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2,541,931

LEAKPROOF DRY CELL

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Fig. 2

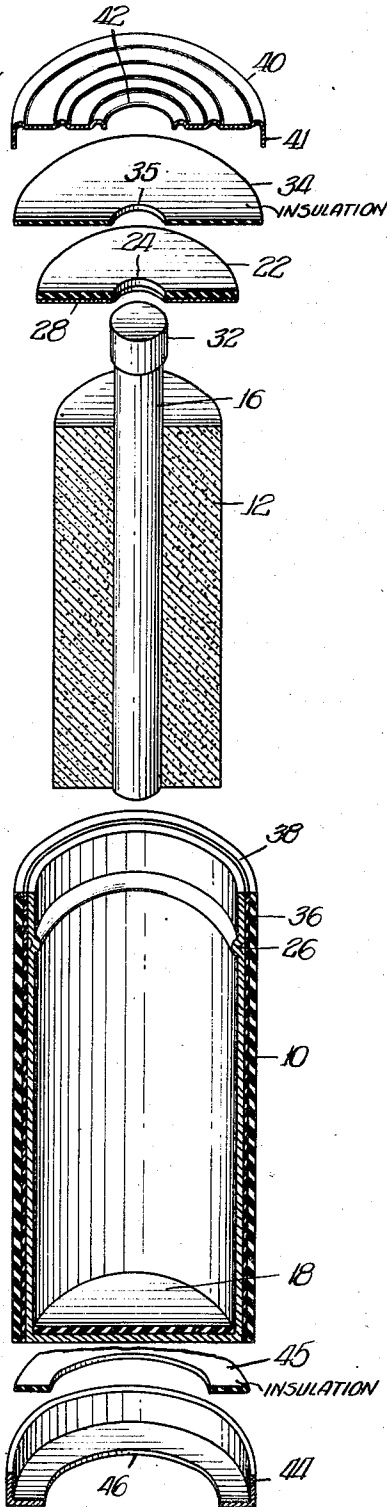


Fig. 1

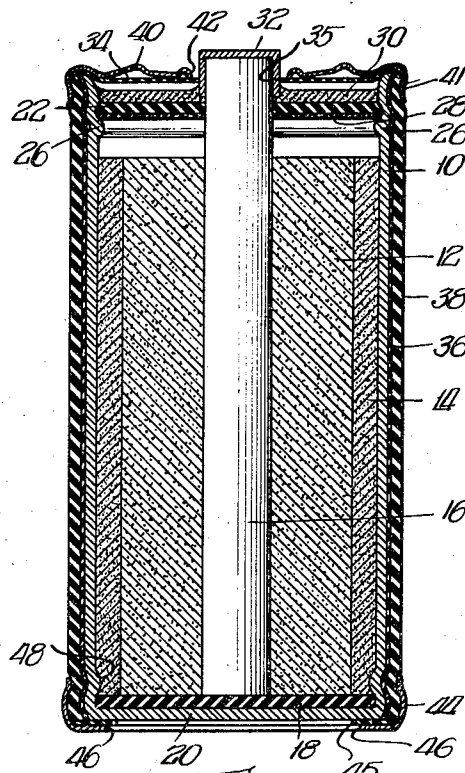
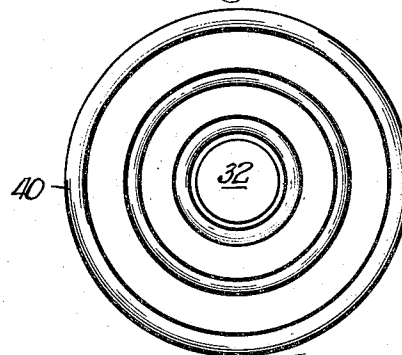


Fig. 3



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LEAKPROOF DRY CELL

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5 Claims. (Cl. 136—133)

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This invention relates to improvements in electrical dry cells and more particularly to an improved construction thereof which prevents the exudation or leakage of any part of the contents of such a cell and therefore eliminates possible damage to associated equipment.

