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PRIMARY ALKALINE CELL

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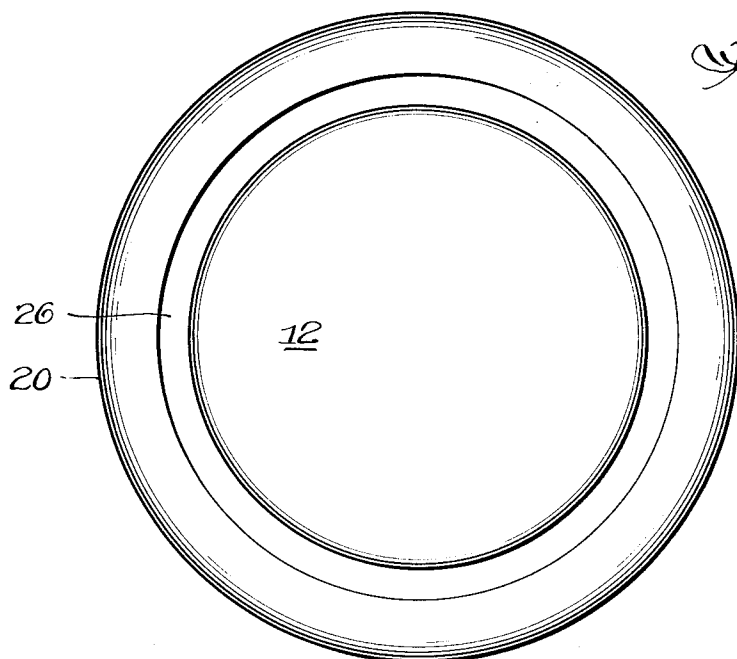


Fig. 2

Fig. 3

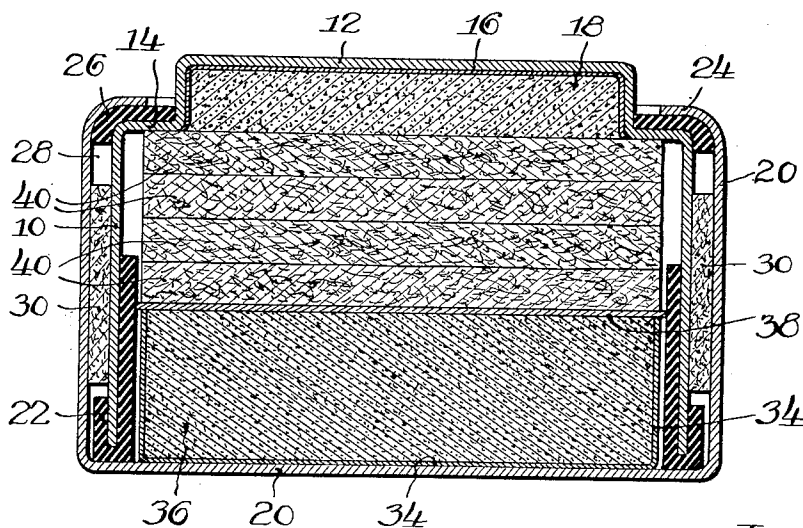
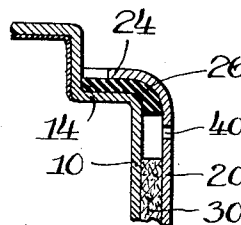


Fig. 1

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PRIMARY ALKALINE CELL

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5 Claims. (Cl. 136—107)

This invention relates to primary electric cells and particularly to structure for current-producing dry cells having an alkaline electrolyte.

In dry cells of the type mentioned, gas is generated in the cell while it stands on open circuit and unless such gas is vented in a proper manner, pressure is built up within the cell until rupture of the enclosure occurs or the seal of the cell is forced open and the gas escapes and carries with it some of the liquid cell electrolyte. Leakage of electrolyte is objectionable, in that it has a deleterious effect upon objects with which it comes in contact, as is well known.

It is the object of the present invention to provide a dry cell of the character described having a structure which serves to vent the gases to the surrounding space and at the same time inhibits leakage of liquid electrolyte to the exterior of the cell.

Other objects of the invention will become apparent from the following description, which is to be read in conjunction with the accompanying drawing in which

Fig. 1 is a vertical sectional view of an embodiment of a cell constructed in accordance with the invention,

Fig. 2 is a top view of said embodiment, and

Fig. 3 is a fragmental sectional view of a different embodiment of the invention.

