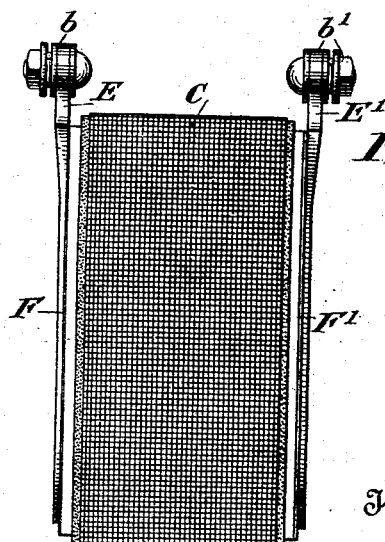
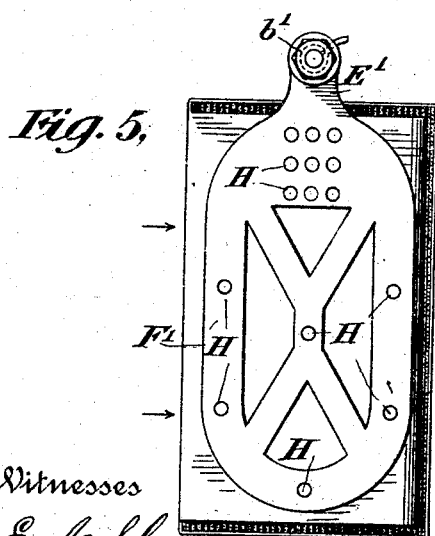
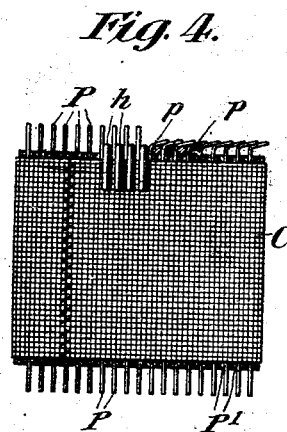
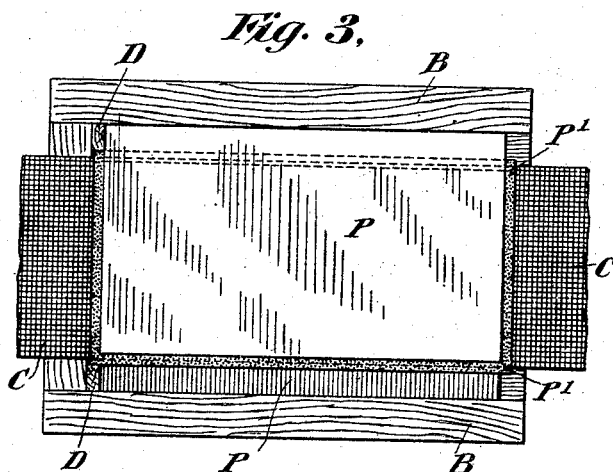
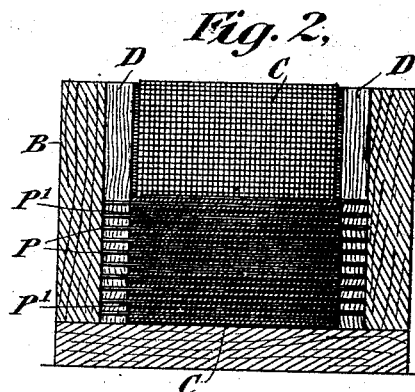
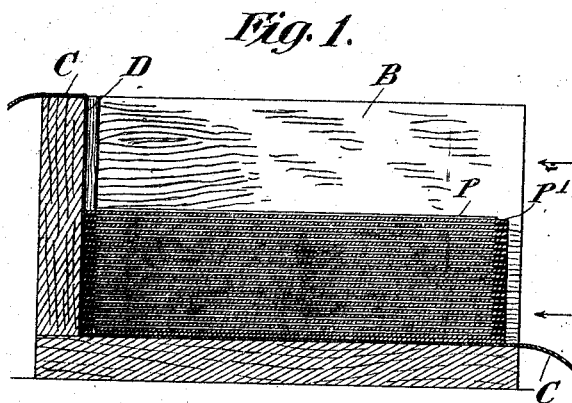


(No Model.)

G. W. HARRIS.  
STORAGE BATTERY ELECTRODE.

No. 489,186.

Patented Jan. 3, 1893.



Witnesses  
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# UNITED STATES PATENT OFFICE.

GEORGE W. HARRIS, OF NEW YORK, N. Y.

## STORAGE-BATTERY ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 489,186, dated January 3, 1893.

Application filed April 14, 1892. Serial No. 429,162. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. HARRIS, a citizen of the United States, residing at New York, county and State of New York, have made a new and useful Invention in Storage-Battery Electrodes, of which the following is a specification.

