(No Model.)

E. T. STARR.

ELECTRIC BATTERY ELEMENT OR ELECTRODE.

No. 347,259. Patented Aug. 10, 1886.

Fig. 1.

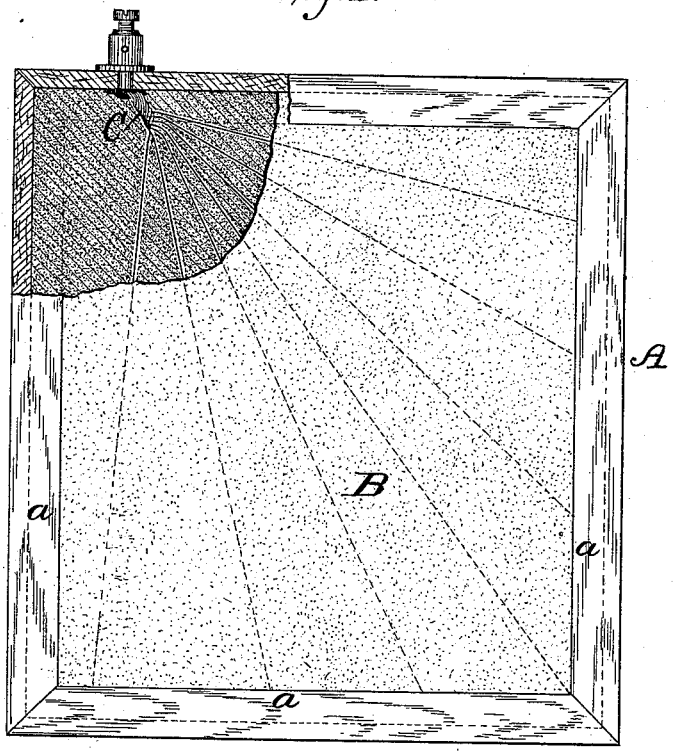
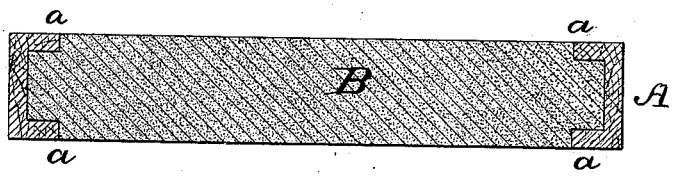


Fig. 2.



WITNESSES

Wm. A. Skinkle.

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INVENTOR:

Eli. T. Starr,

By his Attorney

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UNITED STATES PATENT OFFICE.

ELI T. STARR, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE STARR ELECTRIC STORAGE COMPANY, OF CAMDEN, NEW JERSEY.

ELECTRIC-BATTERY ELEMENT OR ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 347,259, dated August 10, 1886.

Application filed December 27, 1883. Serial No. 115,775. (No model.)

To all whom it may concern:

Be it known that I, ELI T. STARR, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Electric-Battery Elements or Electrodes, of which the following is a specification.

My invention relates more particularly to electrodes or elements for secondary batteries; and its object is to provide a very strong, durable, and efficient electrode or element having no injurious tendency to "buckle" or bend in the operation of the battery, and which may be comparatively cheaply and rapidly made, and which is also of comparatively light weight.

My improvements are first sufficiently set forth in detail as embodied in the best way now known to me, and then particularly pointed out in the claims at the close of the specification. Some of my improvements as claimed by me may be used without the others.

In the accompanying drawings, Figure 1 is a face view of one of my improved electrodes or elements, partly in section or broken away; and Fig. 2 is a horizontal section therethrough on the line 2 2 of Fig. 1.

In embodying my present improvements I make use of an open-sided or skeleton frame, A, which is preferably made of lead, but may be made of any other suitable material. Said frame is also preferably grooved or provided with flanges, as at *a a*, at its inner edges, and both at the front and back sides of the frame.

The main or body portion B of the electrode is made of a mass of finely-divided active material, or material to be made active, united into a firmly-cohering body or plate by pressure or otherwise, and is inserted or set in said frame A so as to be surrounded preferably at all its edges thereby, and, when the frame is a grooved or flanged one, so as also to be overlapped by the edges or flanges of the frame at front and rear, whereby the body portion B is firmly locked or held in the surrounding frame.

