closure of this invention is preferably made of an insulating material such as plastics. For example, the following materials may be used:— polyethylene, polypropylene, vinyl polymers, polycarbonate, high impact polystyrene, copolymers made from acrylonitrile, butadiene and styrene (ABS), and nylon. Of the above, polyethylene is the preferred material and preferably at least the surface of the polyethylene is adhesively secured to the container, the current collector

advantageously being corona treated so as to improve the surface adhesion characteristics of the polyethylene. A suitable process for corona treating polyethylene is disclosed in U.S. Patent No. 3,914,521.

Adhesives suitable for use in securing the closure to the rim of the container and to the current collector or cap can be any adhesive that will not adversely react with either the closure material or the cell components and which will secure the closure to the respective cell components. Suitable adhesives are disclosed in the textbook titled "Handbook of Adhesives" edited by Irving Skeist-Reinhold Publishing Corp. New York (1962). Specific adhesives suitable for use in this invention are polyamide resins which are either thermoplastic heat seal or heat-activated adhesives or thermoset, structural adhesives.

Another class of suitable adhesives is the fatty polyamides which are produced from dibasic fatty acids. As defined in the "Encyclopedia of Polymer Science and Technology" Vol. 10, Interscience Publishers, a division of John Wiley & Sons, Inc., fatty polyamides are condensation products of di- and polyfunctional amines and di- and polybasic acids obtained by the polymerization of unsaturated vegetable oil acids or their esters. Fatty polyamide adhesives, in addition to being excellent adhesives, also resist wetting by alkaline electrolytes and therefore can retard "creep" of such electrolytes within or from the cells over a long period of time. The use of fatty polyamides in galvanic cells is disclosed in U. S. Patent No. 3,922,178.

One of the primary requirements of adhesives for use in this invention is that they effectively provide a leakproof seal at pressures of about 5 psig (gauge) and above. Specific adhesives suitable for use in this invention are cold setting cyanoacrylate adhesives available commercially as "Eastman 910" from the Eastman Kodak Co. in New York, hot melt adhesives available commercially as "Eastman A 40-S" also from Eastman Kodak Co. and hot melt fatty polyamide adhesives available commercially as "Swift's 610 Hot Melt Adhesive" from the Swift Chemical Co. in Illinois.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:—
Figure 1 is an elevational view, partly in cross-section, of a primary galvanic dry cell embodying the invention;

Figure 2 is an elevational view, partly in cross-section, of the closure used in the dry cell shown in Figure 1;

Figure 3 is an elevational cross-sectional view of a portion of another embodiment of the invention;

Figure 4 is an elevational view, partly in

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cross-section, of the closure used in the dry cell shown in Figure 3;

Figure 5 is an elevational cross-sectional view of a portion of another embodiment of the invention;

Figure 6 is an elevational view, partly in cross-section, of the closure used in the dry cell shown in Figure 5;

Figure 7 is an elevational cross-sectional view of a top portion of another embodiment of the invention; and

Figure 8 is an elevational view, partly in view of a portion of another embodiment of the invention; and

Referring to the drawing and particularly to Figures 1 and 2, there is shown a galvanic dry cell embodying the invention. The dry cell includes a cylindrical container 2 which is made of an electro-chemically consumable metal such as zinc and which serves as the anode of the cell. Included in the container 2 are an insulator disc (not shown) disposed at the base of the container 2, a separator 4 lining the cylindrical wall of the container, a cathode electrode, comprising a depolarizer mix 6 disposed within but separated from the container by the insulator disc and the separator 4, and a current collector 8 centrally embedded in the depolarizer mix 6. The insulator disc could be made of plastics or any other suitable insulating material. The separator 4 may comprise a thin electrolyte paste layer or may be a thin film separator containing electrolyte, e.g., a thin bibulous paper coated with an electrolyte gel paste. The cathode depolarizer mix 6 is an electrochemically active cell component and may contain, for example, manganese dioxide, a conductive material such as carbon black or graphite and an electrolyte. The depolarizer mix 6 is usually molded around a central carbon rod providing the collector 8 before being inserted into the cell container but the depolarizer mix 6 may be first inserted into the container 2, the current collector 8 then being forced into the mix. A conventional centre washer (not shown) may be employed to maintain the current collector 8 in a central position extending axially of the container.

The surface of the depolarizer mix 6 is disposed a fixed distance below the open end of the cell container 2 to provide the usual airspace 10 to accommodate any liquid spew that may be formed during cell storage and/or cell discharge.

