

No. 732,842.

PATENTED JULY 7, 1903.

W. GARDINER.
SECONDARY BATTERY.

APPLICATION FILED JAN. 23, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

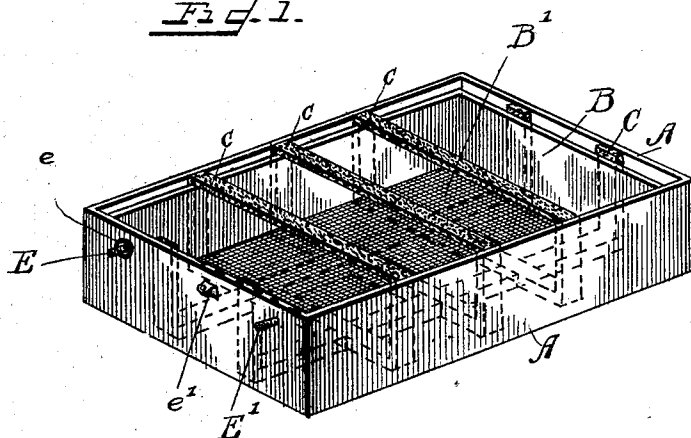


Fig. 3.

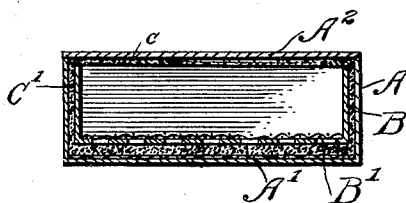


Fig. 2.

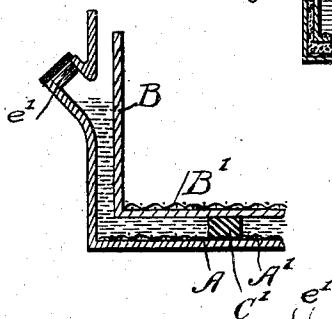
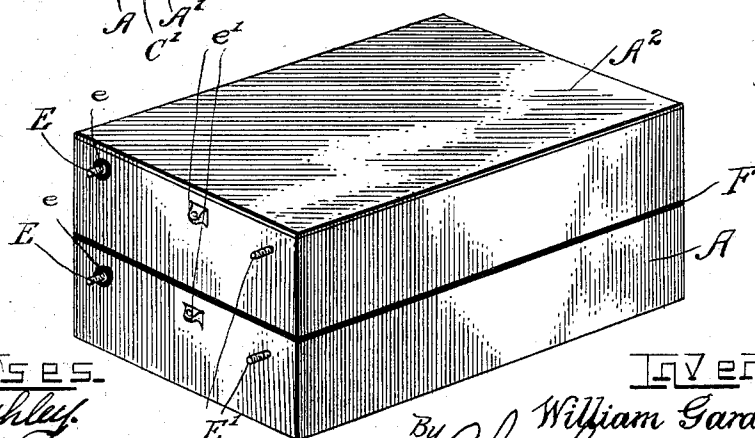


Fig. 4.



WITNESSES.

R. W. Ashley.
J. H. Glendinning.

INVENTOR.

