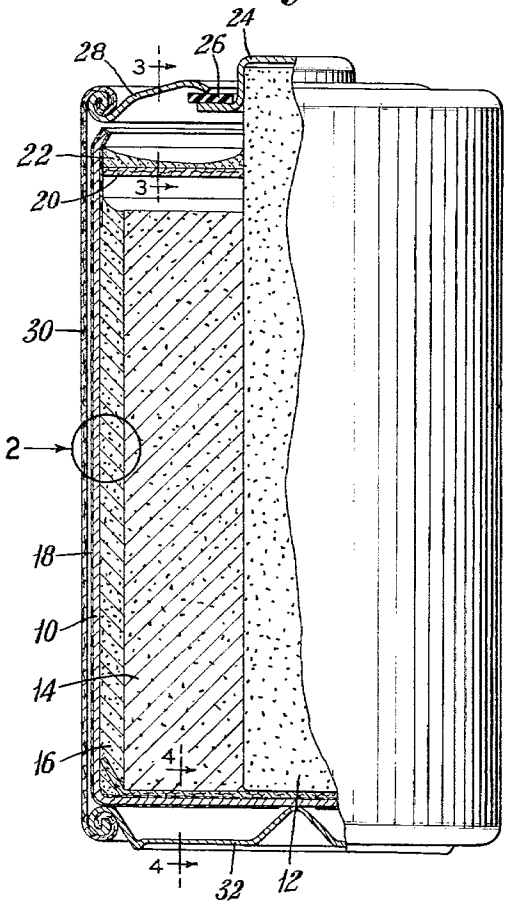
Aug. 24, 1965 L. F. URRY 3,202,549

LEAK-RESISTANT DRY CELLS

Filed May 1, 1961

Fig. 1.



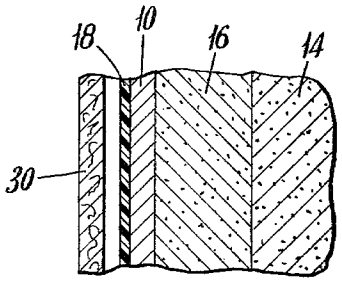


Fig. 2.

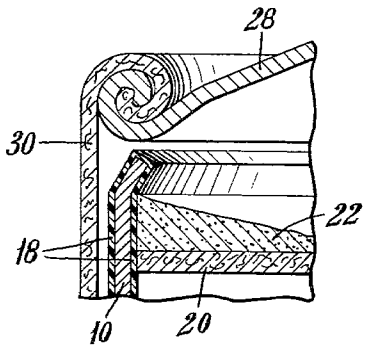


Fig. 3.

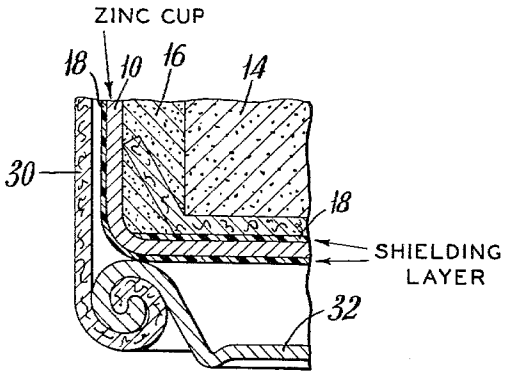


Fig. 4.

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LEAK-RESISTANT DRY CELLS

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8 Claims. (Cl. 136—132)

This invention relates to leak-resistant dry cells of the type having a closed container surrounding the cell proper.

The so-called LeClanche dry cell used for flashlights, portable radios, photoflash and other devices has gone through an evolution of improvements during the past decade or more in an attempt by manufacturers to prevent leakage from the cell during and after its use. Despite the many proposals, however, that have been advanced, there still remains a need for a better leak-resistant dry cell.

One proposal that has been adopted commercially is to encase a conventional dry cell within a closed container comprising a non-metallic jacket, a "false" bottom and a metallic top closure. Difficulty has been encountered, however, in preventing the jacket, which has been made from a fibrous material, for example, paper, from being penetrated by liquid exudate which may escape from the cell, for example, in the event the container-electrode becomes perforated during use of the cell. Several proposals have been suggested for overcoming this difficulty by incorporating a liquid-proof barrier into the jacket. Such proposals, however, while protecting the jacket, still permitted liquid to escape from the cell and suffer from the disadvantage that the liquid is free to migrate throughout the cell container, eventually coming into contact with the top and bottom closures where leakage is most apt to occur. Another difficulty brought about by this migration of liquid has been the possible interference with the proper venting of gas from the cell, resulting in the harmful build-up of pressure within the cell container. Still another difficulty encountered has been that the liquid often becomes a source for the generation of gas, for when it comes into contact between the container-electrode and the bottom of the cell container, they being made from different metals, an electrolytic couple is created which may cause gas to be generated. Various proposals have been advanced for overcoming these difficulties, for example, by incorporating a seal between the container-electrode and jacket, but these suggestions have not entirely solved the problem and generally have increased the difficulty and cost of manufacturing the cells.