To prevent such leakage in dry cells of the type which have been widely used in flashlights has become increasingly important, since such cells are also now being used in equipment of considerably greater value, such as hearing aids or portable radio receivers.

Numerous types of construction have been developed with the idea in mind of eliminating the danger of cell leakage. In most of these types of construction it has been necessary to sacrifice some of the other desirable characteristics of the cell in order to obtain a non-leaking variety. For instance, in the type of construction utilizing the double zinc cup, the size of the inner can and the bobbin of depolarizing material and the volume of electrolyte have necessarily been reduced. This is true, since the outside dimensions of flashlight cells have been standardized by the industry for obvious reasons. Therefore any increase in the width of the protecting material and the width of the container for the bobbin and the electrolyte will naturally restrict the diameter of the bobbin and the volume of the electrolyte since the internal capacity of the container will be reduced.

In addition, if a metal jacket or a second zinc cup is used to enclose the zinc cup which acts as one of the electrodes, the construction cost of the cell is substantially increased. It therefore would be desirable to be able to achieve the protection of an all metal double-wall construction without the expense of a metal jacket or second cup.

It is therefore the object of this invention to provide a practical, inexpensive and efficient cell having a protective casing which entirely eliminates the danger of leakage from the cell and which consequently eliminates the disadvantages which result from such leakage.

It is a further object to provide a cell of the character described without sacrificing other desirable characteristics such as reducing the volume of active ingredients contained therein.

An additional object is to provide an electrical dry cell which is of leak-proof construction but which may be manufactured at a cost comparable with cells of the non-leak-proof variety.

Further objects and advantages of this invention will become evident as the description proceeds, and from an examination of the accom-

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panying drawing which illustrates one embodiment of the invention and in which similar numerals refer to similar parts throughout the several views.

In the drawing—

Fig. 1 is a vertical sectional view of a dry cell embodying one form of this invention;

Fig. 2 is an exploded view of the various parts making up the dry cell, as shown in Fig. 1, the parts being shown in their appropriate vertical relation to each other;

Fig. 3 is a top plane view of the cell shown in Fig. 1.

Referring now to Figures 1 and 2, the dry cell has the zinc cup electrode 10 which contains the usual bobbin 12 and the electrolyte 14. The electrolyte 14 is disposed between the outer surface of the bobbin 12 and the inner surface of zinc cup 10. A carbon electrode 16 is centrally disposed in the depolarizing material forming the main body of the bobbin 12 and projects from the upper end of the latter. The insulating disc 18 rests on the base 20 of the zinc can 10 within the can and the bobbin 12, in turn, rests on this insulating disc 18.

The disc 22, having a central opening 24 adapted to tightly enclose the carbon electrode 16, is force-fitted over that electrode and moved into abutting relation with the circumferential bead 26 adjacent the upper end of the zinc can 10. The disc 22 is preferably of vulcanized fiber and has at least its underside coated with a suitable protective material 28, such as one of several grades of vinylite finishes which are well known in the art which are resistant to the action of the materials within the cell.

A suitable thermoplastic material 30, such as the usual asphalt compound, is poured over the disc 22 while in a plastic condition and allowed to solidify to form a seal above this disc. The cap 32 of suitable metal may be force-fitted over the carbon electrode 16 prior to the application of this thermoplastic material 30 so that its lower edge extends into the material 30 when the latter has solidified, as shown in Fig. 1.

A thin resilient sheath or film 36 which may be formed of any suitable rubber-like substance which is substantially impervious to the materials which may exude from the dry cell, together with a jacket 38 formed of paper or other suitable inexpensive material to which the sheath 36 is internally secured, is then placed over the zinc cup. This film 36 and the paper jacket 38 are preferably of a pre-formed construction and make up a laminated cover for the zinc cup. The film

36 is secured to the inner surface of the paper jacket 38 with a suitable cement prior to the time the laminated cover is slipped over the can 10. The laminated tube is of the same length as the zinc cup 10 so that the upper and lower edges of the tube are flush with the upper edge and the base 20 of the cup 10, respectively.

