

E. THOMSON & E. J. HOUSTON.  
Galvanic-Battery Cell.

No. 220,507.

Patented Oct. 14, 1879.

FIG. 1.

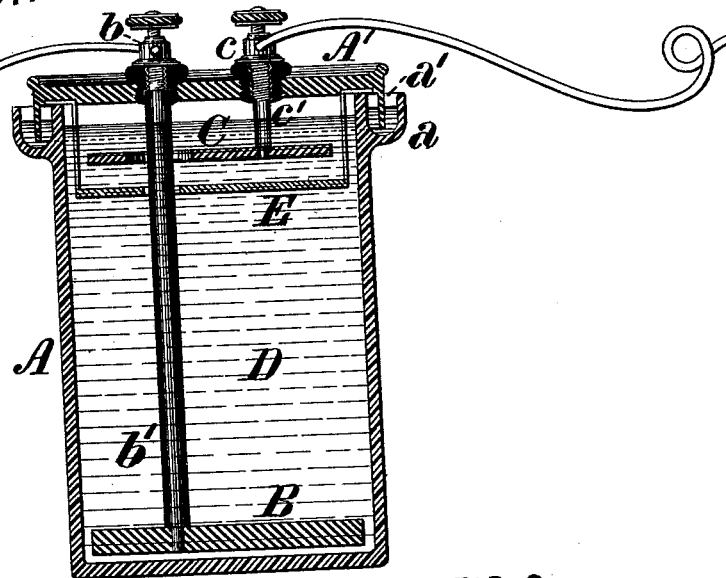


FIG. 2.

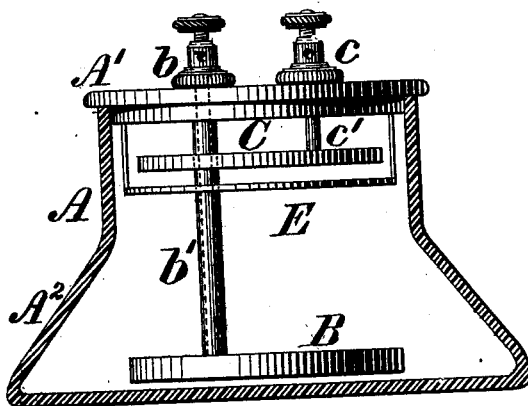


FIG. 3.

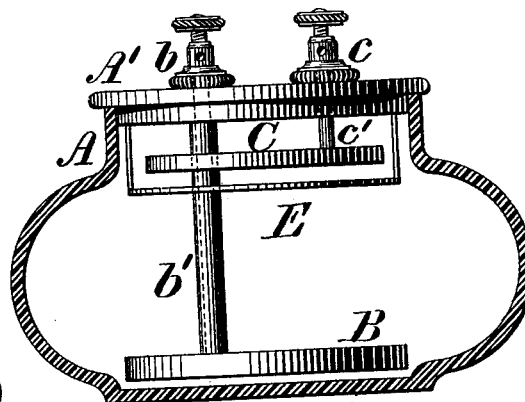
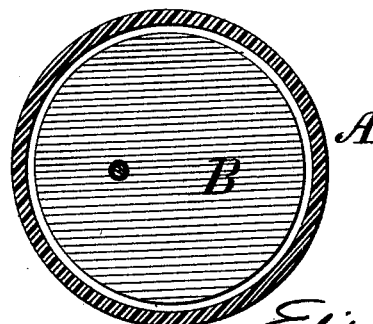


FIG. 4.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

ELIHU THOMSON AND EDWIN J. HOUSTON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS OF ONE-THIRD OF THEIR RIGHT TO THOMAS H. MCCOLLIN, OF SAME PLACE.

## IMPROVEMENT IN GALVANIC-BATTERY CELLS.

Specification forming part of Letters Patent No. **220,507**, dated October 14, 1879; application filed February 25, 1879.

*To all whom it may concern:*

Be it known that we, ELIHU THOMSON and EDWIN J. HOUSTON, both of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Voltaic-Battery Cells, of which improvements the following is a specification.

The object of our invention is to provide a battery-cell which shall be of simple construction and effective in its action, and which will, further, be specially adapted for the application of a process for the original excitation of electrical action, and for revivification when exhausted, such process consisting in effecting decomposition and deposition by the passage of an electrical current through the cell in a direction opposite to that of the current produced by the cell when in action.

To this end our invention consists in the combination of an inclosing-vessel and two conducting depositing-plates, each of which is connected by a conductor with a binding-post and immersed in a solution which, by the passage of an electrical current, will be decomposed, with the deposition of an electro-positive metal upon the plate toward which the current is flowing, and the formation of an electro-negative compound from the material of the other plate and the surrounding solution, as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a vertical central section through a voltaic-battery cell embodying our improvements; Fig. 2, a horizontal section through the same; and Figs. 3 and 4, vertical sections, showing modifications in the form of the vessel.

To carry out our invention we provide an inclosing vessel or jar, A, of glass or other suitable material, within which we place two plates, B and C, each of which must be a conductor of electricity. One of these plates B, preferably of copper, rests upon or near the bottom of the vessel A, and the other, C, which is also preferably of copper, although iron, lead, hard carbon, &c., may take its place, is supported from the cap or cover A<sup>1</sup> at a short distance below the top of the vessel. The plate B is connected, by an insulated conductor, b', with

a binding-post, b, upon the cap A<sup>1</sup>, and the plate C is connected by a conductor, c', with another binding-post, c, upon the cap. The vessel A is filled to point above the upper surface of the plate C with a solution, D, of such a character as to be capable of decomposition by the passage through it of an electric current, such as a saturated solution of a metallic salt—in this instance zinc sulphate—and the vessel is, by preference, hermetically sealed, so as to prevent evaporation of the solution, which may be done by providing its cap A<sup>1</sup> with a downwardly-projecting flange, a', which enters an annular trough, a, formed around the top of the vessel, and filled with oil or cement, or in any other suitable manner.

