

PATENT SPECIFICATION

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(54) GALVANIC PRIMARY CELL

(71) We, VARTA BATTERIE AKTIEN-GESELLSCHAFT, a German company, of 3000 Hanover 21, Am Leineufer 51, Federal Republic of Germany 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:

10 The invention relates to a galvanic primary cell comprising a cylindrical cell container sealed by a sealing element made of a synthetic resin against the underside of which sealing element a flanged border of the cell can or container engages.

15 Primary cells operating with an acid or alkaline electrolyte are generally of a cylindrical shape and comprise a cup-shaped cell container for accommodation of the electrode materials, a liquid-tight sealing element made of a synthetic resin enclosing the top end of the primary cell, a positive contact disc and a negative contact disc including an insulating casing.

20 Primary cells of various constructions are known. In some of these constructions, the negative soluble or generating electrode is provided in the form of a cup-shaped cell container (Leclanche cell) in which a sealing element made of a synthetic resin forms a plug which is pressed into the cell container. The synthetic-resin sealing element may, for example, be clamped between a bead provided in the cell container and the flanged upper border of the cell container (United States Patent Specifications 3 694 267). In other constructions, the sealing element resting on the electrode is positioned by the flanged cell container (United States Patent Specification 3 016 414).

25 These synthetic-resin sealing elements of the known constructions have the disadvantage of occupying a substantial part of the available cell volume which cannot

thus be used for accommodation of the active materials of the electrode. Moreover, upon the occurrence of excess pressures in the primary cell, the elasticity of these sealing plugs is inadequate, resulting in swelling along the longitudinal axis far beyond the permissible length of primary cells. Upon the occurrence of suddenly rising excess pressures which are caused, for example, by incorrect polarity of the primary cell in the appliance, such sealing plugs made of a synthetic resin are ejected from the cell container with explosive force.

This may be avoided by using synthetic-resin sealing elements which engage only partially in the flanged cell container and in which the sealing effect is obtained by means of a projecting edge at the top end of the cell container. Thus, for example, a sealing element described in German Patent Specification 2 238 406 is provided with a resilient flange projecting into the interior of the cell container and with a thin, ring-shaped flange forming a flutter valve resiliently contacting the external end face.

According to German Patent Specification 1 496 189 a resilient, ring-shaped flange engages in a flanged cell container and a secondary ring-shaped flange engages the periphery of the flanged cell container, the secondary flange performing an additional sealing function.

The latter constructions are frequently referred to as "top seals" which, if a reliable functioning of the sealing element is to be ensured, also require the outer cell casing generally provided in the form of a steel casing, to be provided with an overlapping flanged border by which the sealing laminations resiliently contacting the cell container are pressed against the container. In these constructions, the actual sealing effect is not obtained until after completion of the final assembly of the primary cell after completed flanging of the cell casing en-

closing the cell container and the sealing element.

During the interval between the insertion of the electrode material and the flanging of the cell casing, the surface of the electrode in these constructions is thus inadequately protected against drying out. This may lead to substantial variation of the electric state variables of primary cells, particularly in cells of small dimensions, and in the presence of specific electrolytes, for example, zinc chloride electrolytes of a high concentration or in the presence of various alkaline electrolytes. For this reason, an additional paraffined disc or a bituminous or wax coating is generally applied or sprayed from nozzles directly on to the surface of the electrode.

The fact that the actual seal is not obtained until after completed flanging of the cell casing results in an additional disadvantage: fatigue or shrinkage of the sealing materials may occur during storage so that an optimum compression between the seal and the cell container can no longer be ensured. Leakage after storage can thus only be avoided by frequent application of additional elastic sealing compounds to the border of the cell container.

It is thus an object of the invention to develop a seal of the type hereinbefore described (top seal) which is fitted immediately after introduction of the electrode material and of the electrolyte and which, like a sealing plug, seals the primary cell in this condition thus protecting it against drying out without the use of additional sealing compounds while simultaneously performing its sealing function independently of the use of an additional flanged cell casing.

In accordance with the invention, this object is achieved in that the border of the cell container is flanged at an angle of from 140° minimum to about 190° maximum, preferably at an angle of from about 170° to about 190°; the flanged zone positively contacts and seals a flanged part on the underside of the seal at an angle of from 50° minimum to about 100° maximum, and the end of the flanged zone is positioned on a shoulder of the sealing element by self-locking engagement.

