Sept. 2, 1958 L. F. URRY 2,850,558

LEAK-RESISTANT DRY CELL

Filed Sept. 1, 1955

Fig. 1.

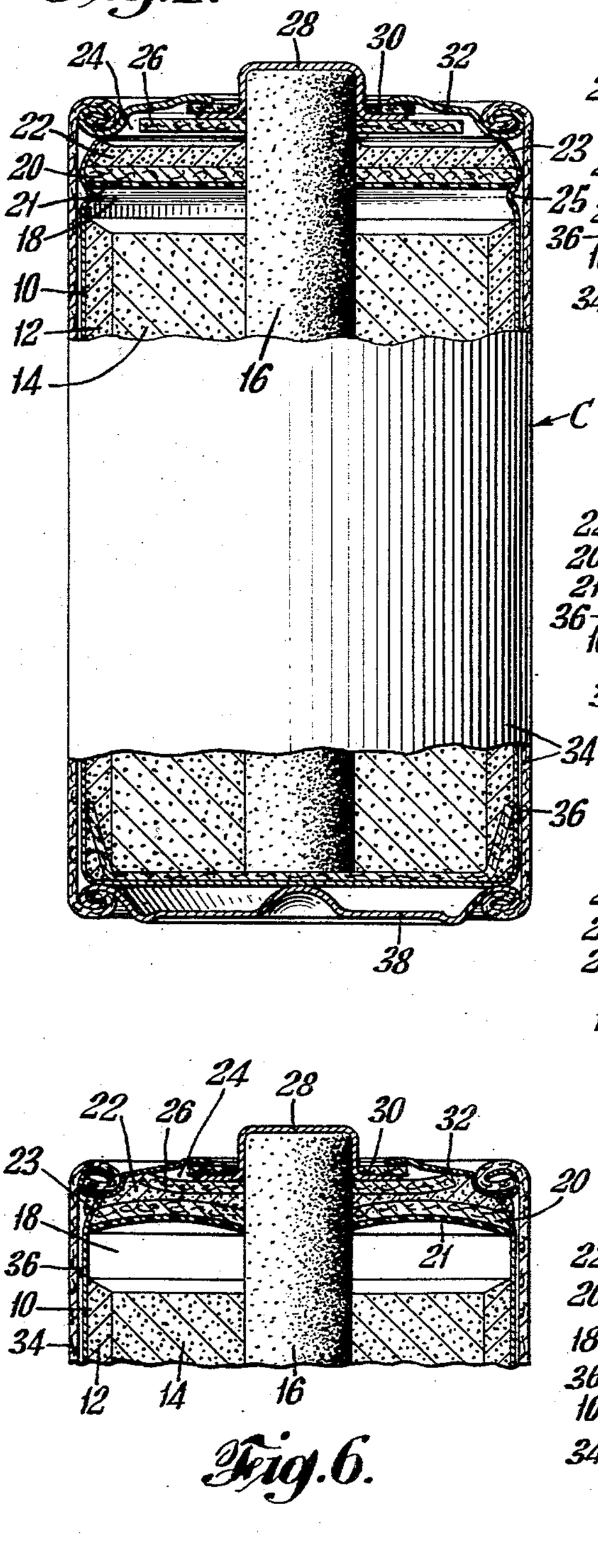

Fig. 2.

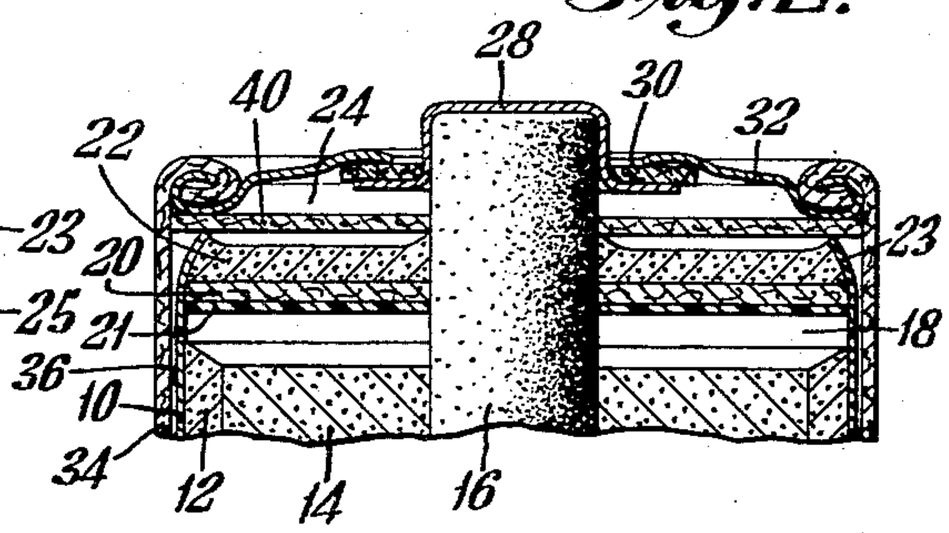

Fig. 3.

