

PATENT SPECIFICATION

(11) 1207 102

1207 102

DRAWINGS ATTACHED

- (21) Application No. 8026/69 (22) Filed 14 Feb. 1969
 (31) Convention Application No. 706028 (32) Filed 16 Feb. 1968 in
 (33) United States of America (US)
 (45) Complete Specification published 30 Sept. 1970
 (51) International Classification H 01 m 1/06
 (52) Index at acceptance

H1B D10C D12 D9A D9M P1M P2B1 P4B



(54) DRY CELL

(71) We, UNION CARBIDE CORPORATION, of 270, Park Avenue, New York, State of New York, 10017, United States of America, a Corporation organized under the laws of the State of New York, United States of America, (assignees of LEWIS FREDERICK URRY), 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:—

This invention relates to dry cells and especially dry cells employing a magnesium anode, and more specifically concerns the provision of novel venting means for releasing gas pressure developed during discharge of such cells.

Magnesium dry cells are ideally suited for use as the power source in many applications where a high working voltage is required. As compared to the conventional Leclanché dry cell with a zinc anode, magnesium cells operate at a voltage of about 0.3 volt higher under conditions of equivalent current drain. Despite this rather significant advantage, magnesium cells have not yet attained widespread use primarily because they have been plagued by many difficulties.

One of the most serious difficulties encountered with magnesium cells is that of gas generation and possible build-up of dangerous gas pressure during discharge of the cells. This is due to the rather poor efficiency of the active magnesium anode which reacts wastefully with water in the electrolyte to produce hydrogen gas in copious quantities.

In the past, Leclanché dry cells have employed venting means for releasing gas pressure developed within the cell. Usually this venting means has consisted of an open diffusion vent of one type or another formed within the cell closure. While this type of venting means may be satisfactory for a Leclanché dry cell, it is by no means suitable for use in a magnesium cell since an open diffusion vent is not capable of rapidly releasing large quantities of gas from inside

the cell. A magnesium cell generally will produce gas on normal discharge at a rate of up to one thousand times faster than a Leclanché dry cell which does not generate gas in serious quantities until the cell has been completely discharged. 50

Another disadvantage of an open diffusion type vent as used in prior Leclanché dry cells is that it too readily permits the continued loss of moisture from the cell. For extended shelf life, a magnesium cell must be capable of retaining substantially all of its initial water content and consequently the cell is required to be hermetically sealed during the period of shelf storage. 55 60

Still another disadvantage of such prior diffusion type vents is that they are open at all times during discharge as well as when the cell is on shelf. Ideally, venting means for a magnesium cell should be capable of maintaining the cell in a sealed condition during shelf storage and then rapidly releasing copious quantities of gas generated when the cell is discharged. In addition, the venting means should be capable of resealing itself once the gas pressure has been released. Moreover, the venting means used must be simple in construction and inexpensive to manufacture. 65 70 75

Accordingly, the present invention provides a dry cell comprising a cylindrical cupped consumable anode container having an open end, a central cathode rod protruding through the opening end of said container and beyond the peripheral edges thereof, an annular closure disc mounted within the open end of said container and having a central opening therein through which said cathode rod extends, and a flanger metal terminal cap mounted over the protruding end of said cathode rod, characterized by a flat annular seal gasket fitted around the cathode rod extending over the annular closure disc and overlying a gas venting aperture in said annular closure disc, said flat annular seal gasket being maintained in normally sealing relationship with the venting aperture by a 80 85 90

[Price 5s. 0d. (25p)]

flanged low edge portion of the terminal cap, disposed over said gasket and in resilient pressure contact therewith.

5 Reference will now be made in the ensuing specification to the accompanying drawings which illustrate the invention, and wherein:

Figure 1 is an elevational view in section of a dry cell embodying the novel valve vent of the invention;

10 Figure 2 is a top plan view of the dry cell shown in Figure 1;

Figure 3 is a sectional view of the top portion only of a dry cell showing a modification of the valve vent of the invention; and

15 Figure 4 is a similar view of a dry cell showing another modification of the invention.

20 Referring to Figures 1 and 2, there is shown a dry cell embodying the invention. As denoted by the reference numeral 2, the cell includes a cylindrical cupped container of a consumable magnesium metal or alloy which serves as the anode of the cell. Within
25 this container-anode 2 there is disposed the usual cathode bobbin consisting of a manganese dioxide depolarizer mixture 3 and a central carbon cathode rod 4. The cathode rod 4 is embedded within the depolarizer mixture 3 and extends at its top end beyond
30 the upper peripheral edges of the container-anode 2. A star washer 5 is placed at the bottom of the cathode bobbin and insulates the depolarizer mixture 3 and the cathode rod 4 from the bottom end of the container-anode 2. An ion permeable separator in the form of a bibulous paper sleeve 6 surrounds
35 the cathode bobbin between the depolarizer mixture 3 and the side wall of the container-anode 2. The separator may consist of a methyl cellulose coated paper, for example.