A second disc 34 which has a central opening 35 adapted to enclose the cap member 32 is then fitted over the protruding carbon electrode 16 and seated on the upper edge of the zinc can 10, the sheath 36, and the paper jacket 38.

The flanged closure 40, which may be of a construction similar to that disclosed in the McEachron et al. Patent No. 2,332,456, is then placed in abutting relation with the disc 34 so that the peripheral edge of the central opening 42 in the closure is in spaced relation to the circumferential side of the cap 32 on the carbon electrode 16, and the flange 41 extends downwardly adjacent the paper jacket 38. The flange 41 of the closure 40 is then crimped inwardly so as to engage the peripheral edge of the disc 34, together with the upper edges of the jacket 38, the film 36 and the zinc cup 10. As shown in Fig. 1, the disc 34 serves to insulate the upper edge of the zinc cup 10 from the main body of the metal closure 40, and the upper edge of the paper jacket 38 serves to insulate the crimped, peripheral edge of the closure 40 likewise from the cup 10. This disposition of the metal closure 40 effectively seals the open end of the cell. The film 36 is also effectively sealed against the zinc cup 10 at the point at which the peripheral edge of the closure 40 is crimped inwardly. This is true since, as shown in Fig. 1, the inward crimping of the closure 40 also results in a crimping of the upper edge of the zinc can 10 and the upper edge of the paper jacket 38. The upper edge of the film 36 is therefore effectively compressed by the crimped paper jacket against the correspondingly crimped portion of the zinc cup.

This inward displacement of the zinc cup 10 occurs immediately above the disc 22, so that the latter is effectively locked in place by the bead 26 and this displacement. The presence of the thermoplastic 30 together with this locking action insures a tight seal between the zinc cup 10 and the disc 22 around its peripheral edge.

A flanged ring 44 with a large central opening 46 is then slipped over the bottom of the cell with the insulating ring washer 45 therein so that it encloses the bottom edge of the jacket 38 and is flush against the washer 45 which is, in turn, adjacent the base 20 of the zinc cup 10. The flange on this ring is then crimped to the bottom of the cell, effectively sealing the film 36 to the zinc cup 10 in substantially the same fashion as described above in connection with the sealing action of the closure member 40. After the ring is so disposed it is electrically insulated from the zinc cup electrode 10 just as is the closure 40. The crimping of the flange on the ring 44 also displaces the jacket 38 and the zinc cup 10 to form the bead 48 immediately above the insulating disc 18.

From the above description it will be seen that the zinc cup 10 is tightly enclosed by the laminated tube made up of the paper jacket 38 and the film 36. Since it sometimes happens in this type of dry cell that the zinc can is partially consumed and corroded during the normal use of the cell, with the result that the electrolyte housed within the can is forced or otherwise leaks out of the zinc can to the exterior thereof, some suitable method of confining these exudations is

highly desirable. The fact that the film 36 is not attached to the zinc cup 10 by an adhesive but is merely pressure sealed, adjacent the two ends of the zinc cup, is significant in connection with this characteristic of such cells. In case perforation of the zinc cup occurs, the material forced through to the external surface of the cup will be dispersed over the entire outside surface of the cup between the latter and the film 36, since such material is of a fluid or semi-fluid nature. The pressure seals between the film 36 and the zinc cup 10 described above will maintain such exuded material in the area between these circumferential seals, and the film 36, being impervious, will prevent it from passing through to the paper jacket.

Due to the generation of gases within the cell during the period of use, considerable pressure is often built up in the interior of the cell. This pressure often forces the electrolyte out through any perforations which may have been formed in the zinc can. It is therefore important that any material which is utilized to confine this exuded material has sufficient strength to withstand such pressure as it is built up without becoming distorted. This material should be such that it permits no appreciable swelling to take place, for instance, since valuable equipment can be damaged as readily by such swelling as by the corrosive effects of the exudations. By crimping the paper cover at each end so that it is tightly compressed against the zinc can, it is normally held under a slight longitudinal tension. This tension tends to resist any outward displacement of the cover such as that which might occur when the electrolyte or other material is forced out of the zinc cup into the area between the cup and the film.

