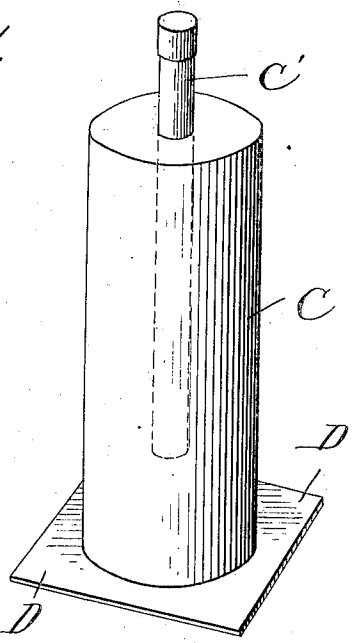
O. E. RUHOFF.

MANUFACTURE OF DRY CELLS.

APPLICATION FILED JAN. 30, 1920.

1,361,499. Patented Dec. 7, 1920.

Fig. 1.



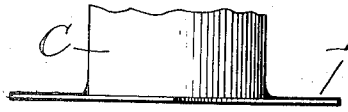


Fig. 2

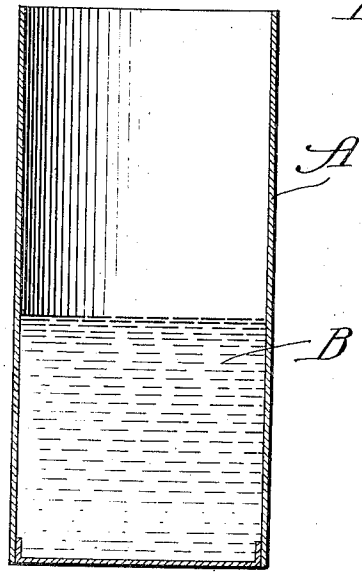
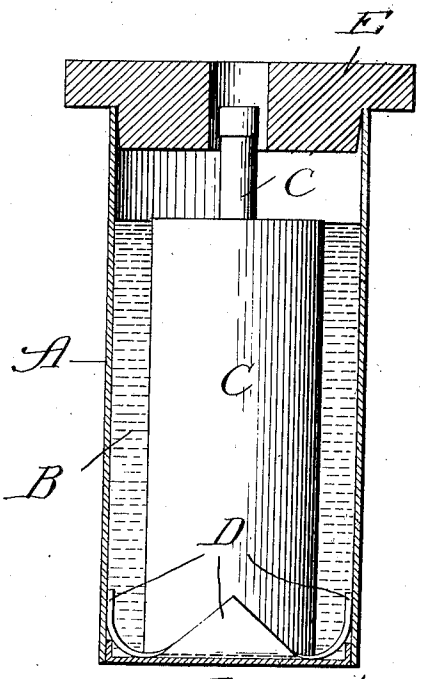


Fig. 3.



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MANUFACTURE OF DRY CELLS.

1,361,499. Specification of Letters Patent. Patented Dec. 7, 1920.

Application filed January 30, 1920. Serial No. 355,244.

To all whom it may concern:

Be it known that I, OTTO E. RUHOFF, a citizen of the United States, residing at Madison, in the county of Dane and State of Wisconsin, have invented a new and useful Improvement in the Manufacture of Dry Cells, of which the following is a specification.

The present invention relates to a method of manufacturing dry cells; and the primary object is to provide an improved and thoroughly practicable method of manufacturing dry cells without the use of a cheesecloth covering for the depolarizing core, or without the use of a bibulous sheet of material between the depolarizing core and the surrounding wall of the zinc container.

The improved process is illustrated in the accompanying drawing, in which—

Figure 1 represents a perspective view of a depolarizing core having attached to its lower end, as by means of any suitable adhesive, a spacing member; Fig. 2, a sectional view of the container and a broken view of the lower portion of the core, illustrating the manner in which the core is to be introduced into the container; and Fig. 3, a sectional view illustrating the core and electrolyte in the can and showing the manner in which the core is held in a centered position while the electrolyte is being gelatinized.