An electrically insulating closure 12 is provided for seating the open end of the cell container 2. As best shown in Figure 2, the closure 12 is formed as a disc-like member having a protruding tubular neck 14 whose internal wall 16 defines an opening 18. At the periphery of the closure 12 is a depending tubular skirt or apron 20 having an internal wall 22. As shown in Figure 1,

the diameter of the neck 14 of the closure 12 is chosen to provide a snug sliding fit over the current collector 8 and the diameter of the depending skirt 20 is selected to provide a snug sliding fit with the rim portion 24 of the container 2. Preferably the rim portion 24 of the container 2 is crimped or necked in to allow for the thickness of the skirt so as to provide an overall uniform raw cell diameter as shown in Figure 1. A layer of suitable adhesive 26 is disposed between the wall 16 of the neck 14 and the outer surface of the current collector 8 and between the wall 22 of the skirt 20 and the outer surface of the crimped rim portion 24 of the container 2. The adhesive may be applied to the inner walls 16 and 22 of the closure 12 and/or to the corresponding surface of the current collector 8 and the crimped rim portion 24 of the container 2, respectively. It should be noted that the adhesive joint for the skirt 20 is preferably made with the outside surface of the container which is clean, or can easily be made so, as compared with the inside surface of the container which could be contaminated with the ingredients of the depolarizer mix during its insertion into the container.

The lengths of the skirt 20 and the neck 14 are sufficient to insure a reliable seal area. For example, the length of the skirt for American National Standard Specifications "D" size cells could vary between about 3/16 inch and 5/8 inch and preferably be about 3/8 inch while the length of the skirt for American National Standard Specifications "C" size cells could vary between about 3/16 inch and 5/8 inch and preferably be about 3/10 inch. The length of the closure neck may vary depending on the diameter of the current collector rod. For example, the length of the closure neck could vary between about 1/16 inch and about 1/4 inch for a current collector having a diameter of about 5/16 inch. However, when vacuum drawing techniques are employed to fabricate the closure of this invention, the neck must not be drawn too long since this may result in thinning of the material at the neck radius thus decreasing the strength of the neck to a degree where moisture retention within the cell is jeopardized. Preferably, the neck radius is chamfered so as to provide space for receiving a reservoir of sealant so as to further insure a good seal.

The material thickness of the closure can vary although a thickness between about 0.005 inch and about 0.06 inch has been found acceptable with a thickness about 0.02 inch being preferable. Closure material thickness less than about 0.005 inch would be insufficient to provide a good seal while a material thickness above about 0.06 inch

would only result in decreasing the airspace in the cell while increasing the cost of the cell.

As shown in Figure 1, with the closure 12 in place a fluid-tight seal around the open end of the cell container 2 is formed which effectively seals the raw cell against the escape of electrolyte and/or moisture by evaporation and seals it against the ingress of air and oxygen from the atmosphere. As stated above, the sealed raw cell could vent through the porous current collector such as a carbon rod.

The cell proper (i.e. raw cell) with the closure 12 locked in place on the open end of the cell container 2 is finished by encasing it within an outer cell assembly including an outer tubular non-corrodible jacket 30 suitably made of a fibrous material such as kraft paper. An end of the tubular jacket 30 extends beyond the closure 12 and is locked in engagement with the outer peripheral edge of a one piece metallic cover 32 in a conventional manner.

The outer cell assembly includes means for venting any gas released from inside the cell container 2 to the outer atmosphere. Such means may be provided, for example, by making the connection between the cover 32 and the jacket 30 permeable to gas.

Figures 3 and 4 show another embodiment of the invention having some components similar with the cell shown in Figure 1 and consequently identified with the same reference numerals, with the distinction being the use of a closure 40 having a different contour. Specifically, the closure 40 has a peripheral depending skirt 42 and a centrally disposed neck 44 formed or defined by a "U" shaped segment 46 of the closure 40. A relatively flat surface 48 disposed between the "U" shaped segment 46 and the depending tubular skirt 42 is contoured to the shape of the inner surface of the one piece cover 32 so as to provide an airspace 10 of maximum volume between the depolarizer mix 6 and the closure 40. The "U" shaped segment 46 provides flexibility to the neck 44 so as to facilitate the insertion of the current collector into and through the opening 50 in the neck 44. As discussed above, the internal wall 52 of the neck 44 is adhesively secured to the current collector 8 and the internal wall 54 is adhesively secured to the outer crimped rim 24 of the container 2.

