

GALVANIC CELL

The invention relates to galvanic cells. In particular the invention relates to galvanic cells comprising a sealed housing including two parts acting as respective poles of the cell, one of the parts being provided with pressure relief means. The cells may be round cells and the housing may be of metal. The two parts may be a cup and a cover.

A preferred area of application for the invention relates to Ni/Cd accumulators, which are widely used in the form of round cells e.g. for supplying energy to devices of leisure electronics and for the operation of miniature motors.

Conventionally round cells are produced by inserting snugly a cover part and a cup part of nickel-plated sheet steel, one into the other. Each of these parts contains a tablet of active material. The cover part is held in the cup part by a sealing ring of plastics. The edge of the cup is turned over the edge of the cover, whereby the housing is sealed in gas-tight manner.

Usually, the contents of the round cell comprise only a positive and a negative active mass tablet which are separated from one another by a separator impregnated with electrolyte. However, two or more pairs of electrodes may alternatively be arranged in one round cell housing, the pairs being connected in parallel with one another.

Alkaline Ni/Cd round cells operate in an oxygen cycle. In the event of long-term overcharging or exhaustive discharge with excessively high current of such a cell there is a risk of oxygen consumption no longer keeping pace with the oxygen-producing current. If this occurs the internal pressure of the cell increases causing the cell to swell and the cell is finally destroyed by explosion. In order to prevent such destruction, round cells and small accumulators of the round-cell type have been

provided with pressure relief means. Such pressure relief means may be constituted by safety valves or predetermined breakable points or regions. DE-PS 29 41 749 discloses for example a round cell whereof the cup base has a weak region, formed by the erosion of wall material in the shape of a plus sign. The weak region bursts open at a predetermined internal pressure. Another round cell with a pressure relief valve on the cup base is disclosed in GB-PS 1 258 210. Round cells can easily be arranged in a stack to form batteries because of their housings have planar surfaces. The cells are fixed in the stack and protected by shrinking a plastic sheath onto the stack.

In order to prevent explosion of the cells if the cells do not have any of the pressure relief devices mentioned, it is known from DE-OS 22 29 593 to provide metal spacers between the individual cells. These metal spacers are welded to the cover of the cells. Bulging of the housing of such a cell breaks the welds between the cell and one of the spacers thereby causing contact and current flow to be interrupted.

It has now been shown that the pressure relief means present, whether they are predetermined breakable regions or valves, fail in some cases if handled incorrectly and moreover are unreliable.

It is an object of the invention to provide galvanic cells, provided with pressure relief means, and which operate not only individually but also in batteries, even when handled incorrectly, without risk of explosion.

In accordance with the invention there is provided a galvanic cell comprising a sealed housing including two parts acting as respective poles of the cell, one of the parts being provided with pressure relief means, wherein a contact cap is mounted on said one part, a space being defined between said one part and

the cap whereby the housing can expand into the space when pressure within the housing becomes excessive, and wherein the pressure relief means comprises a portion of the housing, which portion breaks when subjected to excessive pressure in the housing.

Preferably the cell is a round cell.

Preferably the two parts of the housing are a cup and a cover.

The contact cap may be mounted on the cup or the cover of the housing. Preferably the contact cap is mounted on the cup.

The contact cap preferably surround a cylindrical wall of the housing only by means of its edge.

Preferably the space is between a circular wall section of the cap and a circular wall of a base of the cup. The height of the space is dimensioned such that it allows the adjacent wall part of the housing to give without hindrance under the influence of excessive internal pressure.

The contact surfaces of two cells lying on top of one another are thus shifted apart to such an extent that the part of the housing part covered by the contact cap can expand into the space. The mechanical and electrical connection between the cells is maintained.

Preferably, the cap is located on the part of the housing provided with the pressure relief means, the cap covering the pressure relief means.

The space within the contact cap allows problem-free operation of the pressure relief means where such means requires, in order to operate to relieve pressure in the cell, not only that a predetermined pressure within the cell is exceeded but also bulging out of the cell. A burstable diaphragm or breakable wall region of a cell cannot deform or distance sufficiently to burst or break if it abuts against the neighbouring cell which bears directly against the first-mentioned cell even at moderate pressure; consequently, there is an uncontrolled further increase in pressure which finally leads to bursting of the cell stack.

