Oct. 4, 1927.

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1,644,344

PRIMARY CELL

Filed Dec. 29. 1926

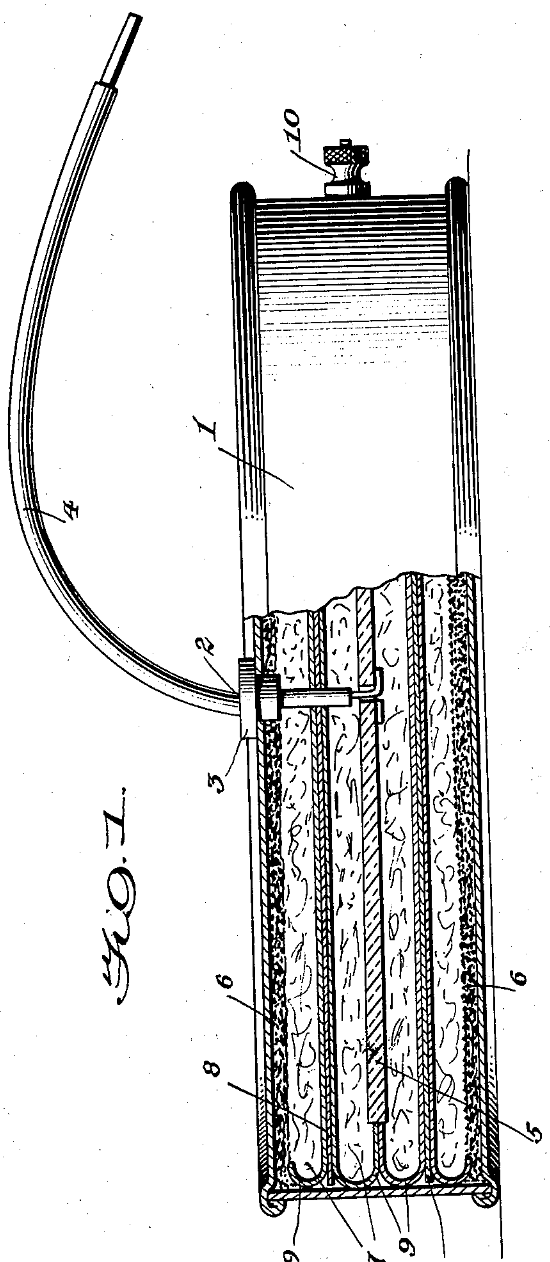

Fig. 1.

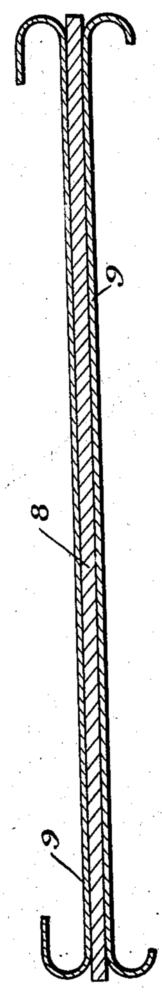

Fig. 2.

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Patented Oct. 4, 1927. **1,644,344**

UNITED STATES PATENT OFFICE.

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PRIMARY CELL.

Application filed December 29, 1926. Serial No. 157,765.

This invention relates to primary cells; and it comprises a cell of the Lalande type having copper oxide opposed to zinc in a caustic alkali electrolyte, said cell containing a pre-shrunk body or mass of cellulose containing zinc compounds in contact with said electrolyte; and it further comprises a method of increasing the open circuit life of such cells wherein cellulose is treated with a solution of alkali zincate and placed in contact with the electrolyte in such a cell; all as more fully hereinafter set forth and as claimed.

Primary cells of the Lalande type having a caustic alkali electrolyte, an electrode of zinc and an electrode of copper oxid, which also serves as a depolarizer, are in general use for all closed circuit purposes. For open circuit work, or any purpose where open circuits occur for any length of time, they are not considered desirable. Their shelf loss is also serious. All these disadvantages depend upon the fact that copper oxid is slightly soluble in solutions of caustic soda and of caustic potash. Even with pure chemicals the solubility is sufficient to be detrimental and in the presence of many organic impurities, the solubility is heightened. With the circuit closed, this solubility is unimportant, since the current keeps the electrolyte stripped. But in open circuit, after a time, copper in solution reaches the zinc and starts local action. This solution effect is, however, quite an uncertain one. The presence of all sorts of bodies influences it; many impurities heightening the solubility and therefore shortening the time during which the cell can safely stand in open circuit, while others have the converse effect. Among the latter is cotton or other form of cellulose. Cellulose in the presence of alkali tends to withdraw or absorb copper from solution. The active agent is really the alkali cellulose which is formed when the cotton comes into contact with the cell electrolyte. Cheese cloth and other fabrics are often used in these cells for structural reasons and they add to their utility in this respect the further function of giving the cell greater open circuit life.

