June 17, 1947. F. D. WILLIAMS, JR 2,422,606

METHOD OF MAKING ZINC ROLL ANODE FOR PRIMARY CELLS

Filed Dec. 10, 1943

Fig. 1

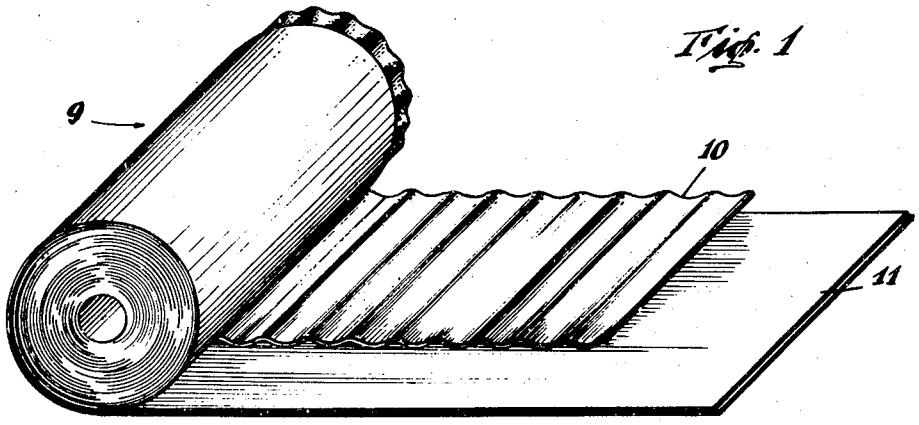
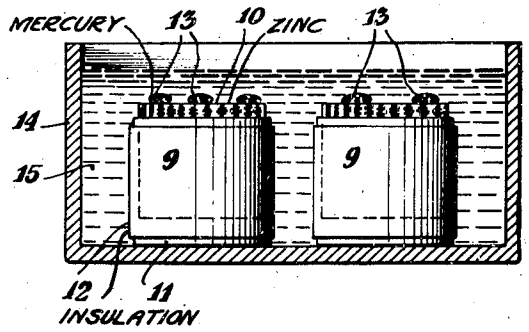


Fig. 2



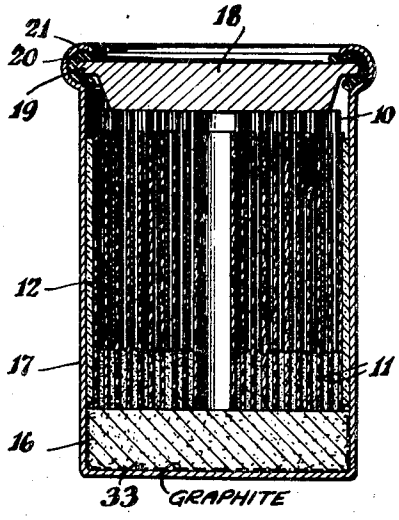


Fig. 3

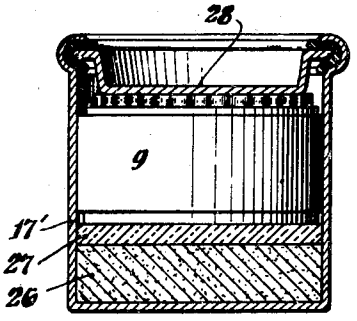


Fig. 4

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METHOD OF MAKING ZINC ROLL ANODE FOR PRIMARY CELLS

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11 Claims. (Cl. 136—130)

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This invention relates to primary electric cells, their construction and manufacture.

An object is to improve primary cells and methods of making them.

Other objects of the invention will be apparent from the description and claims.

In the drawing:

Figure 1 is a perspective view showing a step in the manufacture of a primary cell electrode;

Figure 2 shows a method of amalgamating the electrode;

Figure 3 is a longitudinal section through a completed cell; and

Figure 4 is a sectional view of a modified cell.

The present invention contemplates methods of making a cell and the anode structure thereof and a process for amalgamating the anode for the cell.

In its preferred embodiment the invention is applied to a primary cell having an anode of zinc or its equivalent, an alkaline electrolyte and a depolarizing electrode formed of an oxidizing agent, for example mercuric oxide or cupric oxide. The invention is particularly well adapted for the cell compositions described in Samuel Ruben application Serial No. 486,367, filed May 10, 1943.