When the frame A is a metal or conducting frame, (as intended to be represented in Fig. 2,) the circuit-connections are preferably attached thereto, the frame having a suitable terminal lug or extension-piece for the purpose. If the frame is of non-conducting material—such as wood or hard rubber, for instance—(as intended to be illustrated in Fig. 1,) suitable connection is made with the active or body portion B of the element by means of an embedded conducting strip or strips C, for example.

I prefer the body portion B of the electrode to be made of a mass of finely-divided lead or lead compound, such as lead oxide, which presents large active surface while of comparatively light weight, and I prefer to unite the particles of the mass into a plate or firmly-cohesive form by pressure.

In practice the surrounding frame may be filled with the active material B, in the form of a flat mass mixed to a pasty condition with sulphuric acid, preferably a dilute solution thereof—say a ten per cent. solution of acid and water—and the mass then subjected to pressure to consolidate and unite it together into a plate or firmly-cohesive body and force the edges of the mass into the groove or between the flanges of the surrounding frame, whereby the body portion of the electrode is firmly united together and to said surrounding frame. The application of pressure to the pasty mixture of finely-divided active matter and dilute acid is not essential, however, to the formation of the mixture into a plate or firmly-cohesive body, as it rapidly sets or hardens. In order, also, to convert the mass of active material into a firm plate or body, I may mix therewith a small percentage of a binding agent, say, five per cent., more or less—which may be a non-active binding agent, such as shellac, for example—brought to a fluid form to facilitate incorporation with the active material, and which upon solidifying, or upon the mass being subjected to pressure, binds the mass thoroughly together into plate or cohesive form and to the surrounding frame.

I do not broadly claim herein a mass of finely-divided active material inserted in or surrounded by an open-sided frame, as that forms the subject-matter of other applications and patents of mine. In such cases, however, the finely-divided material is not pressed, consolidated, or united into a firmly-cohesive plate

or body and to the frame, but is supported at the sides by porous media or open supports. By my present improvements such supports are unnecessary, (though they may be employed,) and at the same time solid cast or rolled metal plates or bodies are avoided, while the electrodes or elements are capable of being rapidly and economically made, have excellent electrical contacts and conductivity, are of marked efficiency, and are durable and strong, while comparatively very light in weight, which is highly important. Large active surface is also presented, and the electrodes may be thoroughly and economically charged. In assembling my improved electrodes in the battery box or cell dilute sulphuric acid or other suitable electrolyte or battery fluid may be employed, and in charging the positive electrodes (or those connected with the positive pole of the charging-generator) are peroxidized, while the negative electrodes are reduced, as usual. Nor do I broadly claim herein a flanged or grooved frame in which the main or body portion of an electrode is inserted or by which it is surrounded. This I have also claimed in another application filed July 11, 1883, subsequently patented December 25, 1883, as No. 290,943.

I do not wish to be understood as claiming herein an electrode having a frame into which a solid rolled or cast-metal plate is removably inserted and held, as shown and described in Van Winkle's patent of April 13, 1880, my improvements being very different from such a device; but

What I do claim herein as my invention, and which I have not claimed in any prior case of mine, is—

1. An electrode or element having a mass of finely-divided material (active or to be made active in a secondary battery) constituting the active or body portion of the element, said material being united into a plate or firmly-cohesive body and set into or surrounded at its edges by an open-sided frame, substantially as described.

2. A battery electrode or element having a mass of finely-divided material (constituting the active or body portion of the element) united into a plate or firmly-cohesive form and set into or surrounded at its edges by a grooved or flanged frame, substantially as described.

3. A secondary battery electrode having an open-sided non-conducting frame with a body portion set in or surrounded at its edges by said frame, said body portion consisting of lead or a lead compound united into a plate or firmly-cohesive form, substantially as described.

In testimony whereof I have hereunto subscribed my name this 26th day of November, A. D. 1883.

ELI T. STARR.

Witnesses:
WM. J. PAYTON,
GEO. P. MORGAN.