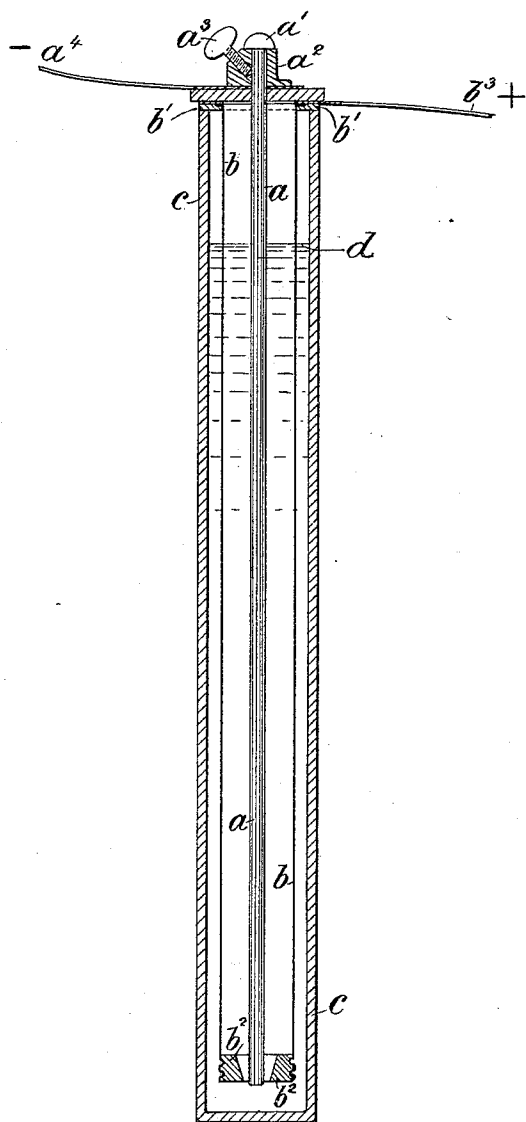


(No Model.)

L. M. J. C. C. RENARD.
GALVANIC BATTERY.

No. 425,959.

Patented Apr. 15, 1890.



Attest
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UNITED STATES PATENT OFFICE.

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GALVANIC BATTERY.

SPECIFICATION forming part of Letters Patent No. 425,959, dated April 15, 1890.

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To all whom it may concern:

Be it known that I, LOUIS MARIE JOSEPH CHARLES CLEMENT RENARD, major of engineers and chief of the Etablissement Central d'Aerostation Militaire, a citizen of the French Republic, residing at No. 7 Avenue de Trivaux, Mendon, near Paris, France, have invented certain new and useful Improvements in and relating to Electric Batteries, (for which I have obtained Letters Patent in France, No. 190,600, dated July 20, 1888; in Belgium, No. 82,139, dated June 9, 1888; in Italy, No. 9,606, dated October 22, 1888, and in England, No. 8,700, dated June 13, 1888;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, and to the letters marked thereon.

My invention relates to galvanic batteries; and the first part of my said invention consists in providing an improved chemical composition of chromic liquid for use in electric or galvanic batteries as an exciting-liquid.

My said invention comprises, moreover, other improvements, hereinafter set forth.

In carrying my said invention into practice I employ as an exciting-fluid chromic liquid formed by a solution of chromic acid (and not of an alkaline chromate) in dilute hydrochloric acid. Chromic acid can, moreover, be employed either in its ordinary or usual form or in the form of solutions, more or less pure, obtained by treating alkaline chromates with sulphuric acid and by crystallizing the alkaline sulphates resulting from the reaction, in order to eliminate them from the liquid. A chlorochromic solution can also be obtained by receiving the vapors of chlorochromic acid in water, in which the said vapors are decomposed and dissolved in the form of a mixture of hydrochloric acid and chromic acid, as required. The said solution can, moreover, be obtained by dissolving in water chlorochromic acid previously prepared.

Various processes are known for obtaining chromic acid in either a solid or fluid condition and sufficiently free from alkaline bases

to be employed in my electric or galvanic battery.

I wish it to be understood that in carrying my invention into effect I can employ chromic acid in all its industrial or other forms and obtained by any well-known process, and effect its mixture with hydrochloric acid by any convenient process and in any proportions.

The employment of chromic acid (and not of an alkaline chromate) in hydrochloric solution forms a distinct feature of my said invention.

The chlorochromic liquids may be obtained by the processes above described; but those which give the best results are obtained by dissolving pure crystallized chromic acid direct in hydrochloric acid more or less dilute. It is under these conditions that the maximum effect can be obtained. Whatever may be the relative proportions of the two acids, goods results are obtained with the elements hereinafter described.

The following is an example of a convenient mixture which will give good results: Hydrochloric acid at 11°, (Baumé's aerometer,) two hundred cubic centimeters, and pure crystallized chromic acid from forty to one hundred grams.

