ELECTRIC PRIMARY ELEMENT AND METHOD OF MANUFACTURING THE SAME

Inventors: Fritz Ahl, Bad Homburg; Wolfgang Brill, Dusseldorf, both of Germany
Assignee: Varta GmbH, Ellwagen/Jagst, Germany
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Primary Examiner—Donald L. Walton
Attorney—Michael S. Striker

ABSTRACT
A tubular member constituting a first electrode contains a depolarizing agent and a second electrode axially extending therethrough. One of the open ends of the tubular member is sealed with a first flexible disc with an end portion of the second electrode projecting outwardly through the disc and provided with an electrically conductive cap which overlies the disc. The other open end of the tubular member constitutes a radially inwardly extending annular bead which fluid-tightly engages and retains a second flexible disc and a contact disc which overlies the second flexible disc and engages the bead of the tubular member. A dielectric and a protective casing surround the tubular member.

14 Claims, 3 Drawing Figures
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BACKGROUND OF THE INVENTION

The present invention relates to an improved electric primary element and a method of manufacturing such an element.

Already known in the art are primary elements or cells in which a carbon electrode is surrounded by a depolarizer which, in turn, is enclosed within an external cup-shaped casing made of zinc or other suitable material, such as magnesium or aluminum, and which constitutes the second electrode of the element or cell.

Such a cup-shaped element, however, is uneconomical as regards its structure in that the metallic material used constitutes the bottom of the element is unprofitable for reasons that this region of the element is electrochemically unproductive.

SUMMARY OF THE INVENTION

It therefore is an objective of the present invention to provide an improved element or cell having a structure which suitably resolves the above-mentioned superfluous and uneconomical usage of outer electrode material.

It is a further objective of the present invention to provide a method of continuously manufacturing such an improved electric primary element or cell.

Such an improved electric primary element according to the present invention comprises a tubular member constituting a first electrode and having opposite open ends and a circumferential radially inwardly extending annular portion at a first of the open ends. A depolarizing agent is contained within the tubular member and electrically non-conductive sealing means are provided at the opposite open ends of the former to seal the depolarizing agent in the tubular member. A second electrode extends axially through the depolarizing agent and through the closure means at the second of the open ends and is attached to an electrically conductive member of this latter open end. A second electrically conductive member overlies the sealing means at the first of the open ends of the tubular member and firmly engages both the sealing means and the circumferential radially inwardly extending annular portion at the latter open end to thereby fluid-tightly seal this open end.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved arrangement itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of a specific embodiment with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a longitudinal cross-sectional view of an electric primary element embodied according to the present invention.

FIG. 2 illustrates particulars of the sealing and closure arrangement incorporated in the electric primary element of FIG. 1; and

FIG. 3 shows a further embodiment of the sealing and closure arrangement of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in which like reference numerals index like parts, FIG. 1 illustrates an improved electric primary element or cell according to the present invention and which comprises a metallic tubular member 1 which constitutes a first or external electrode and has opposite open ends 1a, 1b and a circumferential radially inwardly extending annular substantially bead-shaped portion 1c at the open end 1b.

Contained within the interior of the tubular electrode is a depolarizing agent 2 through which a second or inner electrode 3, made essentially of carbon material, axially extends. Fluid-tightly closing the tubular electrode 1 within the confines of the upper end 1a thereof, is an electrically non-conductive flexible sealing member 4, preferably made of a plastic material, and having a central passage 4a through which the end portion 3a of the inner electrode 3 projects outwardly.

The projecting end portion 3a of the electrode 3 is connected with an electrically conductive cap member 5 which is substantially disc-shaped, overlies the sealing member 4, and is retained in position peripherally by a radially inwardly extending circumferential end portion 6a of a dielectric jacket 6 which surrounds the tubular electrode 1.