By William Gardiner.
Charles W. Mills.
ATTY

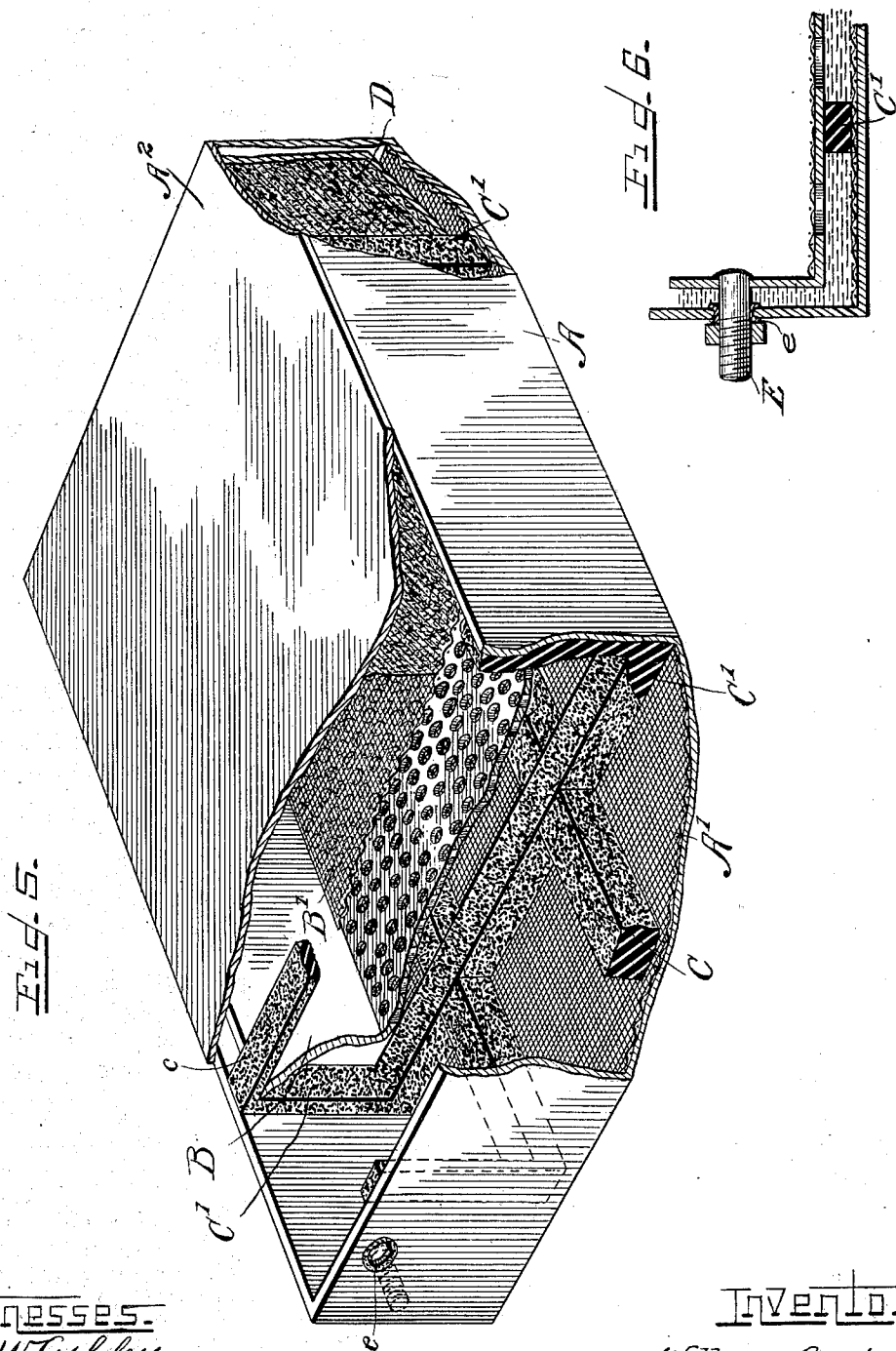
No. 732,842.

PATENTED JULY 7, 1903.

W. GARDINER.
SECONDARY BATTERY.
APPLICATION FILED JAN. 23, 1902.

NO MODEL.

2 SHEETS—SHEET 2.



Witnesses.
R. W. Ashley.
J. H. Glendinning.

Inventor.
By William Gardiner.
Charles M. Hill, Atty.

UNITED STATES PATENT OFFICE.

WILLIAM GARDINER, OF CHICAGO, ILLINOIS, ASSIGNOR TO NORTHWESTERN STORAGE BATTERY COMPANY, A CORPORATION OF ILLINOIS.

SECONDARY BATTERY.

SPECIFICATION forming part of Letters Patent No. 732,842, dated July 7, 1903.

Application filed January 23, 1902. Serial No. 90,940. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM GARDINER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Accumulators or Secondary Batteries; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an improvement in an accumulator or secondary battery, and more particularly to an accumulator of comparatively light weight and high efficiency, embracing ingredients and elements so constructed and combined as to prevent deterioration of the cells through long-continued use or disuse.

It is also an object of the invention to provide an accumulator adapted to be quickly discharged without injury thereto.

The invention consists of the matters hereinafter described, and more fully pointed out and defined in the appended claims.