An important characteristic of my said invention consists in the specific activity of my chlorochromic battery, the power of which, calculated in number of "watts" per kilogram of battery and per second, being greatly superior to that of ordinary chromic batteries. As an example, supposing three exactly similar elements to be charged, the first with chlorochromic liquid, the second with a hydrochloric solution of bichromate of potash, (d'Arsonval's battery,) the third with the sulphuric solution of bichromate of potash ordinarily employed, the results obtained—that is to say, the power developed—represented in numbers of watts, will be nearly proportional to the figures 6, 2, and 1. My electric or galvanic battery has, moreover, a total specific energy (calculated in number of "joules" given off per kilogram of the battery) much superior to that of chromic batteries gener-

ally in use. By substituting for part of the hydrochloric acid a like quantity of sulphuric acid the energy exerted by the liquid per second is decreased; but the total energy developed remains the same. By these means the length of time in which the total energy of the exciting-liquid is expended may be regulated according to requirements.

I employ elements consisting each of one or more vertical tubular couples of electrodes comprising a zinc pencil or rod the diameter of which is very small in comparison to its length and a conducting-cylinder entirely surrounding the zinc pencil and consisting of a tube of carbon or of any suitable metal. A cell constructed of glass, ebonite, or other suitable material is employed to contain the liquid in which the zinc pencil surrounded by the conducting-cylinder is immersed.

In the accompanying drawing I have represented in vertical section an element consisting of a single couple of electrodes of the form and proportions found best to answer in carrying my invention into effect.

In the drawing, *a* represents the positive electrode, consisting of a zinc pencil which has a very small diameter in comparison with its length.

b is the negative electrode, surrounding the zinc pencil and supported by a ring or washer *b'* at its upper end and connected to a ring *b²* of ebonite at its lower end. The zinc pencil *a* is formed with a head *a'* at its upper end, resting on a metal boss *a²*, a set-screw *a³* being employed to fix the zinc pencil *a* in the boss *a²*.

a⁴ is the positive conductor, and *b³* the negative conductor.

c is the cell, of ebonite, glass, or other suitable material.

d represents the level of the exciting-liquid.

Each element may consist of one tubular couple of electrodes immersed in a cell, as represented in the accompanying drawing, or it may consist of two or more similar tubular couples of electrodes immersed in the same cell. In the first case the said cell can, if desired, be dispensed with, and the exciting-fluid in such case can be placed directly in the above-described cylinder composed of conducting material, which is rendered watertight for such purpose.

I would here remark that I do not claim, broadly, the employment of a zinc electrode surrounded by a tube of carbon or of metal, as a zinc pencil has already been employed in the Leclanché battery, nor the employment of tubes of carbon or of metal, but the combination of the zinc pencil with the tubular envelope and in their relative arrangement and proportions, as shown and described. There are also known batteries—Bunsen's, for example—in which zinc is in the interior of a carbon cylinder; but the zinc is not a pencil. It is a very thick piece in relation to its length.

I preferably employ a zinc pencil whose dimensions are so calculated that the zinc is entirely dissolved when the liquid is exhausted, so that each new charge of liquid should correspond with the renewal of the zinc pencil. This arrangement has for its object to place in the battery only the exact weight of zinc necessary for its working, and consequently to reduce to the minimum the weight and volume.

By constructing my battery as above described I increase the density of the current upon the zinc, and consequently diminish the local action as compared with the electric action or action which constitutes the useful work of the battery. The working power of the electric or galvanic battery is thus much increased by the above-described arrangement. The tubular form of the elements in about the proportions above described is, moreover, favorable to the cooling down of the same, which is necessary in this battery, as the specific activity is very great and the exciting-fluid might attain too high a temperature if the cells did not present a considerable external surface in proportion to their volume.

Another feature of my invention is the employment as a negative electrode of a sheet of silver covered by lamination on both surfaces with a very thin coating of platinum. I thus obtain a conductor possessing the conducting power of silver with the inalterability of platinum, the cost of which, moreover, is not much more than if it were made entirely of silver.

Although I have hereinbefore described a convenient method of carrying my said invention into practice, it is obvious that I can somewhat modify the construction of my battery without departing from the nature of my invention—as, for instance, instead of forming the zinc pencil *a* and the negative electrode *b* of a circular form, they may be of angular or other form, provided they are employed in somewhat similar proportions to those hereinbefore described, and shown in the drawing.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A galvanic cell consisting of a cup containing chlorochromic acid and silver electrodes platinized on both surfaces by lamination, as described.

2. A single fluid galvanic cell having an exciting-liquid composed of chromic acid and hydrochloric acid combined with sulphuric acid, as explained.

LOUIS MARIE JOSEPH

CHARLES CLEMENT RENARD.

Witnesses:

PAUL RENARD,
C. GEORGE.