Referring to the drawing, Figure 1 shows a method for making a composite anode structure 9 comprising a corrugated strip of zinc foil 10 and a strip of absorbent paper 11. Corrugated zinc is preferred to allow for paper expansion but plain zinc ribbon may be used if desired. The zinc strip is narrower than the paper and the two are wound together as shown in offset relation to provide a projecting zinc portion at one end of the roll and paper at the other end. The paper strip is somewhat longer than the zinc to provide at least one complete turn of paper on the inside and outside of the roll.

Zinc of high purity and clean surface should preferably be used to avoid adverse electrolytic effects so far as possible.

The paper strip 11 should be resistant to alkalies. A paper which has been used successfully is formed from a mixture of wood and hemp fibres, the paper pulp being treated or washed with an alkali solution, such as sodium hydroxide solution, in the process of paper manufacture. This produces a reaction of the alkali with part of the paper constituents and results in a paper which is resistant to alkalies and hence will not be greatly weakened by the alkaline electrolyte to be used in the primary cell. Jute and cotton fibre papers may also be used for strip 11 and in some cases may be of sufficient purity or alkali resistance so that the alkali treatment of the pulp may not be required.

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A plastic sleeve or cylinder 12 (Figures 2 and 3) formed of a suitable plastic such as rubber hydrochloride, polyvinyl chloride or polystyrene is slipped over the completed roll to hold it together.

For cells of this type it is desirable to amalgamate the surface of the zinc with mercury. However, if mercury is applied before rolling the zinc becomes brittle and rolling is made difficult or impossible. Figure 2 shows a process of amalgamation and impregnation which avoids these difficulties. A number of the anode-spacer assemblies 9 are placed in a flat bottom dish 14 with the zinc end up. The cell electrolyte 15 is poured into the dish slowly allowing the electrolyte to be drawn up into the rolls by capillarity. Electrolyte is added until approximately ⅛ inch above the tops of the rolls and a measured quantity of mercury 13 is introduced on top of the rolls in contact with the zinc. The amount of mercury used will depend on the area of the zinc and is determined by calculation or experiment. Preferably about ⅓ of the mercury is placed at the center and ⅔ near the outer edge. The dish is then covered and placed in an oven at 60° C. for several hours, for example 12–16 hours. This permits the mercury to spread over the entire zinc foil surface and completely amalgamate it. In general, the heating operation involves holding the foil assembly at a temperature above 50° C. for several hours. With the preferred electrolyte described in the Samuel Ruben application, cells may be held in the electrolyte in this condition for several days, if required, without damage.

Just before assembly the excess electrolyte is drained from the anodes for several minutes under moderate vacuum.

The depolarizing electrode 16 comprises an oxide composition which is pressed as a compact layer or pellet into the bottom of an iron or steel cup 17 to form the cathode-container sub-assembly. The bottom and lower inside walls of the cup are first painted with a graphite suspension 33 which promotes good electric contact.

When ready for assembly the anode-spacer assembly is inserted in the cup zinc end up. The roll is pressed down so that the paper 11 makes contact with the top surface of the cathode 16.

A zinc disc 18 having a thick central portion and a narrower rim 19 is placed on top of the zinc end of the roll and a ring or band 20 of

synthetic rubber or other plastic insulating sealing material is placed over the rim 19. The free edge 21 of cup 17 is then spun over the ring 20 to seal the cell and to apply pressure between top disc 18 and zinc anode foil 10. It is found that this pressure contact remains perfect for the life of the cell.

As one example of a cell constructed according to the invention a zinc foil strip .002 inch thick, $\frac{3}{8}$ inch wide and 13 inches long is corrugated with about 50 corrugations per inch. Two layers of porous paper, such as filter paper, are used each .004 inch thick, $\frac{12}{32}$ inch wide and 15 inches long. The cup 17 has an inside diameter of ½ inch and a depth of about ½ inch exclusive of the flange 21. Two grams of the preferred depolarizer material consisting of 90% mercuric oxide and 10% micronized graphite is pressed in the bottom of the cup resulting in a layer approximately .090 inch thick. The paper 11, being soft and porous, swells and expands to close the space between turns at the bottom end of the anode roll so that all electrolytic conduction in the cell is through electrolyte held absorbed in the paper.