The synthetic-resin sealing element has the usual central bore through which an electrode lead or conductor may be passed.

Where a synthetic resin material having elastomeric properties is used for the sealing element, the desired degree of precompression between the sealing element and the flanged zone of the cell container may be particularly conveniently provided. While the cell containers of known constructions may be provided with an angular or curved flange, flanged at an angle not exceeding 90° so that it is possible for the

edge of the cell container to cut into a recess provided in the sealing element during insertion of the sealing element into the container. However, in the construction according to the invention, the edge of the cell container cannot cut into the sealing element before it reaches its final position since the semicircular inwardly flanged border of the cell container concentrically compresses the shoulder extension of the sealing element and does not engage behind the flanged border by self-locking engagement until the end position is reached.

In addition, any desired packet may then be applied to the cell; however, the electrode material previously introduced into the cell container is always protected against loss of electrolyte moisture by the self-sealing synthetic-resin sealing element immediately after its introduction, independently of the moment at which the primary cell is provided with an additional jacket made of cardboard, a synthetic resin, a metal, or combinations of jackets of these materials.

The radius of the flange encircling the border of the cell container may amount to from 0.7 to 2.5 mm depending upon the diameter of the cell which ranges between 10 and 35 mm in cells of the usual international standard dimensions.

The synthetic-resin sealing arrangement according to the invention is suitable for the usual primary cells operating with an acid electrolyte and also for primary cells operating with an alkaline electrolyte (alkaline manganese cell). Thus, the steel container of an alkaline cell may also be flanged through an angle of from 140° minimum to about 190° maximum, the sealing element containing a bore through which the negative lead or conductor connected to a negative contact plate may be passed. In these alkaline cells particularly, the sealing element may be provided with a pressure-relief valve or breaking point, for example in the form of a diaphragm valve or a breaking or safety diaphragm; such a sealing element may, however, also be used in Leclanche type primary cells.

Embodiments of the invention are hereinafter described, by way of example, with reference to Figures 1 to 5 of the accompanying drawings, in which:—

Figure 1 is a sectional elevation of a primary cell provided with a top seal according to the invention and encased in a labelled sheath;

Figure 2 is a sectional elevation of a similar cell provided with a labelled sheath and encased in a synthetic resin tube;

Figure 3 is a sectional elevation of a primary cell including a top seal according to the invention, a contact cap and a metal casing;

Figure 4 is a sectional elevation of a similar primary cell to that shown in Figure 3 but provided with a sealing element of an improved construction; and

5 Figure 5 is a sectional elevation of a primary cell operating with an alkaline electrolyte and provided with a top seal according to the invention.

With reference to Figure 1, the upper
10 border of a cell can or container 1 is formed with an inwardly-directed curved flange 2. The flange 2, when viewed in the plane of the drawing, has an arcuate extent in the range from 140° to 190°, the preferred
15 range being from 170° to 190°. The can or container 1 may comprise the active material of one polarity of the cell and so could be of zinc. A positive electrode lead or conductor 3 with a contact cap 4 passes
20 through a sealing element 5 of a synthetic resin material which may have rubber-elastic properties so that it may be compressed. The underside of a flange 6 of the sealing element 5 is provided with a
25 curved surface having a radius of curvature corresponding to that of the flange 2 so that the sealing element 5 positively contacts and effects a seal with the flange 2. The sealing contact between the flange 2 and
30 the curved surface of the flange 6 has an arcuate extent in the range from 50° to 100° when viewed in the plane of the drawing. The border of the cell container or the end of the flanged zone engages behind
35 a shoulder extension 8 of the sealing element 5 and it is positioned by self-locking engagement at that position. The positive electrode material 9 previously introduced into the cell container is thus protected
40 against loss of moisture even before a labelled packet 10 is applied. The sealing zone is denoted by the reference numeral 7.

The sealing element 5 shown in Figure 45 2 has substantially the same shape as the sealing element shown in Figure 1. The cell is provided with an additional flexible synthetic resin tube 11 which may be printed or colourless, its upper bodder being advantageously introduced into a corresponding cavity 12 provided in the top surface of the sealing element 5.