Although the film 36 does not extend beyond the bottom edge of the zinc can 10 and the base of the can 20 is therefore exposed through the central opening 46 in the flanged ring 44, there is no danger of leakage at this point. This is true because the insulating disc 18 is composed of a material which protects the base 20 from the chemical action which ordinarily takes place on the sidewall within the cup. The base is therefore protected from possible corrosion and resultant leakage. Furthermore, since there is a circumferential seal between the film 36 and the zinc can 10 adjacent to the base of the can, exuded material cannot leak down from the sides of the can into contact with the external surface of the base 20 of the can. This construction of the bottom portion of the dry cell not only eliminates the danger of leakage in this area but also provides a simple method of producing a circuit terminal at the bottom end of the can.

It has been found desirable to pre-form the film 36 and the paper jacket 38 as a laminated tube prior to disposing either the film or the paper jacket on the zinc cup 10. If the film 36 is handled independently it is much more difficult to maintain it in the proper shape in order to easily insert the zinc can 10 therein. For instance, a tube of such material has a tendency to remain collapsed in the form of a flat strip with the two sides of such strip adhering firmly to each other. Opening this collapsed tube and maintaining it in such an open form is a problem which causes difficulty in a mass production technique. In addition, it has been found that it is impossible under current methods of manufacture to produce a tube of suitable resilient material which has dimensions accurate enough

to make it satisfactory for this type of use, where the tolerances must be quite small. Also, the dimensions of most materials of this general type are radically affected by changes in temperature, so that it would be necessary to closely control the room temperature during the manufacturing process.

Under the preferred procedure the formation of the laminated tube can be carried out by spirally winding a strip of suitable rubber-like material on a mandrel so that its edges overlap. These edges are then sealed by heat or a suitable adhesive to form the film 36. Thereafter a suitable adhesive is also applied to the outer surface of this resilient material and a strip of paper or like material is spirally wound thereover to form the jacket 38. The completed tube is then cut to the proper lengths which are removed from the mandrel and the individual sections so formed may then be slipped over the zinc cup to form the protective covering described above. The flanged metal closure is then spun in retaining engagement with the paper jacket and the side wall of the can at the top of the cell, and the flanged ring is similarly spun in place at the bottom of the cell, all in accordance with the description set out above.

The operations of inserting the cell into the section of laminated covering material and the spinning of the metal closure and the flanged ring into the desired position are such that they lend themselves to being accomplished by high speed mechanical means. This fact plus the elimination of a large portion of the metal usually utilized in the manufacture of leak-proof cells enables the manufacturer to produce such a leak-proof cell at a cost which is considerably below that which has been considered necessary prior to this time.

The drawing and the above description are not intended to represent the only possible form of this invention, in regard to details of construction. Changes in form and in the proportion of parts, as well as the substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit or scope of this invention.

What is claimed is:

1. A non-leaking dry cell provided with circuit terminals at both ends comprising a metal cup electrode, a core electrode, means for closing said cell comprising a non-conducting material closely engaging said core electrode and said cup electrode, a sleeve of flexible, rubbery material substantially impervious to the possible exudations of said dry cell non-adherently sheathing said cup electrode, a non-metallic cover secured to and overlying said sleeve, a flanged ring closely embracing the lower end of said dry cell, the flange on said ring being in crimping engagement with the lower edges of said cover, said sleeve and said cup electrode, and a flanged disc closely embracing the upper end of said dry cell, the flange on said disc being in crimped relation with the upper edges of said cover, said sleeve, and said cup electrode, the crimped portions of said flanged disc and said flanged ring causing said resilient sleeve to be compressed between said cover and said cup electrode so as to form a tight pressure-seal between said sleeve and said cup electrode adjacent its upper and lower ends.