By way of example, only, one electrolyte of the type described in the Samuel Ruben application which can be used is formed by dissolving 75 grams KOH in 100 ml. of water and boiling with an excess of zinc oxide until the electrolyte is saturated therewith, then cooling and vacuum filtering through a fine grain glass filter so that a clear solution is obtained.

Figure 4 illustrates a modified cell wherein the compact in the bottom of the container includes an inert microporous barrier disc 27 which is pressed on top of the depolarizer 26. Barrier 27 may be a porous ceramic material or other porous material which is inert to the electrolyte. This construction is desirable when the depolarizer consists of cupric oxide or other oxides which have a tendency to migrate to the anode at elevated temperatures. The paper 11 itself affords substantial protection against migration under normal conditions but the barrier disc improves the protection where extreme temperature conditions or long shelf life are encountered. A sufficiently fine barrier may be used to retard migration effects even where these effects involve actual solution of a small amount of the depolarizing oxide.

A modified cell top 28 is also illustrated in Figure 4 comprising a zinc disc having a central depression drawn therein. External contact is made to the zinc terminal disc 18 or 28 by a pressure clip or by a soldered terminal wire as required.

While specific embodiments of the invention have been described, it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. The method of making an anode-spacer assembly for a primary cell which comprises rolling together a strip of anode metal foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and maintaining said contact until mercury has spread over the entire foil surface.

2. The method of making an anode-spacer sub-assembly for a primary cell which comprises rolling together a strip of zinc foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and maintaining said contact until mercury has spread over the entire foil surface.

3. The method of making an anode-spacer assembly for a primary cell which comprises rolling together a strip of anode metal foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and holding the assembly at an elevated temperature until amalgamation is substantially complete.

4. The method of making an anode-spacer assembly for a primary cell which comprises rolling together a strip of anode metal foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and holding the assembly at an elevated temperature for an extended period of time to promote spreading of the mercury over the foil surface.

5. The method of making an anode-spacer subassembly for a primary cell which comprises rolling together a strip of zinc foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and holding the assembly at a temperature above 50° C. for several hours.

6. The method of making an anode-spacer subassembly for a primary cell which comprises rolling together a strip of zinc foil and porous sheet spacer material in offset relation whereby the foil projects from one end of the roll, impregnating the roll with electrolyte and then amalgamating said foil by bringing mercury into contact with the projecting edge of said foil, and holding the assembly at a temperature in the order of 60° C. for several hours.

7. The method of amalgamating an electrode metal which comprises immersing the metal in an alkaline solution, bringing mercury into contact with said metal at limited portions of its area only and holding the electrode in contact with said mercury in said solution at an elevated temperature for an extended period of time to permit said mercury to spread over the surface of said metal and amalgamate therewith.

8. The method of amalgamating a metal foil strip which comprises winding said strip into a roll with an interposed layer of absorbent material impregnating said roll with an alkaline solution and placing mercury in contact with an end of said roll and maintaining said contact for a period sufficient to permit said mercury to spread over said foil surface and amalgamate therewith.

9. The method of making an amalgamated zinc foil electrode assembly for a primary cell which comprises winding a strip of zinc foil into a roll with an interposed strip of absorbent sheet material, impregnating the assembly with the primary cell electrolyte, placing mercury in contact with the zinc foil at an end of the impregnated roll, holding the assembly thus produced at an elevated temperature for a period at least sufficient

to permit spreading of said mercury over substantially all of the surface of said zinc foil.

10. The method of making a composite electrode for alkaline primary cells which comprises treating paper pulp with an alkali solution and then making paper from said pulp, interwinding strips of said paper and of electrode foil into a roll, and impregnating said roll with an alkaline primary cell electrolyte, and then placing mercury in contact with the foil at an end of said roll and holding the roll and mercury in contact at an elevated temperature to promote spreading of the mercury over the entire surface of the foil.

11. The method of making a composite electrode for alkaline primary cells which comprises treating paper pulp with an alkali solution and then making paper from said pulp, interwinding strips of said paper and of zinc foil into a roll, and impregnating said roll with an alkaline primary cell electrolyte, and then placing mercury in contact with the foil at an end of said roll and holding the roll and mercury in contact at an elevated temperature to promote spreading of the mercury over the entire surface of the foil.

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