In the primary cell of the construction shown in Figure 3, a contact cap 13 extending across the surface of the cell is applied to the positive electrode lead or conductor 3, the cell container 1 is contacted by an insulating casing 14 surrounded by a metal casing 15, and the casing 15 is flanged over
60 the insulating casing 14 and over a flange 13a of the contact cap 13.

In the embodiment shown in Figure 4, the cell container or the negative soluble or generating electrode 1 is also provided
65 with a synthetic-resin packet 14 surrounded

by a metal casing 15. In addition, the top of the sealing element 5 is formed with an external, ring-shaped flange 16 which, together with the synthetic-resin jacket 14 and metal casing 15, covers the flange 13a
70 at the border of the contact cap 13.

In Figure 5, finally, the sealing arrangement according to the invention is used in an alkaline primary cell, known *per se*, particularly in an alkaline-manganese cell.
75 The cell container or can 17 is made preferably of steel, its upper border being also provided with a flange according to the invention to facilitate positioning of the top seal 5. The sealing element 5 has a bore
80 18 for accommodation of a negative lead or conductor 19, a negative contact disc 20, the border of which is provided with a raised flange 21, an insulating casing 23 and a metal casing 24 being jointly flanged
85 over a ring-shaped flange 16 on the sealing element 5. The sealing element 5 may be provided with a pressure-relief valve or breaking point in the form of, for example, a diaphragm valve or breaking diaphragm
90 22, known *per se*, which responds to sudden excess pressure without forcing the sealing element 5 out of the flanged steel container 17.

Without necessarily departing from the
95 scope of the invention claimed, preferred embodiments of the invention may be summarised as follows:—

1. A galvanic primary cell provided with a cylindrical cell container or can which is sealed by a sealing element made of a synthetic resin in the underside of which sealing element a flanged border of the cell container engages, characterised in that the border of the cell container is flanged at
100 an angle of from 140° minimum to about 190° maximum, preferably at an angle of from about 170° to about 190°, and the flanged zone positively contacts and seals the flanged part on the underside of the
105 sealing element at an angle of from 50° minimum to about 100° maximum, the end of the flanged zone being positioned by self-locking engagement on a shoulder provided on the sealing element.
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2. A galvanic primary cell according to Summary 1, characterised in that the top border of the sealing element (5) is encircled by a ring-shaped shoulder (16).

3. A galvanic primary cell according to Summary 1 or Summary 2, characterised in that the sealing element (5) is provided with a predetermined breaking point (22).
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WHAT WE CLAIM IS:—

1. A galvanic primary cell comprising a cylindrical container and a sealing element of synthetic resin material sealing an open end of the container, the said end of the container being formed with an inwardly-
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Figure 4 is a sectional elevation of a similar primary cell to that shown in Figure 3 but provided with a sealing element of an improved construction; and

5 Figure 5 is a sectional elevation of a primary cell operating with an alkaline electrolyte and provided with a top seal according to the invention.

With reference to Figure 1, the upper 10 border of a cell can or container 1 is formed with an inwardly-directed curved flange 2. The flange 2, when viewed in the plane of the drawing, has an arcuate extent in the range from 140° to 190°, the preferred 15 range being from 170° to 190°. The can or container 1 may comprise the active material of one polarity of the cell and so could be of zinc. A positive electrode lead or conductor 3 with a contact cap 4 passes 20 through a sealing element 5 of a synthetic resin material which may have rubber-elastic properties so that it may be compressed. The underside of a flange 6 of the sealing element 5 is provided with a 25 curved surface having a radius of curvature corresponding to that of the flange 2 so that the sealing element 5 positively contacts and effects a seal with the flange 2. The sealing contact between the flange 2 and 30 the curved surface of the flange 6 has an arcuate extent in the range from 50° to 100° when viewed in the plane of the drawing. The border of the cell container or the end of the flanged zone engages behind 35 a shoulder extension 8 of the sealing element 5 and it is positioned by self-locking engagement at that position. The positive electrode material 9 previously introduced into the cell container is thus protected 40 against loss of moisture even before a labelled packet 10 is applied. The sealing zone is denoted by the reference numeral 7.

The sealing element 5 shown in Figure 45 2 has substantially the same shape as the sealing element shown in Figure 1. The cell is provided with an additional flexible synthetic resin tube 11 which may be printed or colourless, its upper bodder being advantageously introduced into a corresponding 50 cavity 12 provided in the top surface of the sealing element 5.