In the illustration given, A represents the usual zinc can of a dry cell; B, a suitable electrolyte, which is adapted to gelatinize, or assume a thick, pasty consistency; C, a core of depolarizing material having embedded therein a carbon electrode C′ whose upper end projects above the upper end of the core; D, a separator member in the form of a disk of rather stiff flexible paraffined paper, secured to the lower end of the core, as by means of a suitable adhesive; and E, a temporary centering device in the upper portion of the core.

The preferred method of manufacture is to compound an electrolyte mixture comprising a solution of ammonium chlorid, zinc chlorid, and a starchy material, which is adapted to gelatinize by the action of one or both of the chlorids; pour a suitable quantity of this electrolyte mixture into the zinc can, as indicated in Fig. 2; then insert the core into the can, during which operation the spacing member D serves as a centering device, and the core causes displacement of the electrolyte, causing it to fill the annular space between the core and the surrounding wall of the can; then apply the temporarily used centering device E to hold the electrode and core properly centered at the upper end; and then immediately introduce the can and its contents into hot water to cause the starch to become quickly gelatinized, which results in the electrolyte becoming "set," or assuming a thick, firm, jelly-like consistency. The gelatinization may be effected very quickly. Thus, by introducing the can and its contents into water having a temperature of about 80° C., the gelatinizing operation may be performed in from two to five seconds. This heat treatment should follow very promptly the introduction of the electrolyte and core into the can. If the core be allowed to stand in the electrolyte for any considerable time, before effecting gelatinization, the electrolyte, because of its watery character, tends to rapidly disintegrate the core, and may destroy the usefulness of the cell.

The depolarizing mixture of the core usually comprises manganese dioxid, carbonaceous material, sal ammoniac (ammonium chlorid) and sufficient water for compacting purposes. If desired, some binder ingredient of a sticky or cementitious character may be introduced into the material before the compacting operation. A boiled mixture of flour and water will serve, or the solid materials of the core may be moistened before the compacting operation with a syrupy fluid comprising a solution of zinc chlorid and water and a small percentage of starch, gelatinized by said solution. In any event, however, the core of the depolarizing mixture is comparatively fragile and lacking in tenacity, and comparatively easily permeable by a watery solution, or by a thinly fluid mixture, such as ordinary electrolyte, before the starchy content has been gelatinized. Hence, it is desirable, immediately after the core has been introduced into the electrolyte, to subject the can and its contents to heat action to effect gelatinization before any appreciable disintegration of the core can result.

A suitable electrolyte may be prepared as follows: (*a*) dissolve 1034 grams of sal ammoniac in 1990 c. c. of 45° Baumé zinc chlorid solution; (*b*) dissolve 382 grams of

sal ammoniac in 1307 c. c. of water; (*c*) make a thin paste by thoroughly mixing 50 grams of cornstarch and 200 c. c. of water; (*d*) then add this paste to the zinc chlorid and sal ammoniac solution (of step *a*) in a container suitable for thorough agitation and stir until all the starch paste is set or gelatinized; (*e*) then add the sal ammoniac solution (of step *b*) and agitate until the mixture is uniform and of a thin syrupy consistency. The mixture thus formed has the property of being sufficiently pasty to act on the surface of the core to keep out the water which otherwise might disintegrate the core in case the cheesecloth cover were omitted, but, nevertheless, is sufficiently fluid to facilitate the manufacture of the cell.

To the thin syrupy mixture, thus obtained, is added ordinary ungelatinized starch, flour, or other cereal in the proportion of 160 c. c. of the above mixture and 70 grams of corn starch or other cereal. The complete electrolyte mixture, still liquid, is now poured into the space between the core and zinc can, and the gelatinization is effected by immersing the can in hot water. If desired, a sufficient quantity of electrolyte can be poured into the can, and the core can be inserted in the manner illustrated and described.