Figures 5 and 6 show another embodiment of the invention with similar parts to those shown in Figure 1 bearing similar numerals, except that a different closure 60 is employed. Specifically, the closure 60 has a peripheral depending skirt 62 and a centrally disposed neck 64 defined by an inverted depending tubular wall 66. The surface 68 disposed between the depending

tubular wall 66 and the depending tubular skirt 62 is contoured to the shape of the inner surface of the one piece cover 32 so as to provide an airspace of maximum volume for the cell. The extremity 70 of the wall 66 is flared outwardly to facilitate the insertion of the current collector into and through the opening 72 in the neck 64. As stated above, the closure is adhesively secured at the neck 64 to the current collector 8 and at the skirt 62 to the crimped rim 24 of the container 2.

Figures 7 and 8 show another embodiment of the invention wherein parts similar to those shown in Figure 1 bear similar numerals except that a different closure 80 and a two-piece cover 82, 84 are employed. The closure 80 has a peripheral depending skirt 86 and a centrally disposed opening 88. The cap 82 of the two-piece cover is provided with an outwardly flanged rim 90 the outer surface 92 of which seats against and is adhesively secured to the closure's inner surface 94 adjacent to the opening 88. As discussed above in conjunction with Figures 5 and 6, the peripheral skirt 86 is secured to the crimped rim 24. The surface 96 disposed between the opening 88 and the depending skirt 86 is contoured to the shape of the inner surface of the annular metallic cover plate 84 which forms the second part of the two-piece terminal cover. With the cap 82 fitted tightly over the outer end of the current collector 8 and adhesively secured to the closure 80 and the latter adhesively secured to the rim 24, the annular metallic cover plate 84 is positioned on the closure 80 and its outer peripheral edge is locked in engagement with the rim of the tubular jacket 30. Venting is permitted through the hole 98 in the cap 82.

It may be advisable in some applications to put an air vent hole in the closure for assembly purposes. The reason for this is that as the closure is placed on the raw cell, the leading edge of the skirt and neck of the closure come in contact with the container and the current collector, respectively, thereby causing the air within the raw cell to be trapped. As the closure continues to be pushed to its final position, the air trapped in the cell is reduced in volume thereby causing an increase in pressure within the airspace of the cell. It is this increase in pressure, usually about 15 psi, that could cause air leakage between the container and the closure and/or between the current collector and the closure. The adhesive may flow back to seal off any air passages so formed but if it does not then permanent passages are created. The placing of a vent hole in the closure would eliminate this problem since the vent hole would act as a pressure relief for the entrapped gas. The vent hole could subsequently be sealed up

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or used as part of a venting mechanism integral with the finished cell. Alternately, trapped air could be vented by a hole in the container wall near the rim or by a short slot in the current collector. Both of these openings could be disposed such that when the cover is fully seated, the holes would be sealed off by the walls of the closure. One such hole is shown in Figure 3 and designated as 58.

It is also within the scope of this invention to employ a wax fillet, where the edge of the cover and the rim of the jacket are joined as shown in Figure 3 and designated 59. In addition, a spacer ring made of plastics or the like may be disposed between the connection of the cover and jacket and the outer closure as shown in Figure 5 and designated 76. This spacer ring provides a more secure seat for the closure and a seal for a vent hole 75 which is described hereinafter.

The invention provides a closure for the open end of a cylindrical container used in a sealed galvanic dry cell which closure is relatively inexpensive to manufacture. The closure can be easily and accurately assembled during manufacture of a dry cell and gives reliable and reproducible results in containing and confining gases and cell axudate during cell storage and discharge. Moreover, the closure when used in a dry cell employing an outer cell assembly including a tubular jacket, is not exposed to external pressure or impact and is, therefore, protected from accidental damage.

The closure of this invention may offer a number of advantages such as:

1. The raw cell may be aged independently of the jacket;
2. The closure may limit moisture loss and oxygen ingress to the cell;
3. The sealant may be on the outside of the container (zinc) rather than on the inside, so that a potentially better seal may be formed because the outside of the container can be kept clean and free of contamination from the depolarizer mix or the like;
4. The sealant may provide an area contact rather than a line contact, thus an increased leakage resistance path;
5. A reservoir may be provided for the electrode sealant if the closure is suitably selected or if it is chamfered;
6. The closure allows appearance rejects to be reclaimed without disturbing the raw cell assembly, thus providing a potential reduction of service loss;
7. The closure may be thin to provide minimum material cost and can be pressure vacuum formed at high production rates;
8. Sealant may be applied directly to the container rather than the inside of the closure, thus providing a process improvement for assembling cells;
9. Minimum sealant may be used be-

cause of the close fit between the closure and cell components (i.e., currently collector and container);

10. The closure can be assembled directly on the raw cell rather than as part of the jacket assembly;

11. The closure system lends itself to the use of a one-piece metal cover or a two-piece metal or plastics cover with paper or plastics finish; and

12. The closure may provide an increase in void volume of the raw cell for spew containment or an increase in mix height and service capacity compared to an asphalt sealed cell.