It is therefore the principal object of the invention to provide a construction for a leak-resistant dry cell which will more effectively prohibit leakage.

More specifically, another object is to provide such a construction which will prohibit the migration of liquid throughout the cell container of a leak-resistant dry cell.

Briefly, these and other objects are achieved by the invention which comprises the provision of thin shielding layers of a plastic material adhered to the whole exterior surfaces and to the upper interior side walls and bottom of the container-electrode of a leak-resistant dry cell.

In the accompanying drawing:

FIG. 1 is a vertical elevation partially in section of a leak-resistant dry cell embodying the invention;

FIG. 2 is a greatly enlarged view of the encircled portion indicated at 2 in FIG. 1;

FIG. 3 is an enlarged detail view taken along the line 3—3 of FIG. 1; and

FIG. 4 is an enlarged detail view taken along the line 4—4 of FIG. 1.

Referring to the drawing, a dry cell of a conventional construction having a cupped container-anode 10 of a consumable metal, for instance, zinc, containing therein

a carbon electrode 12 embedded within a depolarizer mix 14 and an immobilized electrolyte 16 suitably in the form of a conventional "paste," has provided to the container-anode 10 a thin shielding layer 18 as shown in FIG. 1. As best shown in enlarged detail in FIGS. 2 and 4, the shielding layer 18 is firmly adhered to the exterior bottom and side walls of the container-anode 10. The shielding layer 18 is also applied to the interior side walls of the container-anode 10 at its upper edges above the depolarizer mix 14 and to its interior bottom wall as best shown in enlarged detail in FIGS. 3 and 4. The shielding layer 18 should be inert to materials in the cell and preferably is composed of a plastic material, for example, vinyl resin, low molecular weight polyethylene, acrylic resins, latex and cellulosic derivatives such as cellulose acetate. A lacquer made from cellulosic derivatives such as cellulose ethers may also be used with success. Also, the plastic material preferably should have good elastic properties, vinyl resin being an excellent example of such material for which reason it is generally preferred. A displaceable inner seal consisting of a wax impregnated paper washer 20 and a soft seal 22 of asphalt, for example, preferably is positioned within the upper edges of the container-anode 10. This type of seal serves to entrap liquid within the cell and, being yieldable, also serves to release pressure therein as gas is formed within the cell. A rigid, non-displaceable inner seal of the type disclosed and claimed in my copending application, Serial No. 106,760, filed concurrently herewith, may also be utilized in the construction of the dry cell shown in FIG. 1.

A preferred top closure for the cell comprises a flanged metal cap 24 fitted on top of the carbon electrode 12 and an insulating washer 26 carried by the metal cap 24 on which rests the inner peripheral edges of a metal washer 28. The outer edges of the washer 28 are locked in engagement with a jacket 30. This construction conveniently provides a venting path for the escape of gas from the cell, for example, from between the displaceable edges of the metal washer 28 and insulating washer 26. The jacket 30 is non-corrodible, it being composed of a fibrous material, for example, paper, and also has locked to it a metallic "false" bottom 32 which underlies and is in contact with a portion of the container-anode 10 which is left bare at its bottom exterior wall.

Having described the construction of a dry cell incorporating the principles of the invention, the advantages made possible by the invention may now be clearly visualized. During or after use of the cell, and especially when the cell has been subjected to severe conditions of discharge, the container-anode 10 may become perforated, in which event liquid is prevented from escaping from the cell and from migrating throughout the cell container by the shielding layer 18. Hence, the difficulties heretofore brought about by migration of liquid to the top and bottom closures, for example, interference with proper gas venting from the cell, are effectively eliminated. By this construction, it will also be noted that the use of a liquid-proof barrier heretofore incorporated into the jacket is dispensed with, thereby reducing the cost of manufacturing the cell, since the liquid cannot penetrate the jacket, and the full dry strength of the jacket 30 utilized in order to resist the build-up of gas pressure within the cell container which may develop during operation of the cell.

