Nov. 27, 1962 S. RUBEN 3,066,179

ELECTRIC CURRENT PRODUCING CELL

Filed April 28, 1961 2 Sheets-Sheet 1

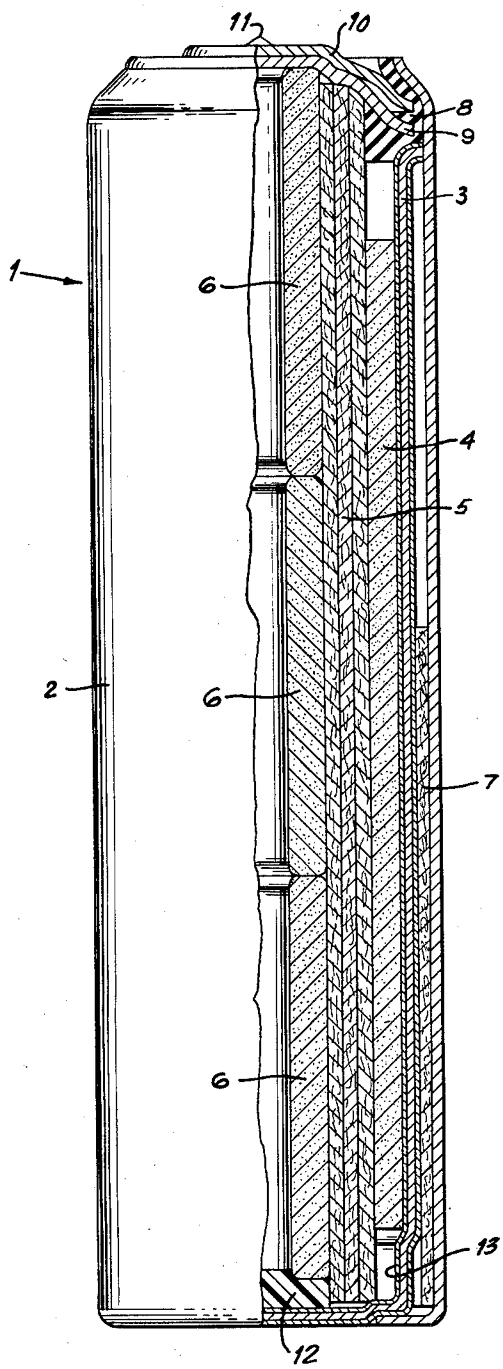

Fig. 1

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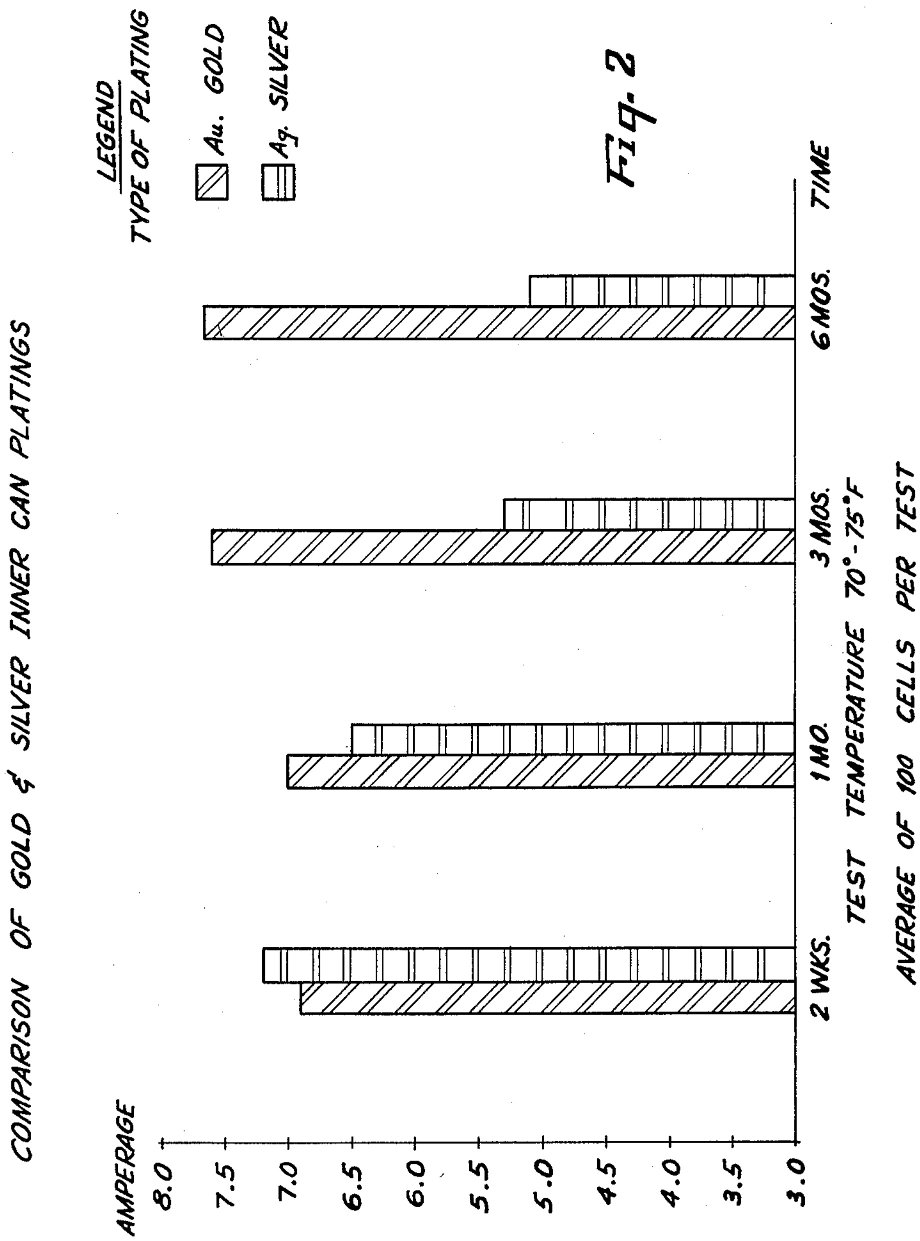