A resealable vent mechanism suggested by Dennis W. McComsey which may be used in this invention comprises at least one vent hole 75 in the closure and a sealing washer or ring, such as the ring 76, made of poly-laminated kraft, neoprene rubber, polystyrene or the like above the vent hole(s). The washer may be secured between the connection of the cover and jacket and the outer surface of the closure as shown for the washer 76 in Figure 5. This resealable vent mechanism would operate such that a build-up of internal pressure would cause an upward movement of the washer and the connection of the cover and jacket thereby permitting venting of evolved gases from the airspace of the cell. When the internal pressure (i.e. that in the space below the closure and above the depolarizer mix) and the external atmospheric pressure have equilibrated, the washer and cover will become firmly reseated over the vent hole(s) thereby sealing the said hole(s). This type of venting mechanism can be adjusted to vary the pressure at which venting occurs by adjusting the pressure on the venting washer through an adjustment of the connection of the cover and jacket or by varying the washer thickness and/or material.

EXAMPLE I

Thirty American National Standard Specifications "D" size raw cells (without the tubular jacket and cover) were constructed substantially as shown in Figure 3. Specifically, the cells were fabricated using a zinc can, a kraft paper insulator disposed in the base of the can, a separator of starch coated paper lining the vertical wall of the zinc can, a positive electrode of depolarizer mix composed of manganese dioxide, carbon black and LeClanche electrolyte disposed in and separated from the zinc can by the bottom separator and the vertical lining and a porous carbon rod centrally embedded in the depolarizer mix. A polypropylene closure was placed over the open end of the zinc can and using an Eastman 910 adhesive the internal wall of the neck of the closure was

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adhesively secured to the carbon rod and the internal wall of the peripheral skirt of the closure was adhesively secured to the outer upper crimped rim of the zinc can. The cells were stored for 14 days at 54°C. and some were discharged across a load of 2.25 ohms for 10 hours. The cells were visually examined and found to exhibit effectively no leakage of liquid spew from within the cell.

10 WHAT WE CLAIM IS:—

1. A galvanic cell comprising a cylindrical container having an open end, an electrode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix and a closure covering the open end of said container, said closure having a tubular neck at its centre and a tubular skirt at its periphery and being disposed such that the current collector passes through said tubular neck and such that the peripheral tubular skirt contacts the exterior of the rim at the open end of said container, the current collector being adhesively secured to said tubular neck and the peripheral tubular skirt being adhesively secured to said exterior of the rim thereby providing a closure seal for said cell.

2. A cell as claimed in claim 1 wherein the rim at the open end of the container is inwardly crimped to accommodate the thickness of the tubular skirt so as to provide an overall uniform diameter for the container and closure assembly.

3. A cell as claimed in claim 1 or 2 wherein the container is encased in an outer cell assembly including an outer tubular jacket an end of which extends beyond the closure and is locked in engagement with a peripheral edge of a metallic cover and wherein a portion of the outer surface of the closure is shaped to fit snugly against a portion of the internal surface of the cover.

4. A cell as claimed in claim 1, 2 or 3 wherein the closure has at least one vent hole.

5. A cell as claimed in any of claims 1 to 4 wherein the closure is made of a material selected from the group consisting of polyethylene, polypropylene, vinyl polymers, polycarbonate, high impact polystyrene, copolymers made from acrylonitrile, butadiene and styrene, and nylon.

6. A galvanic cell comprising a cylindrical container having an open end, an elec-

trode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix, a cap seated on the top of said current collector and having a radially outwardly projecting flange, and a closure covering the open end of said container, said closure having an opening at its centre and a tubular skirt at its periphery and being disposed such that the current collector and the cap pass through said opening, the cap flange being seated against and adhesively secured to the inner surface of the closure adjacent the centre opening therein, and such that the peripheral tubular skirt of the closure contacts the exterior of the rim at the open end of said container, the skirt being adhesively secured to the exterior of said rim, thereby providing a closure seal for said cell.