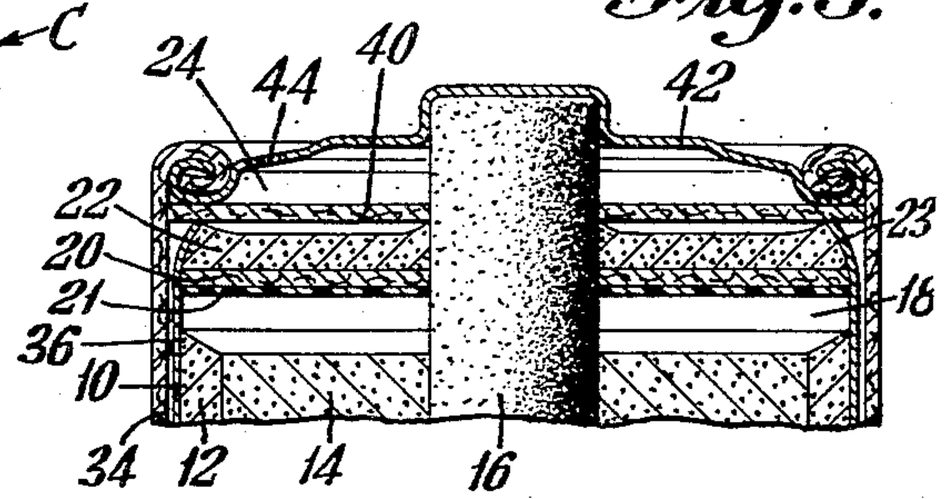

Fig. 4.

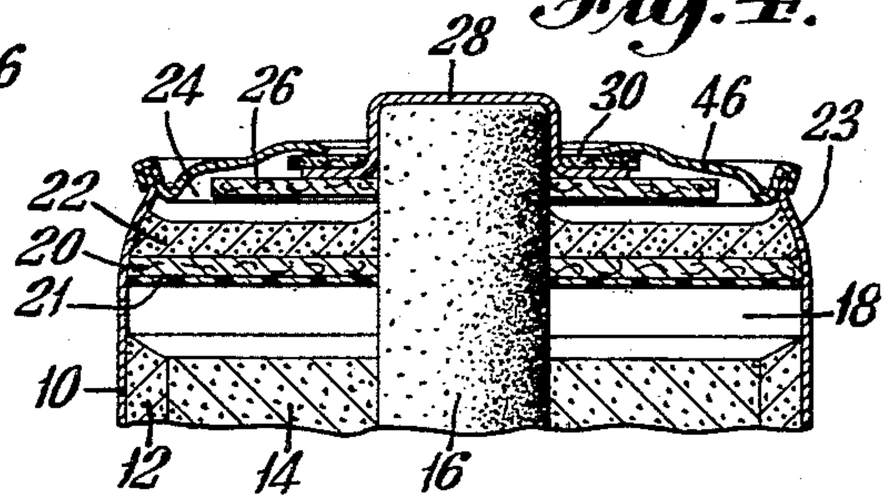

Fig. 5.

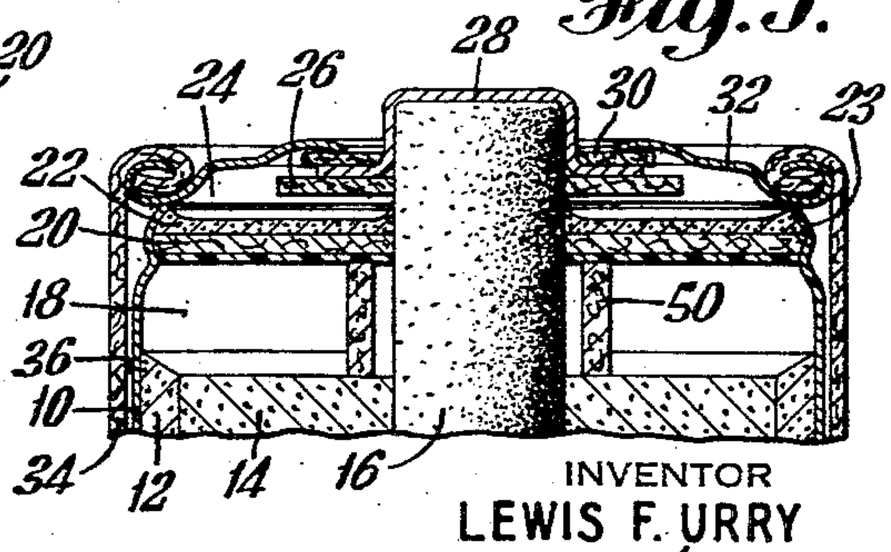

Fig. 6.