The height of the space between said one part of the cell and the contact cap depends on the dimensions of the cell and on the bulging out occurring in practical operation.

The cell housing may be of nickel-plated sheet steel. Similarly the cap is preferably of nickel-plated steel sheet. Alternatively the cap may be of plastics, which may be electrically conductive or separate electrical contacts may be provided, such as in the case of a cell combination.

The wall thickness of the cap depends on the current cell size in each case and is preferably in the range between 0.2 mm and 0.4 mm.

The contact cap is preferably secured to the housing by spot welding or by adhesive. The edge of the cap may be spot welded to the side wall of the housing cup. For plastics caps, adhesive connections are possible.

It is not necessary for the space to be hermetically sealed. As a rule, venting paths are even desirable. Such paths are provided by spot welding the edge of the cap to a cylindrical wall of the cup.

The invention is illustrated below by way of example with reference to the accompanying drawings, wherein:

Figure 1 shows a round cell according to the invention, in association with a further round cell;

Figure 2 shows a similar arrangement of round cells to Figure 1, but with a modified contact cap; and

Figure 3 shows a further contact cap.

In the drawings like reference numerals indicate like parts.

Referring to Figure 1, a round galvanic cell 2 comprises a cup part, which has a cylindrical wall, and a cover part. A contact cap 1 has a circular base or wall and a cylindrical wall, which wall is formed with a step. The upper edge portion of the cylindrical wall of the cap 1 (i.e. the portion of the wall above the step) surrounds the cylindrical wall of the cup part. An intermediate space 3 is defined between the base of the cup part and the part of the cap 1 beneath the step.

The cell 2 is positioned on another round cell 4. The cell 4 has a cup part and a cover part like those of the cell 2.

On stacking the round cells to form a battery, the contact cap 1 can advantageously be fixed first with its circular base on the cover of the cell 4, which is the next round cell down. This is achieved, depending on the cap

material used - metal or plastics - by spot welding or adhesive. Thereafter, the round cell 2 is inserted in the upwardly open cap and the cylindrical wall of its cup part is secured to the cylindrical wall of the contact cap by spot welding or adhesive. The intermediate space 3 results from the step in the contact cap (more clearly visible from the enlarged detail "X").

The contact caps of Figures 2 and 3 are similar to the caps of Figure 1 except as described below.

Referring to Figure 2, the contact cap 1 has a narrowing of its cylindrical wall part at the level of the intermediate space 3. As a result of such shaping, the cap can be given increased elasticity and the capacity to adapt to prescribed lengthwise dimensions of the battery stack.

As shown in Figure 3, the circular base and the cylindrical wall of the cap 1 are interrupted at three peripheral locations up to a particular height by inwardly directed shaped portions 5. The shaped portions 5 form steps on which the associated round cell bears by means of its base part, with the height of the steps at the same time determining the height of the intermediate space.

The cells shown in the drawings include pressure relief means (not illustrated) which are in the cup parts of the round cells, that is to say directly adjacent to the intermediate spaces.

**CLAIMS**

1. A galvanic cell comprising a sealed housing including two parts acting as respective poles of the cell, one of the parts being provided with pressure relief means, wherein a contact cap is mounted on said one part, a space being defined between said one part and the cap whereby the housing can expand into the space when pressure within the housing becomes excessive, and wherein the pressure relief means comprises a portion of the housing, which portion breaks when subjected to excessive pressure in the housing.
2. A cell according to claim 1, wherein the contact cap is of nickel-plated sheet steel.
3. A cell according to any preceding claim, wherein the contact cap is of electrically conductive plastics.
4. A cell according to any preceding claim, wherein the contact cap is secured to the housing by spot welding or adhesive.
5. A cell according to any preceding claim, wherein the contact cap is of material having a thickness between 0.1 mm and 0.4 mm.
6. A cell according to any preceding claim, wherein the housing is of metal.
7. A cell according to any preceding claim, wherein the two parts of the housing are respectively a cup and a cover.
8. A cell according to claim 7, wherein the cap is mounted on the cup.



9. A cell according to any preceding claim wherein the space is defined between the base of the cell and the cap.
10. A cell according to any preceding claim, being a round cell.
11. A galvanic cell substantially as described herein with reference to and as illustrated in Figure 1, 2 or 3 of the drawings.
12. A battery comprising a plurality of galvanic cells according to any preceding claim.