40 The closure for the cell is provided in the form of an insulating annular disc 7 suitably of a plastics material, which is tightly fitted around the upper end portion of the cathode rod 4 within the open end of the container-anode 2. The insulating annular disc 7 is made slightly larger than the inside diameter
45 of the container-anode 2 and is forced through its open end into locked engagement with a peripheral groove 8 provided on the upper interior side wall of the anode 2. The resilient forces exerted by the side wall of the container-anode 2 when the insulating disc 7
50 is forced through its open end form a tight radial seal between the outer peripheral edges of the disc 7 and the interior side wall of the container-anode 2. A flange metal terminal cap 9 is fitted tightly over the top of the cathode rod 4 which protrudes through the
60 central opening in the disc 7 and serves as the positive terminal of the cell.

65 The valve vent in accordance with the invention is formed by the provision in the insulating annular disc 7 of a venting aperture

10 located beneath the terminal cap 9. A flat annular seal gasket 11 is positioned on top of the insulating disc 7 around the cathode rod 4 and overlies the venting aperture 10 at a point near its outer peripheral edge. 70 The seal gasket 11 may be made from any suitable gasket material such as rubber or a rubber compound, for example.

75 As best shown in Figure 1, the terminal cap 9 is formed integrally with a flanged lower edge portion 9a which is mounted directly on top of the flat annular seal gasket 11. The flanged edge portion 9a is positioned at its outermost or free end in resilient pressure contact with that part of the flat seal gasket 11 overlying the venting aperture 10. It will be seen that the flanged edge portion 9a of the terminal cap 9 constitutes
80 in effect a resilient gasket retainer member which biases the flat annular seal gasket 11 into normally sealing relation around the venting aperture 10 but which at the same time is deflectable at its outermost end in a direction away from the flat seal gasket 11 as
85 generally indicated by the arrow in the drawing.

90 During the time that the cell is on shelf storage or on initial discharge when little if any gas is generated, the valve vent is maintained in a normally closed position and there is substantially little if any loss of moisture from the cell. However, when the cell is discharged, there may be generated copious quantities of gas which can give rise to the build-up of an excessive or unsafe internal gas pressure inside the cell. When this pre-determined gas pressure is reached, the
95 flanged lower edge portion 9a of the terminal cap 9 is caused to deflect at its outermost end in a direction away from the flat annular seal gasket 11 by the force of the gas pressure applied through the venting aperture 10. With this deflection of the flanged edge portion 9a, the seal formed around the venting aperture 10 is momentarily broken allowing gas to escape from the cell. Once the gas pressure has been released, the flanged edge portion 9a of the terminal cap 9 returns to its initial biasing position over the top of the flat seal gasket 11, thus resealing the valve vent. 115

120 Figure 3 shows a modification of the valve vent wherein an annular round embossment 12 is formed on the insulating disc 7 just below the outer peripheral edges of the flat annular seal gasket 11. It will be seen that by this modification the outer periphery of the flat seal gasket 11 is forced into tight sealing relation with the annular embossment 12, thus assuring a good seal around the venting aperture 10 for prohibiting moisture loss during the time that the valve vent is closed on shelf storage.

125 Another modification of the valve vent is shown in Figure 4. Here the valve vent em-

5 employs a flat annular seal gasket 13a which is formed integrally with an annular grommet 13 fitted within the central opening in the insulating disc 7. The grommet 13 forms a tight seal between the disc 7 and the cathode rod 4 which further aids in prohibiting moisture loss from the cell.

10 The valve vent may be designed to open and vent gas from inside the cell at any given predetermined pressure by varying the effective area of gas contact on the underneath side of the flat annular seal gasket 11. Thus, the valve vent may be made to open at lower pressures by increasing the size or diameter of the venting aperture 10. However, this may be undesirable in some cases and especially with smaller cells such as A size cells⁽¹⁾ since the larger venting aperture tends to weaken the insulating disc 7. One way to avoid this problem is to increase the area of gas contact on the flat seal gasket 11 by providing the venting aperture 10 with an enlarged opening or recess 14 on the top surface of the disc 7 as shown in Figure 3.

25 The present invention thus provides a novel valve vent which will maintain the cell in a sealed condition while on shelf storage but which is capable of rapidly releasing copious quantities of gas on discharge. The valve vent is also constructed from parts normally used to form the sealed closure for the cell.