In the cell embodiment illustrated in Figs. 1 and 2, there are two open-top cups 10 and 20 arranged in mutually telescoping relation to form the enclosure for the cell. The inner cup 10 is composed of a suitable metal such as steel and has its open-top directed downwardly and has the major central portion of its bottom dished upwardly as shown to form the dished portion 12. Between the dished portion 12 and the cylindrical wall of inner cup 10 is the annular shoulder 14. The exterior surface of steel cup 10 may be nickel-plated if desired. The interior surface of the dished portion 12 has an adherent coating 16 of zinc thereon, formed by plating or other suitable method. Within said dished portion 12 and resting in contact with zinc layer 16 is the negative electrode or anode 18 of the cell, said anode being composed of amalgamated zinc and preferably being in the form of a body of compressed amalgamated zinc particles. The amalgamated zinc powder is pressed into the dished portion 12 under such pressure that it remains firmly in place throughout the life of the cell.

The outer cup 20 is composed of a suitable metal such as steel and has its open top directed upwardly. The exterior surface of steel cup 20 may be nickel-plated if desired. Between the cylindrical edge of the open top of inner cup 10 and the bottom wall of outer cup 20 is an annular sealing gasket 22 of a suitable compliant sealing material such as compliant neoprene, polyethylene, or polyvinyl chloride. Such gasket 22 is shaped in cross section in the form of a deep, narrow U, the base of the U being under pressure between the edge of the inner cup 10 and the bottom of the outer cup 20, the outer leg of the U extending upwardly a short distance in contact

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with the exterior surface of cup 10 within the space between said cup and outer cup 20, and the inner leg extending upwardly a greater distance, somewhat more than one-half of the height of cup 10, in contact with the interior surface of said cup 10.

The upper end portion of the cylindrical wall of outer cup 20 is turned inwardly to form the flange 24 and an annular spacing member 26 is arranged between shoulder 14 and flange 24. Spacing member 26 is composed of a suitable substantially rigid non-conductive material such as rigid neoprene, modified polystyrene, or vulcanized fiber. The arrangement is such that spacing member 26 is clamped between flange 24 and shoulder 14 under pressure as will be described more fully hereinafter. Such pressure is transmitted to gasket 22. Spacing member 26 maintains the cylindrical walls of the inner and outer cups spaced apart to provide the annular space 28 within which is the mass of absorbent material 30 which may be absorbent paper such as blotting paper. Within outer cup 20 and fixed to the bottom wall of the latter as by welding or soldering is a third open top cup 34 which is also composed of steel. The exterior diameter of cup 34 is less than the interior diameter of cup 10 to leave a narrow annular space between the two members. Cup 34 is shallow in relation to the height of cups 10 and 20 to leave a substantial space between the top of said cup 34 and the surface of anode 18.

Within cup 34 is the depolarizing cathode 36 which is composed of a mixture of powdered suitable oxygen-yielding substance such as mercuric oxide, mercurous oxide, silver oxide, silver peroxide, cupric oxide, cuprous oxide, or other readily-reducible oxygen-yielding compound, or mixtures of such compounds, and a suitable conductive substance such as micronized graphite. The depolarizer composition is compressed into cup 24, the amount of composition being sufficient to fill cup 24 substantially level with the top edge thereof.

Resting upon the top surface of the depolarizing cathode 36 and the upper edge of cathode cup 34 is a relatively thin barrier disk 38 of a suitable liquid and ion-permeable material, resistant to the action of the electrolyte, such as parchment paper, vinyl resin, vinylidene resin, or the like. The edge of said disk 38 extends outwardly beyond the side wall of cup 34 and into contact with gasket 22. Above the barrier disk 38 is the electrolyte-receptive body 40 which is composed of a suitable porous, absorbent, electrolyte-resistant material, such as wood fibers, cotton fibers, or the like, examples of which are porous absorbent paper and cotton. The body 40 is of cylindrical shape and has a diameter smaller than the internal diameter of inner cup 10 whereby an annular space is provided between the cup 10 and the body 40. The body 40 is under compression between the anode 18 and the barrier disk 38 and is sufficiently porous to be highly absorbent of the liquid electrolyte of the cell.