Sealably closing the tubular electrode 1 within the confines of the lower end 1b thereof, is a substantially disc-shaped electrically non-conductive flexible sealing member 7 which lies across the end 1b and has a peripheral flange-shaped enlargement 7a which in the embodiment shown in FIGS. 1 and 2 is substantially V-shaped but which, as shown in FIG. 3 at 7b, may have a configuration other than V-shaped.

The sealing member 7 is pressed into the open end 1b into abutting engagement with the end portion 3b of the inner electrode 3 and has its flange-shaped enlargement 7a abuttingly engaging the inner peripheral wall 1d at the lower end 1b.

Engaging the sealing member 7 in overlying relation therewith, is an electrically conductive disc-shaped end member 8 having a flanged periphery 8e which, at the one hand, tightly abuttingly engages a seat 7c of the peripheral enlargement 7a of the sealing member 7 and, at the other hand, firmly interlocks with the radially inwardly extending circumferential annular portion 1c at the lower end 1b of the tubular electrode 1 to thereby fluid-tightly close the lower end 1b.

Surrounding the dielectric jacket 6 preferably of cardboard is a protective casing 9, which in the preferred embodiment is made of steel and includes radially inwardly extending circumferential end portions 9a, 9b which respectively overly the end portions 6a of the dielectric jacket 6.

The tubular electrode 1 in the embodiment shown, is constituted by a helically wound metallic band with the adjoining edges of each two adjacent windings of the tubular structure welded to each other.

However, as an alternative, the tubular electrode 1 may be constituted by an elongated metallic band having a prerequisite length and which is folded transversely to its elongation and has its adjoining elongated edges welded to each other.

In manufacturing the electric primary element described above, a mixture of a depolarizer substance and a liquid electrolyte is subjected to extrusion and formed into a strand which, if required, is provided with an additional amount of electrolyte, for example, by spraying or by dipping the strand into an electrolytic bath.

Thereupon the mixture strand is sufficiently dried and provided with the tubular electrode 1 by helically winding a metallic band around the mixture strand and welding the adjoining edges of each two adjacent windings to each other in any suitable conventional manner.

If a separation layer is required between the depolarizer 2 and the tubular electrode 1, a layer composed either of an ion permeable, binder, or similar material, may be interposed between the depolarizer 2 and the tubular electrode 1 or may be applied at the outer surface of the tubular electrode 1.

Upon welding of the windings to each other, the thus formed combination is severed at a prerequisite length and one end of the tubular electrode 1 is closed with the sealing member 4 and the inner electrode 3 introduced into the depolarizer 2 with the end portion 3a of the electrode 3 projecting outwardly through the opening 4a of the sealing member 4. At this stage, the upper end 1a of the tubular electrode 1 is fluid-tightly sealed.

Pressure is applied to the depolarizer prior to and following closing of the upper end 1a and introduction of the inner elec-
trode 3 so as to compress the depolarizer into a compact substance.

Following the latter step, the flexible sealing member 7 and the electrically conductive end member 8 are placed within the confines of the lower end 1b of the tubular electrode 1 with the flanged periphery 8a of the end member 8 seated against the seat 7c of the sealing member 7. Thereupon, the lower most end 1e of the tubular electrode is circumferentially flanged into a radially inwardly extending annular bead which fluid-tightly interlocks with the flanged periphery 8a and thereby simultaneously presses the flanged enlargement 7a into abutting engagement with the inner peripheral wall 1d of the tubular electrode 1 at the lower end 1b thereof.

The sequence of the individual steps of sealing the tubular electrode 1 may be inverted by first closing and sealing the latter with the sealing member 7 and the end member 8 at the lower end 1b, then introducing the inner electrode 3 into the depolarizer 2, and subsequently sealing the upper end 1a, in the manner as described hereinbefore.

The above indicated sealing methods are only applicable for primary elements whose external electrodes are separated from the depolarizing agent by means of an ion permeable electrically non-conductive layer having a sufficiently high stability.