My invention has for its objects; first the construction of a storage battery electrode having large active surface with low internal resistance. Second the construction of an electrode which shall possess minimum weight and great durability, and third to secure the ears or binding posts to the elements of the electrode in such manner as to give increased strength to these parts and afford diminished electrical resistance.

To these ends my invention consists first in the novel method of construction hereinafter described and claimed. Second in the novel electrode constructed in accordance with said method.

In order that my invention may be fully understood by those skilled in the art reference is had to the accompanying drawings taken in connection with the following description thereof.

Figure 1 of the drawings represents a side elevational view of an electrode in course of construction in my improved former, and Fig. 2 represents an end elevation of the same as seen looking at Fig. 1 from right to left in the direction of the arrows, while Fig. 3 is a plan view of the same as seen looking at Fig. 1 from the top toward the bottom of the drawing. Fig. 4 is a top view of an electrode as it appears after it has been removed from the former, illustrating also my novel method of turning down or uniting the edges of the individual elements of like polarity in the electrode. Fig. 5 is a side elevational view of a completed electrode, and Fig. 6 is a similar side elevational view of the electrode as seen looking at Fig. 5 in the direction of the arrows on the left.

Referring now to the drawings in detail, B represents a box or former of wood or analogous material open at the top and at one end, the interior diameter of the box or former being somewhat greater than that of the completed electrode, or the lead or analogous

plates P of which the electrode is formed as clearly shown in Figs. 2 and 3.

D D are cleats secured in the corners at the inner end of the box or former B.

P' P' are sheets of blotting paper, woolen fabric, or any other equivalent porous or absorbent non-conducting material of slightly greater length than the active or lead plates P, as shown in Fig. 3, and of a width sufficient to fit snugly between the cleats D D in the box or former.

C is a strip of cloth or analogous material adapted to secure the parts of the electrode together after it is completed.

F F' represent the completed faces of the electrode, and E and E' the conducting ears or lugs of large surface preferably secured to the faces F and F' by solder around the edges and in the holes H.

b and b' are the binding screws for connecting the completed elements in circuit for charging or discharging.

p p, Fig. 4, are forming pins with downwardly extending heads h, the function of these pins being to separate the extended edges of the lead plates P and to aid in turning said edges over as shown on the right in Fig. 4.

My novel method of construction is as follows. A strip of cloth or analogous pliable non-conducting material of good tensile strength and preferably possessing absorbing qualities, and substantially of the width of the completed electrode, is laid in the box or former B with its ends projecting in the manner shown in Figs. 1 and 3, the length of this strip being sufficient to completely surround the completed electrode in the manner shown in Fig. 4, where the ends are shown as stitched together. I then lay one or more sheets of blotting paper of equivalent non-conducting absorbing material P' upon the cloth in the bottom of the box or former the inner end or ends projecting against the cloth at the rear end of the box or former and fitting snugly between the cleats D D, the sides of said blotting paper being parallel with the sides of the box or former. I next place upon the sheet or sheets of blotting paper thus disposed a thin sheet of lead of slightly greater width and less length than the blotting paper

in such manner that its inner end rests against one of the cleats D and one lateral edge bears against one of the lateral inner faces of the box or former B. I then place another layer of blotting paper upon this sheet of lead and then an additional sheet of lead upon this blotting paper as before; in this instance however, the other lateral edge of the second plate P is caused to rest against the other lateral inner face of the box or former. Alternate layers of blotting paper and sheets of lead are thus disposed until the box or former is filled to the desired depth, the lateral projecting edges on one side constituting the terminals to be united as one element or pole of the electrode, and the like projecting edges on the other side constituting the terminals for the other element or pole. (see Figs. 2 and 4). I then draw together and firmly unite the ends of the cloth strip or fabric C, by stitching (see Fig. 4) and carefully remove the electrode from the box or former, after which I place it between clamps. While the clamps are thus in position I insert long metallic pins *p* provided with heads or handles *h*, between the projecting edges of the entire set of plates P on one side and iron or otherwise turn down these projecting edges in the manner shown on the right in Fig. 4. The pins *p* are then drawn out by the aid of the handles *h*, and inserted between the projecting edges of the plates on the opposite side, and these edges are ironed or turned down in a similar manner, it being obvious that great care should be used to leave a sufficient space at the opposite edges of the electrode to prevent any possibility of short circuit between the individual plates of each element. These wires may be of lead and may if preferred be left in position thereby affording a more compactly formed mass. The edges having all been turned down as described, I then unite them in one solid or integral mass by soldering, lead burning, or in any manner which may readily suggest itself to those skilled in metal working. I then prepare ears or lugs E E' of the necessary dimensions for conducting the entire current which the battery is capable of receiving and discharging and unite these ears to the faces F F' by soldering or lead burning them thereto. I prefer to make these ears of tapering or wedge shape and of large area, as shown, and to perforate them with holes H for the purpose of receiving the solder and affording a firm and sure metallic union between all parts of the ears and the faces F F'.

