

SPECIFICATION

An alkaline battery

- 5 The invention relates to a battery comprising a single flat cell or several cells piled on each other and being integrally connected along the circumference, said cells each comprising a zinc anode, an alkaline electrolyte, a cathode of mercuric oxide, mercury or manganese dioxide or a mixture thereof, and a cell casing in the form of a plastic cup.

- Alkaline batteries of the above type with cells piled on each other have not previously been manufactured as it has not been possible to obtain a sufficiently tight assembling of the cells into an integral unit. This problem has now been solved by using a particular method of assembling the cups along their periphery.
- 15 By this method the cups are assembled along their entire peripheries by a rapid process.

- The object of the present invention is to provide an improved security against electrolyte leakage from an alkaline battery of the above type, by preventing electrolyte leakage at the terminal passage in the bottom of each plastic cup.

- Usually electrolyte leakage from an alkaline battery is due to one or more of the following well-known phenomena:

1. Capillary effect in the unevennesses of the surface, by a bad sealing etc.
2. Electrocapillary effect.
3. Oxygen reduction.
4. H_2O reduction.
5. Electroosmosis.
6. The Marangoni effect.

- It must, however, be regarded as certain that in addition to the above, terminal amalgamation is of substantial importance as the zinc electrodes contain mercury dispersing between zinc and terminal metal. This is of importance for the negative terminal, by which only the phenomena mentioned under item 3 to 6 occur, and by which experience shows the greatest sealing difficulties.

- The sealing problems have been solved by the battery according to the invention, which comprises at least two single flat cells piled on each other and being integrally connected along their circumferences, said cells each comprising a zinc anode, an alkaline electrolyte, a cathode of mercuric oxide, mercury or manganese dioxide or a mixture thereof, and a cell casing in the form of a plastic cup, said plastic cups being composed of or incorporating an elastomeric material, and a terminal plate being located both on the inner side and on the outer side of the bottom of each cup, one of said plates comprising a projecting knob extending through an aperture in the middle of the bottom of the cup and being spot welded, riveted, soldered or similarly secured to the other terminal plate in such a manner that the plates firmly sandwich the

material of the bottom of the cup, and a sealing ring being located in the aperture in the bottom of each cup, said ring surrounding the knob projecting from one of the terminal plates.

- Such a connection with a great specific pressure between the terminal metal and the elastomeric material provides a durable sealing as cold flow is avoided, which would otherwise cause a decreasing pressure between polymer and metal. Furthermore a double sealing between metal and polymer is obtained with an interspace interrupting the capillary effect, and a long creepage path between terminal metal and polymer.

- The connection is provided by a simple method and with a relatively great deformation of material, whereby rather great tolerances are permitted regarding the aperture in the plastic cup and regarding the metal knob and in a sealing ring located between the metal knob and the edge in one embodiment of the battery. In this embodiment two separate sealing portions are obtained between the metal and the rubber with air therebetween. As a result the capillary effect is interrupted.

- As an additional reduction of the risk for electrolyte leakage, the terminal plate not contacting the anode may according to the invention be of a metal particularly impeding for the reduction of O_2 and H_2O , and which furthermore can be manufactured particularly smooth, but for that matter may be unstable at contact with the anode.

- According to an alternative embodiment of the battery according to the invention, the cups are cast of hard, thermoplastic elastomer, and the aperture in the bottom of each cup is defined by an edge shaped with annular projecting sealing portions.

- By using plastic cups of elastomeric materials, cells having particularly good temperature properties are obtained, as these materials have very low glass transition temperatures, and the cups can resist strong mechanical influences in the later battery producing process.

- The invention will be described below with reference to the accompanying drawing, in which

Figure 1 illustrates a connection between two cells and a passage to the atmosphere in an embodiment of the battery according to the invention, and

- Figure 2* illustrates an alternative embodiment of the terminal passage between the cells or to the surroundings.

- Fig. 1* illustrates two plastic cups 1 forming cell casings interconnected by connecting surfaces 2 in an instant process influencing the entire periphery at the same time. Such an instant influence may for instance be produced by ultrasonic welding, gluing by dipping, hot welding, high frequency welding or another similar assembling process.

The lowermost cell in Fig. 1 is completely mounted with a pressed cathode 3 of mercuric oxide, mercury or manganese dioxide or mixtures thereof, two separator diaphragms 4, and an anode 5 comprising powdered zinc in alkaline electrolyte. A negative terminal plate 6 with curved edges is located above the cathode 3, and a terminal plate 7 is located under the anode 5 in the bottom of the cup.

The terminal plates 6 and 7 in plastic cups 1 piled on each other are interconnected through an aperture in the middle of the bottom 8 of the uppermost cup, the first terminal plate 7 comprising an embossed, projecting knob 9 extending through the aperture in the bottom of the cup, and furthermore being spot welded to the middle of the second terminal plate 6. The spot welding is performed in such a manner that the terminal plates 6 and 7 firmly sandwich the material of the bottom 8, whereby a pressure sealing between the terminal metals and the elastomeric material in the bottom is established. As a result cold flow and thereby involved decreasing contact pressure are avoided. As the terminal plates squeeze against both sides of the bottom, a double sealing between metal and plastic polymer surfaces under a specific sealing pressure is obtained, said sealing pressure being very high across the relatively small sealing portion. Furthermore, the terminal plate 6 may optionally consist of a metal particularly impeding for the reduction of O_2 and H_2O etc., whereby an additional securing against leakage is provided. The battery illustrated furthermore provides a long electrolyte creepage path.

In the embodiment illustrated in Fig. 1, the knob 9 on the terminal plate 7 is surrounded by a sealing ring 10 such as for instance a torique of rubber deformed under influence of pressure when the terminal plates are being assembled. In this manner two separate sealing portions are provided between metal and rubber with air therebetween, which interrupt the capillary effect.

In the embodiment illustrated in Fig. 2 the plastic cup is cast of a hard, thermoplastic elastomer, and the edge about the aperture in the bottom of the cup is provided with three projecting sealing portions 11 forming three separate plastic-metal sealing portions with air therebetween.

It is to be understood that the above terminal passage principle may also be used in the top and the bottom of a single flat cell.

CLAIMS

1. A battery comprising at least two single flat cells piled on each other and being integrally connected along their circumferences, said cells each comprising a zinc anode, an alkaline electrolyte, a cathode of mercuric oxide, mercury or manganese dioxide or a mixture thereof, and a cell casing in the form of a

plastic cup said plastic cups being composed of or incorporating an elastomeric material, and a terminal plate being located both on the inner side and on the outer side of the bottom of each cup, one of said plates comprising a projecting knob extending through an aperture in the middle of the bottom of the cup and being spot welded, riveted, soldered or similarly secured to the other terminal plate in such a manner that the plates firmly sandwich the material of the bottom of the cup, and a sealing ring being located in the aperture in the bottom of each cup, said ring surrounding the knob projecting from one of the terminal plates.

2. A battery as claimed in Claim 1, in which the the terminal plate not contacting the anode is of a metal particularly impeding for the reduction of O_2 and H_2O .

3. A battery as claimed in Claim 1 or Claim 2, in which the cups are cast of hard, thermoplastic elastomer, and that the aperture in the bottom of each cup is defined by an edge shaped with annular projecting sealing portions.

4. A battery substantially as hereinbefore described with reference to the accompanying drawings.

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