INVENTOR
LEWIS F. URRY
BY John F. Holzmann
ATTORNEY

United States Patent Office

2,850,558

Patented Sept. 2, 1958

2,850,558

LEAK-RESISTANT DRY CELL

Lewis F. Urry, Lakewood, Ohio, assignor to Union Carbide Canada Limited, a corporation of Canada

Application September 1, 1955, Serial No. 531,922

9 Claims. (Cl. 136—133)

This invention relates to leak-resistant dry cells.

One of the most familiar articles of commerce is the so-called dry cell used for flashlights, portable radios, photoflash and other devices. This small package of electricity has been accepted as a necessary tool of industry and household alike. As with all tools, more and more is demanded of it. But in seeking to provide longer life, higher possible current drains and generally greater output, battery manufacturers have been plagued with the problem of preventing leakage from the cell.

Although the problem has existed for many years, and although millions of dollars have been spent in research in attempts to solve it, there is still need for improvement. One of the principal attacks on the problem has been made from the standpoint of attempting to prevent leakage by placing the cell in a closed container. One widely used expedient comprises a metal container, but this suffers from the disadvantage that the metal is subject to corrosion by cell exudate and may be destroyed by it, thereby defeating its purpose. On the other hand, non-corrodible containers do not have the mechanical strength of metal containers and suffer from the disadvantage that pressure built up within the container is sufficient in many cases to cause the container to yield by bulging, and under extreme conditions, even to burst.

To avoid the disadvantages of the high pressure system just described, suggestions have been advanced for low-pressure systems in which the attempt is made to restrain liquid leakage while permitting continuous venting of gas from the cell. This venting may take place through the central carbon electrode and out a perforation in the terminal cap placed thereon or may be expected to occur through adventitous voids such as those between closure and jacket for instance. The principal difficulty encountered in such systems is that the gas-venting paths tend to become obstructed, sometimes during manufacture, sometimes during use of the cell so that the intended low-pressure system actually becomes a high-pressure one, and bulging or rupture of the container and leakage of liquid ensue.

It is the principal object of this invention to provide in a leak-resistant cell a continuously operable gas-venting path.

More specifically, it is an object of the invention to provide a continuously operable venting path suitable particularly for use in a type of construction utilizing a non-corrodible container.

These objects are attained by the invention which will be described with reference to the accompanying drawing in which:

Fig. 1 is a vertical elevation partially in section of a dry cell embodying the invention;

Fig. 2 is a similar view of the top portion only of another type of cell construction embodying the invention;

Fig. 3 is similar to Fig. 2 showing another embodiment of the invention;

Fig. 4 is similar showing another embodiment;

Fig. 5 is similar showing yet another embodiment; and

Fig. 6 is a vertical section of the top portion of a cell embodying the invention after use.

Broadly, the invention comprises in combination, a venting washer below the top closure of a leak-resistant dry cell and a yieldable inner sealing member defining a free space above the depolarizer mix of the cell.

Referring to the drawing, there is shown in Fig. 1 a leak-resistant cell of a particular type of construction for which the invention is well suited. The cell C comprises a zinc cup electrode **10** having therein immobilized electrolyte **12**, a depolarizer mix **14** and a carbon electrode **16** embedded in the depolarizer mix **14**. Just below the top of the cup **10** and so placed as to define a lower free space **18** above the depolarizer mix **14** and an upper free space **24** is an inner seal comprising a top collar **20** and a soft seal **22** held in position by the upper end of the cup **10** which is inwardly bent as shown at **23**. The top collar **20** is preferably composed of paper or other fibrous material protected against penetration of electrolyte by a coating **21** of plastic such as polyethylene, for example. A bead **25** may be provided in the cup electrode **10** to aid in locating the top collar **20** during manufacture of the cell. The sealing layer **22** is preferably composed of a soft wax, a microcrystalline wax having a melting point of about 160° C. having been used successfully. A mixture of asphalt and petrolatum may be used for this layer if desired. Spaced somewhat above the soft seal **22** and in the upper free space **24** is a venting washer **26** having a central aperture through which the carbon electrode **16** passes. Preferably the washer **26** fits the electrode **16** rather snugly so as to aid in positioning it during manufacture. The venting washer must provide, in conjunction with the closure of the cell, a passage for gas and preferably is composed of paper or other fibrous material.