For providing primary cells of the Leclanché-type with a closure and sealing arrangement according to the present invention, first the zinc tubular end member is to be formed, then one end of the tubular electrode to be sealed and closed with the members 7 and 8, in the manner as hereinbefore described, subsequently the electrolyte is to be filled into the tubular electrode, and finally the pre-prepared carbon electrode is to be introduced into the electrolyte and the other end of the tubular electrode to be closed, as hereinbefore described.

It will be appreciated that with the above construction of the primary element according to the present invention and with but a few discrete components incorporated therein, a positively fluid-tight sealing of the bottom portion of the tubular electrode is obtained which resolves the unique at the hitherto superfluous and electrochemically unnecessary bottom of conventional cup-shaped primary elements.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. An electric element, comprising in combination, a tubular member constituting a first electrode and having an inner wall, opposite open ends and a circumferential radially inwardly extending annular portion at one of said opposite open ends; a first closure member retained within the confines of the other of said opposite open ends and sealably closing the same; a depolarizing agent contained within said tubular member; a second electrode extending through said depolarizing agent within said tubular member and having a portion extending through said first closure member at said other end of said tubular member; a second closure member at said one open end of said tubular member and having along its periphery engaging means firmly retained by said circumferential radially inwardly extending annular portion of said tubular member to thereby tightly seal said one open end; and sealing means within the confines of said one open end in wardly of said second closure member and being provided with peripheral attachment means sandwiched between said inner wall and said engaging means of said second closure member so as to fluid-tightly seal said one open end.

2. An element as defined in claim 1, wherein said sealing means and said second closure member are substantially disc-shaped, and wherein said attachment means of said sealing means and said engaging means of said second closure member are respective flange-shaped portions of the same.

3. An element as defined in claim 2, wherein said flange-shaped portion of said second closure member tightly abuts against flange-shaped portion of said sealing means, and wherein said circumferential radially inwardly extending annular portion of said tubular member is substantially bead-shaped and interlocks in abutting engagement with said flange-shaped portion of said second closure member.

4. An element as defined in claim 3, wherein said sealing means is made of a flexible dielectric material, and wherein said tubular member and said second closure member are made of an electrically conductive material.

5. An element as defined in claim 2, wherein said flange-shaped portion of said sealing means is a peripheral enlargement of the same.

6. An element as defined in claim 5, wherein said peripheral enlargement includes a seat for sealing said flange-shaped portion of said second closure member.

7. An element as defined in claim 6, wherein said peripheral enlargement is substantially V-shaped.

8. An element as defined in claim 4, wherein said sealing means and said second closure member extend in substantially overlying relation relative to each other, and wherein said second electrode extends coaxially within said tubular member and includes a portion abutting against said sealing means, said latter portion of said second electrode being located axially opposite from said portion thereof extending through said first closure member.

9. An element as defined in claim 8, wherein said second electrode consists at least in part of a carbon material, and wherein said first closure member is substantially disc-shaped and made of a plastic material.

10. An element as defined in claim 8, wherein said first closure member is electrically non-conductive, and wherein said tubular member is provided with a surrounding dielectric jacket having axially opposite end portions radially inwardly extending in overlapping relation with peripheral portions of said first closure member and said second closure member.

11. An element as defined in claim 10, wherein said tubular member is substantially cylindrical and made of metal, and wherein said portion of said second electrode extending through said first closure member is connected with an electrically conductive disc-shaped end member retained along its periphery between said first closure member and one of said axially opposite end portions of said dielectric jacket.

12. An element as defined in claim 10, wherein said dielectric jacket surrounding said tubular member is provided with a surrounding metallic casing.

13. An element as defined in claim 1, wherein said tubular member is constituted by a cylindrically wound metallic band having a plurality of windings with each two adjacent ones of said windings being welded to each other.

14. An element as defined in claim 1, wherein said tubular member is constituted by an elongated metallic band folded transversely to its elongation into a tubular configuration and having adjoining edges welded to each other.