PUBLISHED
MAY 11, 1943.
BY A. P. C.

E. MARHENKEL
DRY CELL
Filed June 30, 1939

Serial No.
282,296

Fig. 1

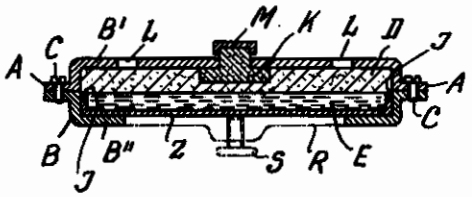


Fig. 2

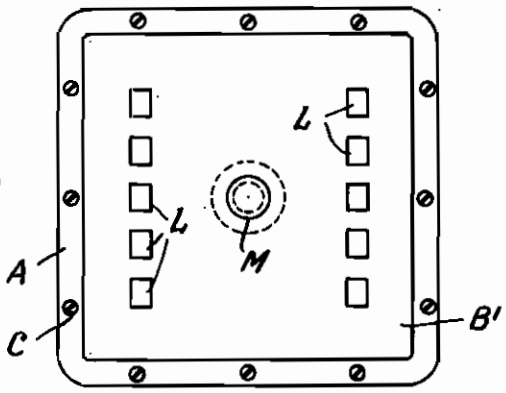
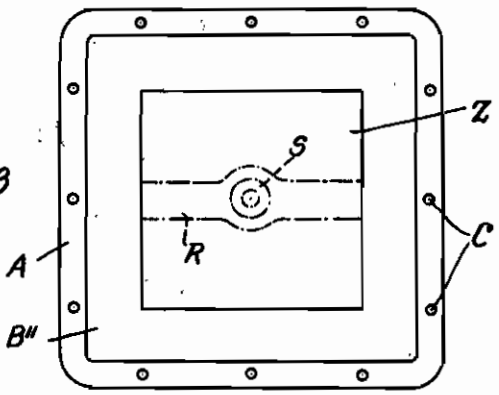


Fig. 3



Inventor,
E. Marhenkel

By: Glascock Downing & Seebold
Attys.

Published May 11, 1943 Serial No. 282,296

ALIEN PROPERTY CUSTODIAN

DRY CELL

Erich Marhenkel, Berlin-Sudende, Germany;
vested in the Alien Property Custodian

Application filed June 30, 1939

This invention relates to a dry cell and to an improved method of producing dry cells.

It is an object of the present invention to provide a dry cell which is adapted to supply a relatively large quantity of current during a long period of time while being relatively small in size.

A special object of the invention is to provide means by which the surface effect of the depolarising electrode is enhanced.

With these and further objects in view which will be apparent from the within disclosures, the invention comprises not only the structures herein pointed out and illustrated, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawing in which—

Fig. 1 is a cross seetional view of a dry cell having the invention applied thereto;

Fig. 2 is a plan view of the same element and

Fig. 3 is a bottom view thereof.

In the known dry cells of the Leclanché type having a depolarisator consisting substantially of manganese dioxide the depolarisation due to the impregnation of the electrode with the electrolyte takes place not only at the surface but also, from the beginning of the discharge, in the interior of the positive electrode or of the depolarisator, respectively. On the contrary, the elements in which the atmospheric oxygen effects the depolarisation which elements have more recently become known and are sometimes referred to as "atmospheric oxygen cells" operate only with a surface depolarisation effect; for, if the depolarising layers would be impregnated with the electrolyte liquid, the atmospheric oxygen would not be admitted and the element after a short time of operation would become unable to supply current.

Since in the elements of the atmospheric oxygen type the depolarising agent, i. e., the atmospheric oxygen, is available in practically unlimited quantities, it should be expected, theoretically, that these elements show a considerably larger output than elements of the manganese dioxide type.

However, hitherto it has not been possible to produce dry cells of the atmospheric oxygen type, more particularly, small size cells, for instance, for normal pocket lamp, which would produce at least approximately the output of the usual pocket lamp cells having a manganese dioxide depolarisator.

I have found that this unsatisfactory output of the elements of the atmospheric oxygen type is due to the fact that the surface layers of the atmospheric oxygen electrode which are covered by the electrolyte due to the generation of current in the element become inactive very soon so that the deeper positioned layers thereof cannot act any more.

According to the present invention the said deleterious effect is avoided or compensated in this manner that the electrolytic paste adhering to the electrode which is being dissolved due to the discharge of the element, i. e. generally the zinc electrode, is caused to come into intimate contact with the deeper positioned depolarising layers which are still effective, by the application of pressure during the discharge of the element, in the same degree as the superficial layers of the depolarising substance become ineffective.

The application of pressure may be effected in various manners, for instance, by hand operation, for example, by means of a set screw acting upon the zinc electrode, or automatically, for example, by encasing the electrolytic paste in such a manner that the normal expansion of the electrolyte due to the discharge produces the required pressure, by spring pressure or similar means.