A preferred closure comprises a flanged metal cap **28** supported on the top of the carbon electrode **16** and carrying an insulating washer **30** on which rest the inner peripheral edges of a metal washer **32** whose outer edges are in liquid-tight engagement with a jacket **34**. In the construction shown in Fig. 1 the jacket **34** is non-corrodible, bars the passage of liquid and fits the electrode **10** rather loosely, thereby providing a supplementary chamber **36** for receiving cell exudate in the event of perforation of the zinc electrode **10**. Also as shown, the jacket **34** is secured to a "false bottom" **38** which makes contact with the zinc electrode **10**.

As shown in Figs. 2 to 5 inclusive, the invention is applicable to other constructions. For example, referring to Fig. 2 the venting washer **40** may be of a diameter somewhat greater than that of the zinc cup electrode **10** and rest upon its top edges. Or, as shown in Fig. 3, a one-piece cover **42** which may be provided with a vent **44** may be used instead of the three-piece closure shown in Figs. 1 and 2. It will be observed that the venting washer **40** used in this construction is of the larger diameter as shown in Fig. 2. This servess to insulate the cover **42** from the cup electrode **10** as well as to serve its venting function. In Fig. 4 an alternative construction is shown in which the outer peripheral edges of the metal washer **46** of a three-piece closure are attached to the upper edges of the zinc cup **10**, the internal construction otherwise being the same as that shown in Fig. 1. With this type of construction any jacket (not shown) may be provided for the cell and secured thereto in conventional manner. As shown in Fig. 5 a tube **50** of cardboard or other gas-permeable material may be provided about the carbon electrode **16** in the free space **18** to prevent cell exudate from coming into contact with the electrode and thereby blocking it

to the passage of gas. Of course such a tube can be used in any of the constructions shown.

Having described the construction of cells incorporating the invention, its operation may now be visualized. During use of a dry cell, and especially under severe conditions, gas is released. This gas may be vented through or around the carbon electrode **16**, into the upper free space **24** and eventually out through the closure or jacket side wall without effect on the inner seal. At the same time, liquid may be exuded from the depolarizer mix and accumulated in the free space **18**. Under the pressure of such liquid and entrapped gas, the inner seal made up of the top collar **20** and sealing layer **22**, being yieldable, is displaced upwardly in the direction of the top closure. By such displacement, the volume of the upper free space **24** is added to that of the lower space **18**, relieving pressure therein. Should perforation of the zinc electrode **10** occur with emission of liquid to the chamber **36** between the jacket **34** and electrode **10**, such liquid is barred from passage out the closure by the sealing layer **22** which, as shown in Fig. 6, effectively blocks off the joint between the closure member **32** and the jacket **34**. In the cases of Figs. 2 and 3, this function is performed by the venting washer **40**.

It will be seen, however, that despite the displacement of the inner seal, a venting path for gas still remains. This path leads from the free space **18**, up through the electrode **16**, or between it and the displaced edges of the inner seal, to the venting washer **26** and to the insulating washer **30** and eventually out of the cell and its container. Thus, gas is continuously vented and no substantial gas pressure is ever built up in the cell or its container. In a cell construction having a one-piece metal cover as shown in Fig. 3, the venting path may be through the vent **44** or through the joint between the cover **42** and the jacket **34** or through the side wall of the jacket **34**. It will be noted that the venting washer **40** overlies the top edges of the container electrode **10** and extends substantially to the inner walls of the jacket **34**.

A number of test cells embodying the invention have been made and subjected to tests ranging from normal usage to severe abuse. These tests demonstrated the effectiveness of the invention, for cells otherwise identical in construction but having no venting washer failed by bursting under the pressures developed therein while those cells embodying the invention consistently showed no evidence of pressure build-up and did not leak under breakdown tests.

One of the advantages of the invention derives from the elimination of the conventional vent in the cap on the central electrode. In prior constructions such vents have been used to permit gas to escape, but some liquid frequently escaped therefrom as well, damaging the contacting surface. In the construction of the invention the cap is preferably not vented, and a more tortuous venting path is provided. Such moisture as may be entrained with the gas is entrapped under the closure or absorbed in the venting or insulating washer.