Fig. 2

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ELECTRIC CURRENT PRODUCING CELL

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11 Claims. (Cl. 136—83)

This invention relates to an alkaline primary cell, more specifically to such a cell using a depolarizing oxide mixed with carbon or graphite in contact with a steel container as the cathode thereof.

For many applications, such as power sources for flash bulbs, it is very important to obtain the maximum possible flash current. This is particularly true in a situation such as indicated above where, if the current is insufficient, the bulb will not "fire." In order to accomplish this, it is necessary to obtain the minimum contact resistance between the cathode depolarizer and the cathode container. An additional problem which presents itself is that the cell may have a satisfactory flash current initially, but later, after some storage, the current falls below an acceptable level.

This is due primarily to relaxation of the depolarizer mix density which results from penetration of the mix by the electrolyte. This increases the voltage drop or contact resistance across the depolarizer-steel (or nickel plated steel) cathode container and hence reduces the flash current. An additional factor in the MnO_2 cell is the increase of the MnO_2-Ni plate contact resistance due to oxidation even when silver plate is used. Some of the synthetic MnO_2 ores have a slight sulfide contact potential with silver sulfides and this causes an increase in contact resistance over a period of time. However, gold is inert and, when a gold plate is used not only is a low contact resistance maintained, but the flash current may actually increase.

Unlike the zinc-AgO cell described in applicant's prior United States Patent No. 2,542,710, depolarizing oxides such as MnO_2 do not reduce to a metal. The cell reaction yields Mn_2O_3 which has an even higher potential drop at the cathode can interface than does MnO_2. Therefore, as can readily be seen, as the cell is used, the potential drop increases and the flash current decreases.

Therefore, it is among the objects of this invention to provide a cell with a maximum flash current.

It is also among the objects of this invention to provide a cell which has a minimum contact resistance between the depolarizer and the steel cathode container.

It is further among the objects of this invention to provide a cell which not only maintains a maximum flash current on storage but in which the flash current actually increases with the passage of time.

It is still further among the objects of this invention to provide a cell which will retain the minimum contact resistance between the cathode and the container during use.

It is still further among the objects of this invention to provide a cell wherein the flash current is increased up to 25% over corresponding cells without the present invention.

It is still further among the objects of this invention to provide a cell which will maintain a low contact resistance on storage.

In practicing the present invention, there is provided, for example, an alkaline primary cell having an amalgamated zinc anode, a cathode composed of a mixture of 91% MnO_2 and 9% micronized graphite, and a steel or nickel plated steel container. A spacer-barrier is placed between the anode and the cathode both to prevent direct contact between the anode and cathode as well as to absorb and retain substantial quantities of electrolyte. The electrolyte is in the form of a potassium zincated water solution of KOH; and there is a thin plate of a low resistance and gold on the container and in contact with the cathode.

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The cathode depolarizer is made by mixing 91% of synthetic MnO_2 with 9% of micronized graphite and pressing said mixture into cylindrical pellets which are then forced into the steel cathode container having a gold plate on its inner surface.