In the drawings, Figure 1 is a perspective view of an accumulator-cell embodying my invention, showing the cover therefor removed and the active material omitted. Fig. 2 is an enlarged fragmentary longitudinal section through the filling-aperture. Fig. 3 is a vertical transverse section. Fig. 4 is a perspective view of a battery of two cells, showing the arrangement of cells with respect to each other. Fig. 5 is an enlarged perspective view of one of the cells, showing the same partly broken away. Fig. 6 is a section taken through the trays of compartments in the plane of the axis of the positive binding-post.

As shown in the drawings, A indicates an outer tray or receptacle, as shown, rectangular in form, relatively shallow, and comprising bottom, side, and end walls. Said receptacle may be of iron, copper, or other suitable metal. In the bottom of said receptacle is a wire-gauze or preferably a reticulation of copper wires, (indicated by A'.) B indicates a similar receptacle or tray having side and end walls and a closely-perforated bottom and of less dimensions than and adapted to be

inclosed in the tray A. Said inner receptacle B may be made of copper and plated with silver or other suitable metal and is provided in its bottom with a network or reticulation of wires, which may be of silver or silver-plated, if preferred.

C and C' indicate, respectively, longitudinal and transverse insulator or separating strips of hard rubber or other suitable insulating material which extends along the bottom and up the sides and the ends in the outer tray or receptacle A and within and upon which closely fits the inner tray B. Transverse strips of similar insulating material are laid over the upper tray to prevent contact of the same with the cover A², which is of the same material as the outer tray or receptacle and is permanently secured thereto when the cell is completed by soldering, brazing, or the like. The perforations in the bottom of the tray B being located close together provide a minimum of metal in the bottom, and the reticulated structure of silver gauze or copper gauze silver-plated laid on the bottom thereof, as shown in Figs. 1 and 5, is sufficiently fine to prevent any active material passing through said apertures. On said wire-gauze and within the tray B is located a tablet of active material in relatively hard but porous form. Said active material comprises a sponge of relatively pure silver thoroughly mixed with mercury and molded to the desired form to fill the inner receptacle or tray, as shown in Fig. 5. Said sponge-silver may be prepared by dissolving pure silver in nitric acid and water, then precipitating the silver by the addition of hydrochloric acid, and then washing the precipitate with pure hot water. The product is then treated by any of the well-known methods to remove the chlorine and leave the silver in a finely-granular condition, which when mixed with mercury may be molded to form a relatively hard but very porous tablet of active material of sufficient size to fill the inner tray.

A conductor of binding-post E is provided, permanently secured to the inner receptacle B, as shown in Fig. 6, and extending outwardly through an aperture in said outer tray or receptacle near the top thereof. As shown, a bushing e, preferably of soft rubber or other

resilient non-conductive material, is secured in the aperture, and said conductor extends therethrough, forcing the washer or non-conductor into engagement with the edges of the apertures and effectually sealing or closing the same. E' indicates the conductor rigidly secured on the outer side of the outer receptacle, forming the other conductor for the cells.

When the elements of each cell are assembled as described, the outer receptacle is permanently closed by rigidly securing the cover A² in position by soldering, brazing, or other suitable means, thereby hermetically sealing the cell. The electrolytic fluid may now be poured into the outer tray through a filling-aperture e', provided for the purpose, preferably on the end of the outer tray between the conductors and near the top, as shown in Figs. 1, 2, and 4. Conveniently said filling-aperture is formed by connecting an upwardly-opening sleeve in the end of the tray and providing a screw-threaded plug therefor adapted to permanently and tightly close the orifice when the electrolyte has been inserted.

The electrolyte preferably used comprises a strong solution of zinc oxid and a caustic alkali, such as potassium or sodium hydrate, which fills the outer tray to a point above the conductor.