The electrolyte of the cell is contained in absorbed condition in the absorbent body 40. The electrolyte is an aqueous solution of a suitable alkaline substance, such as potassium hydroxide, sodium hydroxide, lithium hydroxide, and mixtures of such hydroxides.

The barrier disk 38 is minutely porous and is permeable to the liquid of the electrolyte and to the substances which are in solution therein, that is, the barrier 38 is liquid- and ion-permeable. At the same time, said barrier is impervious to solid particles. The electrolyte and the ions thereof freely traverse said barrier but particles are prevented from migrating from the depolarizer 36 to the anode 18. The electrolyte-receptive element 40 is more coarsely porous and acts as a reservoir or medium

for holding the electrolyte in a substantially immobilized condition.

As stated heretofore, gas is usually generated in the cell while standing on open circuit. If gas pressure within inner cup 10 is moderate, gasket 22 forms a seal between inner cup 10 and outer cup 20, and the gas is retained within cup 10. If excessive gas pressure is developed in cup 10, gas forces its way past gasket 22 and into the annular space 28 from which it is vented to the atmosphere by escaping past spacing member 26. If gas escaping past gasket 22 is accompanied by cell liquid, such liquid is absorbed and retained by the body of absorbent material 30. This result is accomplished by reason of the fact that gasket 22 is composed of a compliant material and spacing member 26 is composed of a substantially rigid material, as has been described. Gasket 22, because of its compliance, forms an effective seal which permits the escape of gas only when the latter is under high pressure. When the gas escapes under high pressure, there is a tendency for it to carry the cell liquid with it. Because spacing member 26 is substantially rigid, and the cooperating surfaces of said spacing member and cups 10 and 20 are not perfectly smooth, member 26 does not form a seal but permits the ready escape of gas under low pressure. When the gas escapes under low pressure past spacing member 26, there is substantially no tendency for it to carry liquid with it, for the cell liquid is effectively absorbed by the porous material 30. Thus, there is no objectionable leakage of liquid from the cell.

As an alternative structure, as illustrated in Fig. 3, spacing member 26 may be composed of a compliant material similar to that of which gasket 22 is composed. In such case, member 26 is also a sealing member and prevents escape of gas except when the latter is under high pressure. With such a sealing member 26, a vent opening 40 is provided in the cylindrical wall of outer cup 20 between sealing member 26 and absorbent member 30. Gas escaping past gasket 22 is vented to the atmosphere through opening 40, and liquid carried by the gas is absorbed absorbent member 30, and leakage of liquid to the exterior of the cell is inhibited.

What is claimed is:

1. An electric cell comprising a pair of open top metal cups oppositely oriented and in mutually telescoping relation, the side walls of said cups being spaced apart to form an annular space therebetween, a gasket under pressure between the edge of the inner cup and the bottom of the outer cup, said gasket being generally U-shaped in cross section and extending in contact with the interior and exterior surfaces of the side wall of said inner cup, said gasket permitting escape of gas under pressure from the interior of said inner cup, the bottom portion of said inner cup providing an annular shoulder, an in-turned flange on said outer cup overlying said shoulder, a spacing member between said flanges and said shoulder, a liquid-absorbent member within said annular space, means for venting gas from said annular space located beyond said liquid-absorbent member with respect to said gasket, a third open top cup within said outer cup, a first electrode arranged in said inner cup and a second electrode arranged in said third cup, the bottoms of said third and outer cups being joined together, said third cup being shallow relative to said inner and outer cups to provide a space between said electrodes, a liquid-absorbent body between said electrodes, and electrolyte impregnating said absorbent body.

2. An electric cell comprising a pair of open-top metal cups oppositely oriented and in mutually telescoping relation, the side walls of said cups being spaced apart to form an annular space therebetween, a gasket under pressure between the edge of the inner cup and the bottom of the outer cup, said gasket being generally U-shaped in cross section and extending in contact with the interior and exterior surfaces of the side wall of said inner cup,

said gasket permitting escape of gas under pressure from the interior of said inner cup, the bottom portion of said inner cup providing an annular shoulder, an in-turned flange on said outer cup overlying said shoulder, a spacing member between said flange and said shoulder, a liquid-absorbent member within said annular space, means for venting gas from said annular space located beyond said liquid-absorbent member with respect to said gasket, a third open top cup within said outer cup, an anode arranged in said inner cup and a cathode arranged in said third cup, the bottoms of said third and outer cups being joined together, the surface of said cathode being substantially flush with the edge of the rim of said third cup, said third cup being shallow relative to said inner and outer cups to provide a space between said anode and said cathode, a liquid-absorbent body between said anode and said cathode, and electrolyte impregnating said absorbent body.