Although specific structural details have been given herein by way of illustration, it will be apparent that the principles of the invention may be applied to other constructions than those shown.

I claim:

1. In a leak-resistant dry cell comprising a cup electrode containing electrolyte-wet depolarizer mix, and a second electrode embedded therein, the combination of a rigid closure for said cell, said closure having gas venting means therein; an inner seal positioned between said depolarizer mix and said closure and out of contact with either, thus defining a free space between said seal and said closure and a free space between said seal and said depolarizer mix, said inner seal being displaceable in the direction of said closure in response to pressure within the cell; and in said free space between said inner seal and said closure a substantially flat venting washer adapted to provide a path for venting gas from said cell in association with said gas venting means in said closure regardless of the position of said displaceable inner seal.

2. The combination defined by claim 1 in which said inner seal comprises a non-absorbent collar extending from said cup electrode to said second electrode and a soft, tacky sealing material overlying said collar and adapted to adhere to said cup electrode and to exposed portions of the underside of said closure when said seal is displaced.

3. The combination defined by claim 1 in which said closure comprises a flanged metal terminal member carried by the central electrode of said cell, an insulating washer carried on the flange of said member and a metal washer, the inner peripheral edges of which rest upon said insulating washer, said insulating washer constituting said gas venting means.

4. The combination defined by claim 1 in which there is provided in said free space between said inner seal and said depolarizer mix means for preventing cell exudate from contacting the central electrode of said cell extending therethrough.

5. A leak-resistant dry cell comprising a consumable metal container anode having therein electrolyte, depolarizer mix and a central non-consumable electrode; a rigid top closure having therein gas venting means for said cell; an inner seal in said container anode positioned between said depolarizer mix and said top closure and out of contact with either, thus defining a free space above said depolarizer mix and a free space below said closure, said inner seal being displaceable in the direction of said top closure in response to pressure within the cell; and a substantially flat venting washer in said free space between said inner seal and said closure, said venting washer providing a venting path for gas in association with said top closure venting means regardless of the position of said inner seal.

6. A leak-resistant dry cell comprising a consumable metal cup anode having therein electrolyte, depolarizer mix and a central non-consumable electrode, a rigid top closure for said cell secured to said cup anode and having gas venting means therein; an inner seal positioned in said cup anode between said depolarizer mix and said closure and out of contact with either, thus defining a free space above said depolarizer mix and a free space below said closure, said inner seal being displaceable in the direction of said top closure in response to pressure within said cell; and a substantially flat venting washer in said free space between said inner seal and said top closure, said venting washer providing a venting path for gas in association with said top closure venting means regardless of the position of said inner seal.

7. A leak-resistant dry cell comprising a consumable metal cup anode having therein electrolyte, depolarizer mix and a central non-consumable electrode, an electrolyte-proof jacket for said cup anode longer than said anode and extending beyond it, a rigid top closure for said cell secured to said jacket and having gas venting means therein, an inner seal in said cup anode positioned between said depolarizer mix and said closure and out of contact with either, thereby defining a free space above said depolarizer mix and a free space below said closure, said inner seal being displaceable in the direction of said top closure in response to pressure within said cell; and a substantially flat venting washer in said free space between said inner seal and said top closure, said venting washer providing a venting path for gas in association with said top closure venting means regardless of the position of said inner seal.

8. In a leak-resistant dry cell comprising a consumable metal cup anode containing therein, a depolarizer mix and a central electrode embedded therein, the combination of a jacket and a rigid top closure for said cell, said

closure being secured to said jacket and having gas venting means therein; a displaceable inner seal positioned between said top closure and said depolarizer mix and out of contact with either, thus defining a free space above said depolarizer mix and a free space below said top closure, said inner seal being displaceable in the direction of said top closure in response to pressure within said cell; and in said free space between said cell and said top closure a substantially flat venting washer adapted to provide a path for venting gas from said cell in association with said gas venting means in said closure regardless of the position of said displaceable inner seal, said washer being of a diameter greater than the diameter of said cup anode.

9. The combination defined by claim 8 in which said closure is of metal in one piece.

References Cited in the file of this patent

UNITED STATES PATENTS

1,866,016	Deibel	July 5, 1932
2,060,796	Cahoon	Nov. 17, 1936
2,060,818	Marsal	Nov. 17, 1936
2,060,832	Smith	Nov. 17, 1936
2,505,014	Terlizzi et al.	Apr. 25, 1950
2,707,200	Urry et al.	Apr. 26, 1955
2,773,926	Glover	Dec. 11, 1956
2,790,022	Glesner	Apr. 23, 1957