The operation is as follows: The construction of the cells is such that the outer tray with its lining of wire-gauze serves as the negative-pole element or electrode and the inner tray with its active material forms the positive-pole electrode, and obviously any number of such cells may be used by laying one on top of the other, as shown in Fig. 4, with a separator F, of rubber or other insulating material, between. In charging the cell or cells pure zinc is liberated from the zinc oxid and deposited in the bottom of the outer tray on the wire-gauze, while the oxygen set free is combined and occluded in the active material in the inner tray. Preferably an electrolyte will be used consisting of a solution of potassium hydrate or sodium hydrate having dissolved and held in suspension therein oxid of zinc in excess of the normal amount dissolvable therein. With such an electrolyte the charging may be very rapidly done, and the cell is enabled to take a maximum charge in a very limited space of time without damage or injury. After a cell is charged, or, in other words, the zinc is deposited, the cell may be stored or left charged or in a discharged condition for any length of time without danger of injury or, if charged, the loss of the charge. In discharging the cell the oxygen contained in the active material is liberated and combines with the zinc, restoring the cell to its original condition. Obviously the said electrolyte may be placed in the outer tray in a fluid or semifluid form before the cover of the outer tray is secured in position and may be tested, diluted, or re-

plenished, as desired, through the pour-hole at any time. After the cell, however, is completed and the filling-orifice is closed, none of the material can escape therefrom and can suffer no material or permanent change through use or disuse. The cell may therefore continue in use for any desired period of time without deterioration in the quality of the elements or ingredients. Furthermore, inasmuch as the elements are placed one above the other, as shown, it is obvious that any amount of jarring or concussion cannot affect the utility of the device, inasmuch as the ingredient in the trays cannot be displaced or escape therefrom.

Many details of this invention may be varied without departing from the principles of my invention.

I claim as my invention—

1. In a device of the kind described, an outer tray or receptacle forming one of the electrodes and comprising a relatively shallow metallic pan or box, a conductor permanently secured thereto, a cover adapted to be permanently secured thereon and to hermetically seal said tray, and an inner shallow tray having a perforated bottom and inclosed within and insulated from the outer and containing the other electrode, and a conductor extending therefrom through the outer tray and insulated therefrom.

2. In a secondary cell an electrode comprising a shallow tray having a perforated bottom and containing active material, a conductor connected therewith, a hollow hermetically-sealed receptacle or box in which said electrode is contained and through one of the walls of which said conductor extends and comprising the other electrode or element of the cell, means for insulating said elements one from the other, and an electrolyte containing caustic alkali and zinc oxid partly filling the space between said active material and the outer receptacle.

3. The combination with a relatively shallow box or tray, of a smaller box or tray having a perforated bottom inclosed therein and adapted to contain active material, an electrolyte in which said inner tray is partly submerged, a permanently-secured cover for the outer tray, a conductor leading outwardly from each of said trays, the inner being insulated from the walls of the outer, said trays being disposed horizontally to permit the cells to lie flat, one on the other.

4. In a secondary battery the combination with an inner shallow box or tray, of a perforated bottom therein, wire-gauze in said bottom, active material resting on the gauze, an outer receptacle inclosing the electrode thus formed and comprising the other electrode of the cell, insulating-strips separating the inner from the outer trays, an electrolyte in which the inner receptacle is partly submerged, conductors leading outwardly from each of said trays, that from the inner pass-

ing through a wall of the outer and packing means on said conductor adapted to hermetically close the aperture in said outer wall.

5 5. In a secondary battery, a shallow metallic tray or receptacle, reticulated material in the bottom of the same, an inner tray inclosed therein and having a perforated bottom, insulating-strips between the inner and outer tray, an active material in said inner
10 tray, conductors extending from the inner and outer tray that from the inner provided with a packing in the passage through the wall of the outer, an electrolyte in which the inner tray is partly submerged and a cover
15 hermetically closing the outer tray by means of brazing, soldering or the like.

20 6. A secondary battery comprising an electrode in the form of a shallow tray having reticulated material in the bottom thereof, the complemental electrode also contained in a shallow tray and inclosed within the other, separator-strips between the same, an active

material embracing compressed and porous sponge metal in the inner tray supported upon a reticulation of wires laid in the perforated bottom of the inner tray, an electrolyte containing oxid of zinc, and a cover permanently and hermetically sealed on the outer tray by means affording a metallic connection. 25

7. An electrode for secondary batteries comprising a relatively shallow metallic tray, having a perforated bottom, wire-gauze in the bottom of said tray, a relatively hard porous tablet of active material compressed within the tray. 30 35

In witness whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

WILLIAM GARDINER.

Witnesses:

C. W. HILLS,
ANNA B. HILLS.