In the primary cell of the construction shown in Figure 3, a contact cap 13 extending across the surface of the cell is applied 55 to the positive electrode lead or conductor 3, the cell container 1 is contacted by an insulating casing 14 surrounded by a metal casing 15, and the casing 15 is flanged over the insulating casing 14 and over a flange 60 13a of the contact cap 13.

In the embodiment shown in Figure 4, the cell container or the negative soluble 65 with a synthetic-resin packet 14 surrounded

by a metal casing 15. In addition, the top of the sealing element 5 is formed with an external, ring-shaped flange 16 which, together with the synthetic-resin jacket 14 and metal casing 15, covers the flange 13a 70 at the border of the contact cap 13.

In Figure 5, finally, the sealing arrangement according to the invention is used in an alkaline primary cell, known *per se*, 75 particularly in an alkaline-manganese cell. The cell container or can 17 is made preferably of steel, its upper border being also provided with a flange according to the invention to facilitate positioning of the top seal 5. The sealing element 5 has a bore 80 18 for accommodation of a negative lead or conductor 19, a negative contact disc 20, the border of which is provided with a raised flange 21, an insulating casing 23 and a metal casing 24 being jointly flanged 85 over a ring-shaped flange 16 on the sealing element 5. The sealing element 5 may be provided with a pressure-relief valve or breaking point in the form of, for example, a diaphragm valve or breaking diaphragm 90 22, known *per se*, which responds to sudden excess pressure without forcing the sealing element 5 out of the flanged steel container 17.

Without necessarily departing from the 95 scope of the invention claimed, preferred embodiments of the invention may be summarised as follows:—

1. A galvanic primary cell provided with a cylindrical cell container or can which is 100 sealed by a sealing element made of a synthetic resin in the underside of which sealing element a flanged border of the cell container engages, characterised in that the border of the cell container is flanged at 105 an angle of from 140° minimum to about 190° maximum, preferably at an angle of from about 170° to about 190°, and the flanged zone positively contacts and seals the flanged part on the underside of the 110 sealing element at an angle of from 50° minimum to about 100° maximum, the end of the flanged zone being positioned by self-locking engagement on a shoulder provided on the sealing element. 115

2. A galvanic primary cell according to Summary 1, characterised in that the top border of the sealing element (5) is encircled by a ring-shaped shoulder (16).

3. A galvanic primary cell according to 120 Summary 1 or Summary 2, characterised in that the sealing element (5) is provided with a predetermined breaking point (22).

WHAT WE CLAIM IS:—

125 1. A galvanic primary cell comprising a cylindrical container and a sealing element of synthetic resin material sealing an open end of the container, the said end of the container being formed with an inwardly- 130

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- directed curved flange having an arcuate extent in a vertical plane in the range from 140° to 190°, and the curved flange contacting the underside of the sealing element to effect a seal with a surface of the sealing element which is curved at a radius corresponding to the curvature of the flange, the sealing contact between the curved surfaces of the flange and sealing element being made over an arcuate extent in the said plane in the range from 50° to 100°, and the sealing element being retained on the container by self-locking engagement of the end of the curved flange with a shoulder provided on the sealing element.
2. A cell, according to Claim 1, in which the sealing element has an upstanding annular shoulder on the periphery of its upper surface.
3. A cell, according to Claim 1 or Claim 2, in which the sealing element has a part which ruptures or opens to relieve excess pressure within the cell.
4. A cell, according to any preceding claim, in which the container comprises the active material of one polarity.
5. A cell, according to any one of Claims 1 to 3, in which the container does not take part in the cell reactions but serves to receive the active materials.
6. A cell, according to any preceding claim, in which the container is surrounded by an insulating tube or jacket which is, in turn, surrounded by a metal casing.
7. A cell, according to any one of Claims 2 to 5, in combination with Claim 35 6, in which the upper ends of insulating tube or jacket and the metal casing are flanged over the said annular shoulder.
8. A cell, according to any preceding claim, in which the inwardly-directed curved flange has an arcuate extent in the range from 170° to 190°.
9. A galvanic primary cell substantially as hereinbefore described with reference to, and as illustrated in, Figure 1, or Figure 2, or Figure 3, or Figure 4, or Figure 5, of the accompanying drawings.

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