We have found that cellulose treated with zinc oxid in the presence of alkali is a considerably more efficient agent than alkali cellulose and forms a particularly efficient separator. As is well known, cotton fiber treated with alkali solution swells and shortens; and a fabric becomes considerably denser in texture. We have found that by using sodium zincate in lieu of caustic soda, this effect is considerably accentuated; and in addition, the fiber takes up and holds a substantial amount of zinc oxid by adsorption or chemical union, as the case may be. The material so made we call, for short, zinc cellulose. And we have found that a primary cell of the Lalande type containing zinc cellulose in contact with the electrolyte is much more resistant to open circuit conditions. Because of the conditions, it is a matter of considerable importance as to how the zinc cellulose is located in the cell. Circulation and diffusion are slow in these cells and it is therefore best that the zinc cellulose occur in lines between the electrodes.

In most embodiments of our invention, we place layers of zinc cellulose directly between the two electrodes. For example, in the structure of the prior patent to Martus, Ross & Becker, Patent 1,548,539, the sheet of cotton linters between the poles may be advantageously replaced by a similar sheet of linters treated with sodium zincate. In other types of cell, we treat cotton batting with sodium zincate and dispose it in the electrolyte between the poles. In another way of embodying our invention, cheese cloth or similar fabric may be treated with sodium zincate and placed next one or other of the poles. In order to increase the quantity of zinc cellulose, it is often desirable to use in a cell both the loose material and the fabric; and this is done in the best embodiment of our invention now known to us.

The sodium zincate solution used for treating the cotton or cloth may be made directly by dissolving zinc or zinc oxid in caustic soda. Or old battery solutions may be used. This latter has the advantage of economy and these solutions are quite effective for our purposes. Dense solutions, going as high as 40° Baumé are desirable. Solutions of approximately 40° Baumé may often be obtained from discharged cells of the Lalande type. On immersion of cotton or cloth in such a solution at the ordinary temperature, shrinkage quickly occurs. In the case of cheese cloth, the area often decreases as much as 48 per cent; that is, a square of cheese cloth with sides of 100 mm. may shrink uniformly in all directions to a square of 72 mm. This is a substantially greater shrinkage than occurs with caustic soda solution. The cloth becomes considerably closer textured.

In the accompanying illustration we have shown, more or less diagrammatically, an embodiment of our invention; that is a Lalande type cell using zinc cellulose. In this showing

Fig. 1 is a cell partly cut away to show the interior, and

Fig. 2 is an enlarged view of a fabric diaphragm.

In the specific embodiment of our invention shown, element 1 is a cell container advantageously made of sheet iron and provided with an opening 2 carrying an insulating bushing 3, through which the conductor 4 passes to make contact with the zinc anode 5. This zinc is advantageously amalgamated. Cathode 6 of copper oxid is disposed above and below the zinc anode and in contact with the container 1, as shown. The electrolyte, a solution of caustic soda having a concentration of 5 to 20 per cent, is held and immobilized within the cell by absorption in a body of cotton linters or other absorbent form of cellulose 7. The linters are previously treated with sodium zincate. Separators 8, made of wood or other form of cellulose, are disposed between the copper oxid cathodes and the zinc anode. These are also preliminarily treated with sodium zincate. The linters and the wood diaphragm together offer a considerable mass of zinc cellulose effective in keeping the electrolyte stripped. In addition, we may, and usually do, employ layers 9 of paper or cheese cloth or other form of cellulose treated with zinc solution. In the embodiment shown, the partitions 9 are made of cheese cloth or paper formed in the shape of a broad U with their edges turned in as shown. They are placed on each side of the separators 8, the two innermost having their curved edges disposed against the ends of the zinc anodes as shown and the edges of the two outermost being in contact with the copper oxid cathodes. This construction is such that these partition members are transverse to all lines between the two electrodes. Terminal 10, directly attached to the metallic casing of the cell, establishes contact with the copper oxid cathodes. The terminal wire 4, from the zinc which passes through the insulating bushing 3, is insulated as shown in the drawing.

What we claim is:—

1. The process of preparing a separating material for assembly and use in primary cells of the type having a copper oxid cathode, a zinc anode and a caustic alkali electrolyte, which comprises treating cellulose with a solution of sodium zincate having a concentration of about 40° Baumé.

2. The process of preparing a separating material for assembly and use in primary cells of the type having a copper oxid cathode, a zinc anode and a caustic alkali electrolyte, which comprises treating cellulose in sheet form with a solution of sodium zincate having a concentration of about 40° Baumé.

3. The process of preparing a separating material for assembly and use in primary cells of the type having a copper-oxid cathode, a zinc anode and a caustic alkali electrolyte, which comprises treating cellulose with a solution of the exhausted electrolyte from such a copper oxid cathode-zinc anode cell.

4. The process of increasing the open circuit life of cells of the Lalande type which comprises adding a body of pre-shrunk zinc cellulose to such a cell.

5. In the assembly of electrolytic cells having an alkaline electrolyte and zinc and copper oxid electrodes, that step which comprises inserting in the electrolyte and between the electrodes a partition formed of cellulose that has been previously treated with a sodium zincate solution.

6. In the assembly of electrolytic cells having an alkaline electrolyte and opposed electrodes, that step which comprises inserting between the electrodes and in the electrolyte a partition formed of pre-shrunk zinc cellulose.

In witness whereof we have hereunto signed our names at Waterbury, Connecticut, this 28th day of December 1926.

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