An important advantage achieved by the invention is made possible by the fact that the shielding layer 18, in the event of perforation of the container-anode 10, prevents liquid from coming into contact with its outer surfaces at least during the useful life of the cell. In contrast with prior dry cell constructions, this construction prohibits an electrolytic or corrosion couple from being formed between the inner amalgamated and outer unamalgamated surfaces of the container-anode 10, which

in such prior constructions has resulted in wasteful consumption of anode material and the harmful generation of gas within the cell container.

Also, a further advantage derived from the invention is the additional protection afforded the inner side and bottom walls of the container-anode **10** by the shielding layer **18**. In prior dry cell constructions, it has been appreciated that these portions of the container-electrode perform no useful purpose, other than to contain liquid within the cell, and in fact are detrimental, for the upper inner edges of the container-electrode, in particular, are subject to being attacked and corroded during use of the cell. This results in escape of liquid from the container-electrode, the harmful generation of gas and the possibility of internal short-circuits occurring within the cell. This latter condition has been found to arise from the fact that, when corrosion occurs, anode metal tends to go into solution which eventually deposits over the depolarizer mix in the form of metallic "trees." These so-called trees produce short circuit paths between the container-electrode and carbon electrode of the cell. Another difficulty in such prior dry cell constructions has been that of bottom wall corrosion of the container-electrode after its side walls have been consumed but while the cell is still being discharged. Under these conditions, gas is readily generated within the cell. In the dry cell construction of the invention, this difficulty is effectively minimized for the bottom wall of the container-anode **10** is provided with a shielding layer **18** on both its inner and outer sides so that practically all of the container-anode bottom is protected against corrosion.

The construction of a dry cell embodying the invention lends itself to manufacture in any of several ways. For example, it is conventional in the manufacture of dry cells to make the container-anode **10** by extruding it from a calotte of zinc. This method for making the container-anode **10** may be conveniently utilized for incorporating the shielding layer **18**. Thus, the container-anode **10** may be extruded together with a sheet or film of the plastic shielding material which is firmly adhered to it through the application of heat. This technique, however, can be used only for applying the shielding layer **18** to the exterior bottom and side walls of the container-anode **10**. Another technique which may also be utilized for manufacturing dry cells consists of spraying or painting the shielding layer **18** onto the container-anode **10** after it is made.

A number of dry cells embodying the invention have been made and tested under severe conditions of use. These tests demonstrated the effectiveness of the invention, for cells otherwise identical in construction but having no shielding layer applied to the container-electrode of the cell evidenced leakage while those cells embodying the invention showed no evidence of leakage nor of migration of liquid throughout the cell container. As further evidence of the effectiveness of the invention, dry cells embodying the invention have been subjected to additional tests for determining the amount of gas released by them over a period of time. It was shown in these

tests that dry cells of the invention released an amount of gas in a period of several months which equalled that released by cells of a conventional construction over a period of a day.

It will be understood that various changes and modifications may be made in the dry cell construction described herein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a leak-resistant dry cell comprising a cupped container-electrode of a consumable metal having therein a depolarizer mix and electrolyte, the top surfaces of which are disposed below the top open end of said container-electrode, and having a thin shielding layer of a plastic material adhered to the exterior side walls and bottom thereof, and a jacket surrounding said cupped container-electrode and having a top closure locked in liquid-tight engagement therewith, said top closure being disposed over the top open end of said container-electrode and defining a free space above said depolarizer mix and electrolyte; the improvement which comprises the provision of additional thin shielding layers of plastic material adhered to the interior side walls above said depolarizer mix within said free space and to the interior bottom of said container-electrode.

2. A leak-resistant dry cell as defined by claim **1** in which said shielding layers are composed of a vinyl resin.

3. A leak-resistant dry cell as defined by claim **1** in which said shielding layers are composed of an acrylic resin.

4. A leak-resistant dry cell as defined by claim **1** in which said shielding layers are composed of latex.

5. A leak-resistant dry cell as defined by claim **1** in which said shielding layers are composed of a low molecular weight polyethylene.

6. A leak-resistant dry cell as defined by claim **1** in which said shielding layers are composed of a cellulosic material.

7. A leak-resistant dry cell as defined by claim **6** in which said cellulosic material is cellulose acetate.

8. A leak-resistant dry cell as defined by claim **6** in which said cellulosic material is a lacquer.

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