As thus constituted, the battery-cell will, until acted on by our revivifying process hereinbefore referred to, be and remain inactive as a source of electrical current, and the distinctive feature which marks the difference between it and the gravity-battery cells or other voltaic cells heretofore employed, so far as our knowledge and information extend, lies in the fact that the arrangement of the parts we have described is incapable, of itself, of generating an electrical current, since the materials that exist in a voltaic battery of the ordinary type are absent—viz., a positive metal to be dissolved by the solution between the plates and materials in said solution, capable of thereby becoming changed into waste products of said battery.

To render possible the generation of an electrical current in and by our improved battery-cell, a current of electricity from a dynamo-electric machine or other source of electricity is passed through it, being caused to enter at the binding-post b, which is connected to the lower copper plate, B, and to pass out at the binding-post c, connected to the upper plate, C. By the passage of the electrical current through the solution of zinc sulphate, D, a decomposition of said solution is effected, metallic zinc being set free and deposited on the plate C, which acts simply as a receiver and conductor for the electro-positive metal, and metallic copper being taken up from the plate B and converted into copper

sulphate, the plate B serving as the source of supply for the electro-negative resultant, a dense solution of copper sulphate being formed above and around the plate B.

For the purpose of preventing loss of power by reason of particles of zinc becoming detached from the plate C and falling upon the lower plate, B, we provide a diaphragm, E, of porous material, which is placed immediately beneath the plate C, and serves to retain any particles that may fall therefrom.

Fig. 2 shows the inclosing-vessel as formed with a swell or enlargement, A<sup>2</sup>, at its base, in order to afford sufficient space for the accumulation of a considerable amount of copper sulphate at the lower portion of the cell, and the same purpose may also be served, as well as the internal resistance decreased, by the use of a vessel of the form shown in Fig. 3, which is swelled or enlarged at a point above its base, to enable the area of cross-section of the contained solution to be correspondingly increased. If desired, the space between the plates B and C may be filled with sawdust, sand, or other similar material wet with the salt solution, for the purpose of preventing diffusion.

When the decomposing and depositing action of the applied current has progressed as far as desirable, which is determined by the time that it is desired that the battery shall remain in action—that is, shall continue to generate effective current before a second revivification shall be applied—the passage of the current is stopped, and the battery is ready for use as an active source of electrical current, the binding-post *b* being the positive terminal thereof. The electrical current will continue to be produced until the electro-positive metal deposited on the upper plate is again dissolved and the electro-negative metal taken up from the lower plate restored thereto, and when the current obtained becomes too weak to be practically or desirably available the cell is revived by again passing a current through it, as before described.

It is obvious that the operation of revivification may be repeated indefinitely, and whenever required, without the addition of fresh materials to the cell.

We do not limit ourselves to the use of any particular materials in the plates B and C, further than that they must be conductors of electricity, and capable, when used with a solution decomposable by the passage of an electric current, of performing the functions, respectively, of receiving an electro-positive deposit from and yielding an electro-negative material to said solution. For example, the plate B, which, in the instance selected, we have described as composed of copper, might be replaced by a body of mercury resting in a suitable receptacle, and which, during the passage of the electric current, is converted into sulphate of mercury. Again, instead of the copper plate B, we may use a plate of silver, which, during the passage of the exciting or revivifying current, will be converted into sil-

ver chloride or silver sulphate, according as zinc chloride or zinc sulphate is used as the solution for charging the cell.

If a lead plate be substituted for the plate B, and the solution used is zinc chloride, lead chloride will be formed above the plate B and metallic zinc deposited on the plate C by the revivifying process.

The solution used, which has been referred to as that of a zinc salt, may be replaced by salts either singly or together, capable of metallic deposition on the plate C, or capable of forming an amalgam with mercury substituted therefor.

The plates B and C can be made in sundry different forms, as found most desirable. The lower plate, B, may be either a simple disk, a serrated or roughened disk, a coil or ribbon, or a tray serving to hold small blocks or pieces of the metal to be used. The upper plate may be a perforated disk, having its under surface coated with a non-conducting varnish or covering, so as to prevent the deposition of zinc upon its lower surface. By this means, in case the deposit of zinc is pulverulent, which occurs if the revivifying current be too intense, no loss can occur from zinc dropping from the plate.

Pieces of hard carbon may be placed upon the plate C, for the reception and retention of the zinc; or spurs or projections may be formed upon its upper surface for a similar purpose.

The application of the revivifying current from the dynamo-electric machine or other source of electricity may be made either to a single one of our improved battery-cells or to a set of cells arranged in series or in multiple arc.

We claim as our invention and desire to secure by Letters Patent—

1. The combination, in a cell for voltaic batteries, of an inclosing-vessel, two conducting-plates, neither of which is electro-positive, one serving as a receiver for deposited electro-positive metal, and the other as a source of supply for the formation of an electro-negative resultant, and a solution in which said plates are immersed, said solution being incapable of generating electrical action until the passage through it of an electrical current, substantially as set forth.

2. As a new article of manufacture, a closed cell for voltaic batteries, which, as constructed, is inert as a source of electricity, said cell containing an unchangeable conducting-plate for the electrical deposition of positive material by the passage through the cell of an electrical current, and being capable of indefinite revivification or restoration to a condition of electrical action without the addition of any fresh material, substantially as set forth.

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Witnesses:

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