35 (1) The dimensions of an A size cell given by the U.S. Department of Commerce, National Bureau of Statistics, are as follows:

Nominal Diameter: 5/8 in.

Height: 1-7/8 in.

Approximate Volume: 0.57 cubic inches

Approximate Weight: 0.045 lbs.

40 WHAT WE CLAIM IS:—

1. A dry cell comprising a cylindrical cupped consumable anode container having

an open end, a central cathode rod protruding through the open end of said container and beyond the peripheral edges thereof, an annular closure disc 45 mounted within the open end of said container and having a central opening therein through which said cathode rod extends, and a flanged metal terminal cap 50 mounted over the protruding end of said cathode rod, characterized by a flat annular seal gasket fitted around the cathode rod extending over the annular closure disc and overlying a gas venting aperture in said annular closure disc said flat annular seal gasket being maintained in normally sealing relationship with the venting aperture by a flanged lower edge portion of the terminal cap disposed over said gasket and in resilient pressure contact therewith. 55 60

2. A dry cell as claimed in claim 1, characterized in that the closure disc is formed with an annular embossment positioned just below the outer peripheral edge of the flat annular gasket, said peripheral edge being distorted from its normally flat condition and supported by said annular embossment. 65

3. A dry cell as claimed in claims 1 and 2, characterized in that the venting aperture terminates into a recess in the top surface of the annular closure disc. 70

4. A dry cell as claimed in claims 1 to 3, characterized in that the flat annular seal gasket is formed integrally with an annular grommet mounted around the cathode rod within the central opening in the annular closure disc. 75

5. A dry cell substantially as herein before described with reference to the accompanying drawings. 80

W. P. THOMPSON & CO.,
12, Church Street,
Liverpool, 1.
Chartered Patent Agents.



5 plays a flat annular seal gasket 13a which is formed integrally with an annular grommet 13 fitted within the central opening in the insulating disc 7. The grommet 13 forms a tight seal between the disc 7 and the cathode rod 4 which further aids in prohibiting moisture loss from the cell.

10 The valve vent may be designed to open and vent gas from inside the cell at any given predetermined pressure by varying the effective area of gas contact on the underneath side of the flat annular seal gasket 11. Thus, the valve vent may be made to open at lower pressures by increasing the size or diameter of the venting aperture 10. However, this may be undesirable in some cases and especially with smaller cells such as A size cells⁽¹⁾ since the larger venting aperture tends to weaken the insulating disc 7. One way to avoid this problem is to increase the area of gas contact on the flat seal gasket 11 by providing the venting aperture 10 with an enlarged opening or recess 14 on the top surface of the disc 7 as shown in Figure 3.

25 The present invention thus provides a novel valve vent which will maintain the cell in a sealed condition while on shelf storage but which is capable of rapidly releasing copious quantities of gas on discharge. The valve vent is also constructed from parts normally used to form the sealed closure for the cell.

35 (1) The dimensions of an A size cell given by the U.S. Department of Commerce, National Bureau of Statistics, are as follows:

Nominal Diameter: 5/8 in.

Height: 1-7/8 in.

Approximate Volume: 0.57 cubic inches

Approximate Weight: 0.045 lbs.

40 WHAT WE CLAIM IS:—

1. A dry cell comprising a cylindrical cupped consumable anode container having

an open end, a central cathode rod protruding through the open end of said container and beyond the peripheral edges thereof, an annular closure disc 45 mounted within the open end of said container and having a central opening therein through which said cathode rod extends, and a flanged metal terminal cap 50 mounted over the protruding end of said cathode rod, characterized by a flat annular seal gasket fitted around the cathode rod extending over the annular closure disc and overlying a gas venting aperture in said 55 annular closure disc said flat annular seal gasket being maintained in normally sealing relationship with the venting aperture by a flanged lower edge portion of the terminal cap disposed over said gasket and in resilient 60 pressure contact therewith.

2. A dry cell as claimed in claim 1, characterized in that the closure disc is formed with an annular embossment positioned just below the outer peripheral edge of the flat annular gasket, said peripheral edge 65 being distorted from its normally flat condition and supported by said annular embossment.

3. A dry cell as claimed in claims 1 and 2, characterized in that the venting aperture terminates into a recess in the top surface of the annular closure disc. 70

4. A dry cell as claimed in claims 1 to 3, characterized in that the flat annular seal gasket is formed integrally with an annular grommet mounted around the cathode rod within the central opening in the annular closure disc. 75

5. A dry cell substantially as herein before described with reference to the accompanying drawings. 80

W. P. THOMPSON & CO.,
12, Church Street,
Liverpool, 1.
Chartered Patent Agents.