7. A cell as claimed in claim 6 wherein said rim is inwardly crimped to accommodate the thickness of the tubular skirt so as to provide an overall uniform diameter for the container and closure assembly.

8. A cell as claimed in claim 6 or 7 wherein the container is encased in an outer cell assembly including an outer tubular jacket an end of which extends beyond the closure and is locked in engagement with a peripheral edge of a metallic cover and wherein a portion of the outer surface of the closure is shaped fit snugly against a portion of the internal surface of the cover.

9. A cell as claimed in claim 6, 7 or 8 wherein the closure has at least one vent hole.

10. A cell as claimed in claim 6, 7, 8 or 9 wherein the closure is made of a material selected from the group consisting of polyethylene, polypropylene, vinyl polymers, polycarbonate, high impact polystyrene, copolymers made from acrylonitrile, butadiene and styrene, and nylon.

11. A cell constructed substantially as herein particularly described with reference to and as illustrated in Figs. 1 and 2; or Figs. 3 and 4; or Figs. 5 and 6; or Figs. 7 and 8 of the accompanying drawings.

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adhesively secured to the carbon rod and the internal wall of the peripheral skirt of the closure was adhesively secured to the outer upper crimped rim of the zinc can. The cells were stored for 14 days at 54°C. and some were discharged across a load of 2.25 ohms for 10 hours. The cells were visually examined and found to exhibit effectively no leakage of liquid spew from within the cell.

10 WHAT WE CLAIM IS:—

1. A galvanic cell comprising a cylindrical container having an open end, an electrode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix and a closure covering the open end of said container, said closure having a tubular neck at its centre and a tubular skirt at its periphery and being disposed such that the current collector passes through said tubular neck and such that the peripheral tubular skirt contacts the exterior of the rim at the open end of said container, the current collector being adhesively secured to said tubular neck and the peripheral tubular skirt being adhesively secured to said exterior of the rim thereby providing a closure seal for said cell.

2. A cell as claimed in claim 1 wherein the rim at the open end of the container is inwardly crimped to accommodate the thickness of the tubular skirt so as to provide an overall uniform diameter for the container and closure assembly.

3. A cell as claimed in claim 1 or 2 wherein the container is encased in an outer cell assembly including an outer tubular jacket an end of which extends beyond the closure and is locked in engagement with a peripheral edge of a metallic cover and wherein a portion of the outer surface of the closure is shaped to fit snugly against a portion of the internal surface of the cover.

4. A cell as claimed in claim 1, 2 or 3 wherein the closure has at least one vent hole.

5. A cell as claimed in any of claims 1 to 4 wherein the closure is made of a material selected from the group consisting of polyethylene, polypropylene, vinyl polymers, polycarbonate, high impact polystyrene, copolymers made from acrylonitrile, butadiene and styrene, and nylon.

6. A galvanic cell comprising a cylindrical container having an open end, an elec-

trode comprising a depolarizer mix disposed within said container and separated therefrom by a separator, a current collector centrally embedded in said depolarizer mix, a cap seated on the top of said current collector and having a radially outwardly projecting flange, and a closure covering the open end of said container, said closure having an opening at its centre and a tubular skirt at its periphery and being disposed such that the current collector and the cap pass through said opening, the cap flange being seated against and adhesively secured to the inner surface of the closure adjacent the centre opening therein, and such that the peripheral tubular skirt of the closure contacts the exterior of the rim at the open end of said container, the skirt being adhesively secured to the exterior of said rim, thereby providing a closure seal for said cell.

7. A cell as claimed in claim 6 wherein said rim is inwardly crimped to accommodate the thickness of the tubular skirt so as to provide an overall uniform diameter for the container and closure assembly.

8. A cell as claimed in claim 6 or 7 wherein the container is encased in an outer cell assembly including an outer tubular jacket an end of which extends beyond the closure and is locked in engagement with a peripheral edge of a metallic cover and wherein a portion of the outer surface of the closure is shaped to fit snugly against a portion of the internal surface of the cover.

9. A cell as claimed in claim 6, 7 or 8 wherein the closure has at least one vent hole.

10. A cell as claimed in claim 6, 7, 8 or 9 wherein the closure is made of a material selected from the group consisting of polyethylene, polypropylene, vinyl polymers, polycarbonate, high impact polystyrene, copolymers made from acrylonitrile, butadiene and styrene, and nylon.

11. A cell constructed substantially as herein particularly described with reference to and as illustrated in Figs. 1 and 2; or Figs. 3 and 4; or Figs. 5 and 6; or Figs. 7 and 8 of the accompanying drawings.

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