The electrode as thus constructed constitutes a single or complete electrode bound together on all sides and therefore ready for transportation and use as a completed article which may be subjected to more than ordinary rough usage without damage. It is light, durable, of very low internal resistance, and not subject to local or short circuit action. Two or more of such electrodes may be united together in series or multiple are relation in

any preferred manner, either by uniting the binding screws *b b'* of such electrode in any of the usual ways, or two or more electrodes may be joined together in a single large cell by uniting the faces F F' on one side in any desired way, such matters being obvious to those skilled in the art.

The electrodes as thus constructed are placed in battery cells or jars in any of the well known storage battery solutions and are charged while in this condition in the usual manner, it being necessary before commencing the charge that they shall stand a sufficient length of time in the solution to allow it to thoroughly saturate the intermediate sheets of blotting paper as will be readily understood by those skilled in the art.

After the electrodes have been formed by charging, discharging and recharging after the manner of forming Planté cells they are ready for future use and transportation and their compact construction is of such a nature that they are not readily subjected to damage either in transportation or use, and they may be charged and hold the charge put into them for months without deleterious results, even though removed from the charging solution.

I am aware that it is old in the art to construct a storage battery cell of alternate thin sheets of lead and blotting paper, and I make no claim broad enough to include such a structure.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:—

1. The described method of constructing a storage battery electrode consisting in building it up from alternate strips or sheets of conducting and absorbent non-conducting material; each alternate sheet of conducting material extending laterally over the opposite edges of the intermediate absorbent material and finally uniting the extending edges together in each instance in one integral face or mass.

2. The described method of constructing a storage battery electrode consisting in piling together alternate sheets or strips of lead and an absorbent as blotting paper, the opposite edges of alternate sheets of lead extending beyond the edges of the corresponding edges of the intervening sheets of blotting paper and finally uniting all of the edges into two independent integral faces.

3. The described method of constructing a storage battery electrode consisting in interleaving overlapping alternate sheets of conducting material adapted to become active under a charging current, and absorbent non-conducting material and then uniting the overlapping edges of the conducting material on opposite sides into integral faces which constitute the poles of the electrode.

4. The described method of constructing a storage battery electrode consisting in interleaving overlapping sheets of material adapt

ed to become active under a charging current and non-conducting absorbent material, then binding all of said sheets together by a binding medium and finally uniting all of the lateral projecting or overlapping edges on opposite sides into integral faces or masses which constitute the two poles of the electrode.

5. The described method of constructing a storage battery electrode consisting in interleaving overlapping sheets of conducting and non-conducting material; then binding all together by a binding medium; then uniting all of the overlapping edges on opposite sides into integral faces or masses and finally integrally attaching conducting ears or lugs to said faces.

6. The described method of constructing a storage battery electrode consisting in interleaving overlapping conducting and absorbent non-conducting sheets, then bending the lateral edges of the conducting sheets around pins inserted between said edges, and finally uniting the edges into integral or solid faces.

7. A storage battery electrode consisting of alternate sheets of conducting and absorbing non-conducting material; the alternate conducting sheets extending laterally over the opposite edges of the intervening absorbent and united together throughout their length so as to form two conducting faces or poles of large conducting capacity, substantially as described.

8. A storage battery electrode consisting of alternate layers of lead and absorbent material as blotting paper; the alternate sheets of lead extending laterally over the opposite

edges of the absorbent and united in each instance throughout their length in combination with a binding medium which unites them all together, substantially as described.

9. A storage battery electrode consisting of alternate layers of sheet lead and blotting paper, the alternate layers of lead extending over the lateral or opposite edges of the blotting paper and united in each instance into one mass or face, in combination with a binding medium which unites them all together and a pair of ears or lugs integrally attached to each face, substantially as described.

10. A storage battery electrode consisting of two series of thin conducting sheets each series united to an independent integral face, in combination with intermediate sheets of absorbent material, substantially as described.

11. A storage battery consisting of two independent series of thin conducting sheets, each series united to an integral or solid face, in combination with intermediate sheets of absorbent material and a binding medium, substantially as described.

12. A storage battery electrode consisting of two independent series of sheets of lead each series being united at their lateral edges to an integral face, in combination with intermediate absorbent material, a binding medium extending around both series of plates and an ear or lug integrally attached to each face, substantially as described.

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Witnesses:

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