3. An electric cell comprising a pair of open top metal cups oppositely oriented and in mutually telescoping relation, the side walls of said cups being spaced apart to form an annular space therebetween, a gasket between the edge of the inner cup and the bottom of the outer cup, said gasket being generally U-shaped in cross section and extending in contact with the interior and exterior surfaces of the side wall of said inner cup, said gasket permitting escape of gas under pressure from the interior of said inner cup, the major portion of the bottom of said inner cup being dished outwardly and providing an annular shoulder on said cup adjacent to said dished portion, an in-turned flange on said outer cup overlying said shoulder, a spacing member between said flange and said shoulder, a liquid-absorbent member within said annular space, means for venting gas from said annular space located beyond said liquid-absorbent member with respect to said gasket, a third open top cup within said outer cup, a first electrode arranged in said dished portion of said inner cup and a second electrode arranged in said third cup, the bottoms of said third and outer cups being joined together, said third cup being shallow relative to said inner and outer cups to provide a space between said anode and said cathode, a liquid-absorbent body between said anode and said cathode, an aqueous-electrolyte impregnating said absorbent body, said electrolyte having solvent and solute components, and a sheet-form barrier between said absorbent body and said cathode, said barrier being permeable to said solvent and solute components, said barrier extending beyond the side wall of said third cup and into contact with said gasket.

4. An electric cell comprising a pair of open-top metal cups oppositely oriented and in mutually telescoping relation, the side walls of said cups being spaced apart to form an annular space therebetween, a gasket under pressure between the edge of the inner cup and the bottom of the outer cup, said gasket being generally U-shaped in cross section and extending in contact with the interior and exterior surfaces of the side wall of said inner cup, said gasket permitting escape of gas under pressure from the interior of said inner cup, the major portion of the bottom of said inner cup being dished outwardly and providing an annular shoulder on said cup adjacent to said dished portion, an in-turned flange on said outer cup overlying said shoulder, a spacing member between said flange and said shoulder, a liquid-absorbent member within said annular space and between said spacing member and said gasket, the side wall of said outer cup having an opening therein at a location beyond said liquid-absorbent member with respect to said gasket, a third open top cup within said outer cup, an anode arranged in said dished portion of said inner cup and a cathode arranged in said third cup, the bottoms of said third and outer cups being joined together, said third cup being shallow relative to said inner and outer cups to provide a space between said anode and said cathode, a liquid-absorbent body between said anode and said cathode, an

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aqueous electrolyte impregnating said liquid-absorbent body, said electrolyte having solvent and solute components, and a sheet-form barrier between said absorbent body and said cathode, said barrier being permeable to said solvent and solute components, said barrier extending beyond the side wall of said third cup and into contact with said gasket.

5. An electric cell comprising a pair of open-top metal cups oppositely oriented and in mutually telescoping relation, the side walls of said cups being spaced apart to form an annular space therebetween, a compliant gasket under pressure between the edge of the inner cup and the bottom of the outer cup, said gasket being generally U-shaped in cross section and extending in contact with the interior and exterior surfaces of the side wall of said inner cup, said gasket permitting escape of gas under pressure from the interior of said inner cup, the major portion of the bottom of said inner cup being dished outwardly and providing an annular shoulder on said cup adjacent to said dished portion, an in-turned flange on said outer cup overlying said shoulder, a substantially rigid spacing member between said flange and said shoulder,

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der, said spacing member permitting ready escape of gas from said annular space, a liquid-absorbent member within said annular space, a third open top cup within said outer cup, an anode arranged in said dished portion of said inner cup and a cathode arranged in said third cup, the bottoms of said third and outer cups being joined together, said third cup being shallow relative to said inner and outer cups to provide a space between said anode and said cathode, a liquid-absorbent body between said anode and said cathode, an aqueous electrolyte impregnating said liquid-absorbent body, said electrolyte having solvent and solute components, and a sheet-form barrier between said absorbent body and said cathode, said barrier being permeable to said solvent and solute components, said barrier extending beyond the side wall of said third cup and into contact with said gasket.

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