The use of this initially gelatinous material in the electrolyte tends to prevent any disintegration during the slight interval which intervenes before the heating operation is performed. By immediately introducing the cell into hot water, however, the use of the initially gelatinized material may be rendered unnecessary. In such case, the electrolyte may be prepared by mixing the sal ammoniac, and zinc chlorid solution, and water, in the proportions indicated above, and thoroughly mixing with the solution a quantity of raw starch, sufficient to give the proportions in the complete electrolyte mixture noted above. The electrolyte and core can then be introduced into the can, and the can instantly placed in hot water to effect the gelatinization of the electrolyte.

In any case, after the electrolyte has become set, a suitable washer may be introduced into the upper portion of the can and the upper portion of the can may then be filled with molten pitch, which upon setting effectively seals the cell. It is usual, of course, to leave an air space below the pitch seal to compensate for the expansion of the electrolyte or the generation of gas.

The invention renders thoroughly practicable the use of a naked, or unwrapped core. This core can be introduced into the can in the manner set forth without danger of disintegration and without danger of short-circuiting the cell. Thus, the cost of manufacturing cells can be reduced, which is a matter of prime importance in an article which is used in very large numbers. A further advantage of this type of construction is that air is not trapped between the core and can and the electrolyte can establish contact at all points with the peripheral surfaces of core and can. Also, the internal resistance of the cell is somewhat lessened.

The invention renders thoroughly practicable the use of a naked, or unwrapped core.

Inasmuch as it is feasible, by operating quickly, to use electrolyte composed of a solution of sal ammoniac and zinc chlorid, mixed with raw starch alone, this method is preferred. If, however, the steps of manufacture are so carried out as to cause any substantial interval of time to elapse before the cells are introduced into hot water, then it is preferred to employ the electrolyte mixture containing a small percentage of initially gelatinized starch. In such case, it is desirable to keep on hand a complete stock mixture of the character described above containing a small percentage of gelatinized starch, and add thereto a larger quantity of raw starch just before introducing the electrolyte mixture into the can.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitation should be understood therefrom, but the appended claims should be construed as broadly as permissible, in view of the prior art.

What I regard as new and desire to secure by Letters Patent is:

1. The process of manufacturing a dry cell, which comprises: compounding an electrolyte mixture comprising a solution of ammonium chlorid and zinc chlorid and material adapted to gelatinize; introducing said mixture and a naked core of depolarizing mixture into a zinc can; and immediately subjecting the can and its contents to the action of heat to effect quick gelatinization of the electrolyte.

2. The process of manufacturing a dry cell, which comprises: compounding an electrolyte mixture comprising a solution of ammonium chlorid and zinc chlorid and ungelatinized starch; introducing said mixture and a naked core of depolarizing mixture into a zinc can; and immediately subjecting the can and its contents to the action of heat to effect quick gelatinization of the starch.

3. The process of manufacturing a dry cell, which comprises: compounding an electrolyte mixture comprising a solution of ammonium chlorid and zinc chlorid and material adapted to gelatinize; pouring a quantity of said mixture into a zinc can; inserting a naked core of depolarizing mixture equipped with a spacing member which serves as a centering device, said core ef-

fecting displacement of the electrolyte during the inserting operation; and immediately subjecting the can and its contents to the actior of heat to quickly "set" the electrolyte.

4. The process of manufacturing a dry cell which comprises: compounding an electrolyte mixture comprising a solution of ammonium chlorid and zinc chlorid and raw starch; pouring a quantity of said mixture into a zinc can; inserting a naked core of depolarizing mixture having its bottom surface equipped with a spacing member which serves as a centering device, said core effecting displacement of the electrolyte during the inserting operation; and placing the cell in a hot liquid to quickly "set" the electrolyte.

OTTO E. RUHOFF.