

The invention relates to a primary cell which may be discharged at high temperature, comprising a positive silver oxide or manganese dioxide electrode, a negative cadmium electrode and an alkaline electrolyte in a metal casing of the round cell type.

An alkaline accumulator which has a negative cadmium electrode and a positive silver oxide electrode is known for example from FR-PS 1 063 338.

A primary cell of the type mentioned at the outset can be inferred from DE-OS 3 337 570. Round cells of this type, preferably on the principle of the high-performance alkaline silver oxide/zinc system, are required in particular for probes and accessories in the exploration of mineral resources. Since deeper and deeper layers of earth have to be made accessible in order to search for and extract the mineral resources, the temperature prevailing therein becomes the most important load factor which decides the possibility of using a battery. A good prerequisite for ensuring that for example manganese dioxide cells remain sufficiently operative even at temperatures above 100°C has already been achieved by introducing caustic potash solution instead of the Leclanché electrolyte in conventional primary cells. A further step towards reducing the corrosive attack, which again accompanies high temperature, of the electrolyte solution on the internal components of the cell, concentrated, according to the DE-OS mentioned, on the selection of higher-resistance materials for the separator, in which a combination between a ceramic paper and an ion exchanger diaphragm has proved to be very advantageous.

However, both alkaline manganese as well as silver oxide round cells with negative zinc electrodes, reach, at approximately 160°C, a limit to their capacity for use despite being equipped with substantially inert separators. The reason, however, is not so much one of quality deficiencies in the electrochemically inactive cell components, but rather, because of explosions by which a number of cells were already affected on the third day during a storage test at 160°C, was recognized as a major development of gas in the zinc electrodes, and

therefore it follows that the hydrogen overload in the zinc is reduced as temperature increases, which expresses itself in an exponentially increasing rate of gassing.

M. G. Klein and M. Eisenberg (Electrochemical Technology, Vol. 3, Nos. 1-2, Jan.-Feb. 1965, pp 58-60) report on an alkaline mercury oxide/cadmium battery and mention a storage test at 73.8°C which this battery withstood with negligible losses of capacitance.

The object of the invention is thus to modify an alkaline primary cell by taking up the otherwise successful structural principle of the round cell having an externally arranged positive electrode such that its reliable use is possible even in the temperature range mentioned and without the dangerous tendency to gassing.

According to the invention, the object is achieved by the means specified in Claim 1. According thereto, a concentric electrode configuration which comprises an outer annular cylinder which forms the positive electrode and is composed of silver oxide or manganese dioxide compressed powder articles, and the internal space of which is filled by a cadmium electrode in the form of a round winding with the interposition of a separator, has proved to be favourable.

Particularly advantageously, according to the invention, a cadmium electrode is used which, according to a process known from DE-OS 28 22 821, can be obtained by cathodic metal deposition from cadmium salt solutions on a metal carrier band and is therefore also designated as an electro-deposited electrode.

The figure shows the overall construction of the primary cell according to the invention. Pressed in the manner of a tube into the metal casing cup 1 are, as the positive electrode, the cathode rings 2 of compressed silver oxide and/or manganese dioxide powder which, where appropriate, contains conductive material such as for example carbon. Bearing against the cathode rings is a one- or multi-layer separator comprising thin foils and/or fleece layers, but preferably comprising an outer PTFE grid and an inner ion exchanger diaphragm 4 formed as a sleeve,

the base of the sleeve being reinforced by an insulating insert 5 made of PTFE.

Films based on irradiation-crosslinked polyethylene, available under the trade name "PERMION"^R from the RAI Research Corp., have proved to be particularly successful as the ion exchanger diaphragm. However, other separators can also be used insofar as they meet the high temperature demands present here.

A further insulating plate 6 separates the cell components as a whole from the metal base of the casing cup 1. The cell interior is substantially occupied by the cadmium electrode 7 constructed as a round winding, the metal carrier band on which the winding is based comprising nickel, a nickel steel, silver or even copper.

Serving as the negative collector is a pin 8, preferably made of special steel and screwed by means of a nut 10 to a contact plate 9, where appropriate also welded or riveted. The contact plate 9, on the other hand, is welded to the round winding 7. The collector 8 passes through the opening of the metal sealing cover 11 and, together with the rivet ring 12, forms the negative cell pole on the upper side of the sealing cover 11. So that the collector 8 has no contact with the sealing cover, however, in each case a sealing (13) or insulating plate 14, preferably made of PTFE or another alkali- and high temperature-resistant plastics, for example polyetherketone, is laid below and above the sealing cover 11.

An aqueous caustic potash solution serves as the electrolyte 15. The sealing cover 11 is connected in hermetically sealed manner to the casing cup 1 by laser welding.

Such a primary cell according to the invention can be used even at extremely high temperatures (up to 200°C and above) and fulfils the object stated, because its negative electrode does not develop any hydrogen under the conditions mentioned. The internal pressure of the cell is substantially determined by the steam pressure of the electrolyte (approx. 6 bar at 200°C).

The advantage of this cell by comparison with conventional alkaline round cells of the $\text{Ag}_2\text{O}/\text{Zn}$ or MnO_2/Zn systems is therefore obvious.

In storage tests it has been shown that cells according to the invention withstand storage times at 200°C of over 6 weeks without losing their functioning capacity. In contrast, with commercially available alkaline high-temperature cells of the $\text{Ag}_2\text{O}/\text{Zn}$ type, bursting at only 163°C as early as after 5 days of use must be expected, because the quantity of hydrogen which has developed then reaches an unacceptable level.



1. Galvanic primary cell which may be discharged at high temperature, comprising a positive silver oxide or manganese dioxide electrode, a negative cadmium electrode and an alkaline electrolyte in a metal casing of the round cell type, characterized in that the metal casing contains, in concentric arrangement, the positive electrode in the form of an outer annular cylinder composed of compressed powder articles and the negative electrode in the form of an inner round winding having an interposed separator, and in that the cell may be discharged at temperatures above 160°C.
2. Primary cell according to Claim 1, characterized in that the cadmium electrode is an electro-deposited electrode produced by cathodic metal deposition from cadmium salt solutions on a metal carrier band.
3. Primary cell according to Claim 2, characterized in that the metal carrier band comprises nickel or a nickel steel.
4. Primary cell according to one of Claims 1 to 3, characterized in that the separator is formed from at least two layers, the outer one of which comprises a PTFE grid (3) and the inner one of which comprises an ion exchanger diaphragm (4).
5. Primary cell according to Claim 4, characterized in that the ion exchanger diaphragm is constructed as a sleeve with an insulating insert (5) made of PTFE.
6. Primary cell according to Claims 1 to 5, characterized in that the casing cup (1) of the metal casing is laser-welded to a sealing cover (11).