The spacer-barrier is composed of spirally wound cellulose with an outer wrapping of parchment. This spacer-barrier is placed inside the cylindrical depolarizer pellets. Cylindrical pellets of amalgamated zinc containing about 13% mercury are placed inside of the central opening in the spacer-barrier. These pellets are formed by pressing the powdered zinc. The pellets rest on a neoprene block or pressure pad which prevents contact with the bottom of the cathode container.

The electrolyte is added by injection into the opening in the center of the anode cylinders and passes into the spacer-barrier which absorbs it. This causes the spacer to swell, filling the space between the anode and the cathode, and thus insuring good electrolytic contact between those elements.

The inner and outer caps are applied with an insulating grommet and the outer can is crimped against the grommet. This seals the cell and presses the anode pellet against the compressible neoprene pad which insures maintenance of good contact with the caps.

In the accompanying drawing constituting a part hereof and in which like reference characters indicate like parts,

FIG. 1 is an elevation partly in section, showing a cell according to the present invention; and

FIG. 2 is a chart comparing the flash currents of cells having gold and silver inner can platings, over a period of six months.

The cell **1** is composed of an outer can **2**, a cathode container **3**, a cathode in the form of cylnidrical pellets **4**, and an anode of cylindrical amalgamated zinc pellets **6**. A spacer-barrier **5** is between the anode and cathode and absorbent sleeve **7** is placed between outer can **2** and cathode container **3**. Plastic grommet **8** insulates can **2** and container **3** from contact with inner cap **9** and outer cap **10**. The double cap arrangement prevents leakage and creepage of electrolyte outside the cell.

Beneath the zinc pellets **6** is placed pressure pad **12** which insulates the pellets from contact with the container **3** and also, due to its resiliency, urges the pellets **6** upward against inner cap **9**. This achieves excellent contact between the anode and the terminal caps. On outer cap **10** is anode contact **11** for aiding in obtaining good external contact.

Gold plate **13** is deposited on container **3** by electroplating or galvanic contact plating so that good contact is made between cathode **4** and container **3**. This reduces the contact resistance and increases the flash current by as much as 25%.

In FIG. 2, there is presented the results of flash current tests made on cells of the contsruction shown in FIG. 1, using a depolarizer consisting preponderately of MnO_2, an amalgamated zinc anode and an alkaline zincated electrolyte.

The cells were identical except that the steel depolarizer containers were silver plated in one case and gold plated in the other. One hundred cells of each type were stored and read at room temperature. The readings in each group were averaged and plotted on FIG. 2.

While only one specific embodiment of this invention has been described, such changes as would be obvious to one skilled in the art may be made without departing therefrom. For example, substantial changes in the shape and formation of the various elements of the cell may be made, so long as the cathode container is plated with gold.

The teachings of the present invention are applicable to similar cells in which the depolarizer is preponderately HgO with generally similar results.

These and similar changes may be made without departing from the scope and spirit of this invention, which is to be broadly construed and not to be limited except by the character of the claims appended hereto.

I claim:

1. A primary cell comprising a steel container, a lining of gold on at least the inner surface of said container, a cathode depolarizer consisting preponderately of a material taken from the class consisting of MnO_2 and HgO closely fitting in said container and in contact with said lining, an electrolyte, an anode and an electrolyte absorbent spacer between said cathode and anode.

2. A cell according to claim 1 wherein said material is MnO_2.

3. A cell according to claim 1 wherein said material is HgO.

4. A cell according to claim 1 wherein said cathode includes a relatively small proportion of carbon.

5. A cell according to claim 1 wherein the electrolyte consists of an aqueous zincated solution of KOH.

6. A primary cell comprising an amalgamated zinc anode, a cathode composed of a mixture of graphite and a compound taken from the class consisting of MnO_2 and HgO, a steel container housing said cathode, a spacer between said anode and said cathode, an electrolyte consisting of potassium zincated KOH and water, and a thin plate of gold on said container and in contact with said cathode.

7. A cell according to claim 6 in which said compound is MnO_2.

8. A cell according to claim 6 in which said compound is HgO.

9. An electric current producing cell comprising a steel container, a gold plate on the inside surface thereof, a cathode composed of a mixture of graphite and a compound taken from the class consisting of MnO_2 and HgO in intimate contact with said plated surface, an anode and an electrolyte.

10. An electric current producing cell comprising a metal member, a gold plate on the surface of said member, an oxygen yielding depolarizer consisting preponderately of a material taken from the class consisting of MnO_2 and HgO in intimate contact with said plated surface, an anode and an electrolyte.

11. A cell according to claim 10 wherein said member is steel.

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