2. A non-leaking dry cell provided with circuit terminals at both ends comprising a metal cup electrode, a core electrode, means for closing said cell comprising a non-conducting material close-

ly engaging said core electrode and said cup electrode, a sleeve of flexible, rubbery material substantially impervious to the possible exudations of said dry cell non-adherently sheathing said cup electrode, a non-metallic cover secured to and overlying said sleeve, a flanged metal ring closely embracing the lower end of said dry cell, the flange on said ring being in crimping engagement with the lower edges of said cover, said sleeve and said cup electrode, a disc of insulating material disposed between the base of said core electrode and the inner surface of the base of said cup electrode, said crimping engagement of said flanged ring being such that said electrode is inwardly displaced immediately above said disc so as to lock the latter against said base of said cup electrode, a flanged metal disc closely embracing the upper end of said dry cell, the flange on said disc being in crimping engagement with the upper edges of said cover, said sleeve, and said cup electrode, the crimped portions of said flanged disc and said flanged ring causing said resilient sleeve to be compressed between said cover and said cup electrode so as to form a tight pressure-seal between said sleeve and said cup electrode adjacent its upper and lower ends, and means for insulating said flanged disc and said flanged ring from said cup electrode.

3. A leakproof dry cell provided with circuit terminals at opposite ends, comprising a metal can serving as an electrode and containing an electrolyte, a centrally disposed carbon electrode and depolarizing mix in said electrolyte, a sleeve of thin, flexible, rubbery material which is resistant to penetration by said electrolyte non-adherently embracing the outside walls of said can, means for closing said can disposed inside thereof, said means closely engaging the inner side walls of said can and a flanged metal disc said carbon electrode, tightly embracing the upper end of said dry cell, the flange on said disc being in crimped relation with the outside walls of said can so as to compress and seal said sleeve against the underlying portion of said can, said flanged disc having an opening therein through which said carbon electrode projects, and a flanged ring member tightly embracing the lower end of said dry cell, the flange on said ring being in crimped relation with the outside walls of said can so as to compress and seal said sleeve against the underlying portion of said can, said flanged ring having an opening in its bottom for exposing the bottom of said can whereby the same may serve as an electrode.

12. A leakproof dry cell provided with circuit terminals at opposite ends, comprising a metal can serving as an electrode and containing an electrolyte, a centrally disposed carbon electrode and depolarizing mix in said electrolyte, a laminated sheath having an inner layer of thin, flexible, rubbery material which is resistant to penetration by said electrolyte non-adherently embracing the outside walls of said can and an outer layer of non-metallic material to which said inner layer of rubbery material is adhesively secured, means for closing said can disposed inside thereof, said means being closely embraced by inner side walls of said can and closely embracing the sides of said carbon electrode, a flanged disc tightly embracing the upper end of said dry cell, the flange on said disc being in crimped relation with the outside walls of said can above said means for closing said can so as to compress and seal said sheath against the underlying portion of said can, said flanged disc

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having an opening therein through which said carbon electrode projects, and a flanged ring member tightly embracing the lower end of said dry cell, the flange on said ring being in crimped relation with the outside walls of said can so as to compress and seal said sheath against the underlying portion of said can said flanged ring having an opening in its bottom for exposing the bottom of said can whereby the same may serve as an electrode.

5. In a leakproof dry cell containing an electrolyte, the combination of a metal cup member serving as an electrode, a laminated sheath having a thin inner layer of flexible, rubbery material which is resistant to penetration by said electrolyte non-adherently embracing the outside walls of said cup and an outer layer of compressible non-metallic material to which said inner layer of rubbery material is adhesively secured, a flanged ring embracing the bottom edge of said cup, the flange on said ring being disposed in crimped engagement with the lower edge of said sheath, a ring of non-conducting material disposed so as to insulate said flange ring from said

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cup, a flanged disc embracing the upper edge of said cup, the flange on said disc being disposed in crimped engagement with the upper edge of said sheath, and a disc of non-conducting material disposed so as to insulate said disc from said cup.

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The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,541,931

February 13, 1951

EDGAR D. McEACHRON ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 39, strike out the words "a flanged metal disc" and insert the same after the word and comma "electrode," in line 40; line 55, for the claim numbered "12" read 4;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of June, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,

Assistant Commissioner of Patents.