Referring to the drawings in greater detail, it will be noted that the cell comprises a substantially rectangular casing or container B which may consist of artificial resin products. Advantageously the said casing consists of two parts B' and B'' which are held together by screws or rivets C passing through flanges A or by any other suitable means. The lower wall of the casing is apertured as shown best in Fig. 3 while the upper wall thereof is provided with two rows of perforations L, for the admission of atmospheric oxygen. The carbon electrode is formed of a cylindrical disc K having a projection which extends through a central bore of the casing B and carries a metal cap M forming the positive terminal. A flat metal trough or cup Z extending across the lower aperture of the casing forms the second electrode which is being dissolved in the operation of the element and consists more particularly of zinc. Provided on the inner surface of the zinc trough is the electrolyte paste E and the space between said electrolyte and the carbon electrode is filled up completely by a further substance D forming the depolarisator. Insulating strips I extending around the side walls of the container and engaging the end faces of the bent up edges of the zinc trough serve to

separate the depolarisator from the zinc electrode.

Various compositions may be used for the electrolyte and for the depolarising mass, but by way of example the following compositions may be stated hereunder which have been found to be very useful in connection with my novel dry cell, viz—

Electrolyte.—100 kgs water, 30 kgs ammonium chloride, 10 kgs zinc chloride. In order to produce the electrolyte paste about 30 grams wheat flour are added per 100 ccms of the said electrolyte mass.

Depolariser mass.—40 kgs active carbon, 10 kgs graphite, 10 kgs ammonium chloride.

In the manufacturing process of the said element the following points must be considered. The atmospheric oxygen electrodes of the known type are either permeable for gas, but impermeable or nearly impermeable for the electrolytic liquid, by the addition of water-repelling substances to the depolarising mass or by a cover which has water-repelling features or forms a hindrance for the access of water. This, however, causes an increase of the inner electric resistance of the element. On the other hand, if the depolarising electrode is used without such a substance or casing hampering the access of the electrolyte, then the electrolyte which according to the known process is introduced into the element in a non-gelatinized state already after a short time causes a substantial impregnation of the atmospheric oxygen depolarising layer, and, as a result, an insufficient electric output of the element is obtained. On the other hand, if the electrolyte is introduced in the form of a finished paste, there would be the drawback that the inclusions of air at the dissolving metallic electrode which are unavoidable in this case produce a corrosive effect that impairs the duration of life or storing properties of the element.

According to a feature of the present invention the aforementioned drawback may be eliminated in this manner that the dissolving electrode is covered with the electrolyte paste before the assemblage of the element and thereafter urged against the depolarising electrode and held in this position. The electrolyte is advantageously applied on the dissolving electrode in this manner that the electrolytic liquid which, for instance has been admixed with flour, is poured onto the electrode and then converted into the gel-state, by a short heating. In this case it is not necessary to provide a substance or envelope for protecting the atmospheric oxygen electrode against the access of the electrolyte.

It will be understood from the foregoing that due to the encasing of the electrolyte paste as shown in Fig. 1 the expansion of the electrolyte which normally occurs with such elements during operation thereof will cause a pressure of the electrolyte paste with respect to the deeper seated depolarising layers. Of course, a similar expansion occurs in the known elements. However, in the known dry cells of the Leclanché type, having, for instance, a zinc cup the upper wall of which is inwardly bent over a card board disc in order to form a packing to prevent escaping of the electrolyte, a hollow space is left between the positive electrode and the card board disc, to permit expansion of the electrolyte. Therefore, during the discharge of the element, the electrolyte expands into the free space provided for the expansion but does not enter into the depolariser electrode which is tightly wrapped and laced up and for the rest has been normally impregnated with the electrolyte already in the course of manufacture of the element.

It has been found that dry cells for pocket lamps operating with atmospheric oxygen depolarisation and made in accordance with the present invention show an increase of output of more than 50% compared to the conventional batteries having a manganese dioxide depolariser.

While the structural expansion of the electrolyte will be normally sufficient to produce the desired effect, it is also possible to provide additionally, or alternatively, hand operated means for producing a mechanical pressure. By way of example, a set screw S having a knurled head may be threaded in a rib R of the container part B'', as indicated in Figs. 1 and 3 in dotted lines. As will be understood, by rotation of the screw S in a clockwise direction the zinc electrode is inwardly bulged out and urges the electrolyte mass E into a more intimate contact with the depolariser D. The set screw S may form the negative terminal of the cell at the same time.

I wish to make it clear that my invention is not restricted to the use of atmospheric oxygen elements the depolarising electrode of which contains active carbon and/or other oxygen transmitters, such as, indigo white, cerium salts and the like. The advantages hereinbefore mentioned will always be obtained in connection with surface depolarisation, and depolarising substances like perborate, persulfate etc. which when applied in the form of a solution would not be sufficiently stable or would have a strong corrosive effect on the dissolving electrode, may be used without difficulties in my novel dry cell, since the said substances can be embodied in the depolarisator mass in a solid form.

I am aware that many further changes may be made and numerous details of construction and composition may be varied through a wide range without departing from the principles of this invention.

ERICH MARHENKEL.