(No Model.)

E. T. STARR.

SECONDARY BATTERY PLATE OR ELECTRODE.

No. 295,455. Patented Mar. 18, 1884.

FIG. 1.

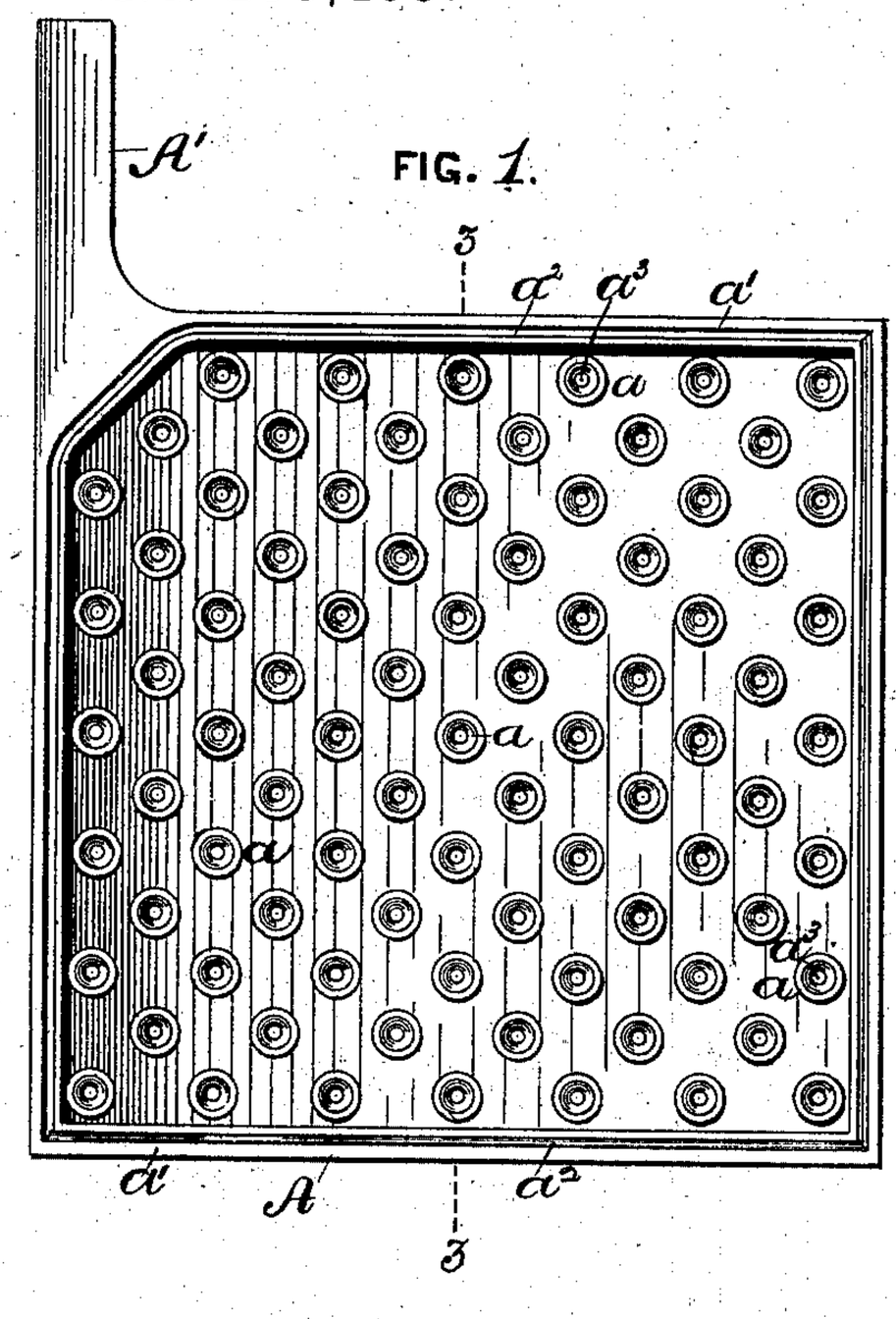


FIG. 2.

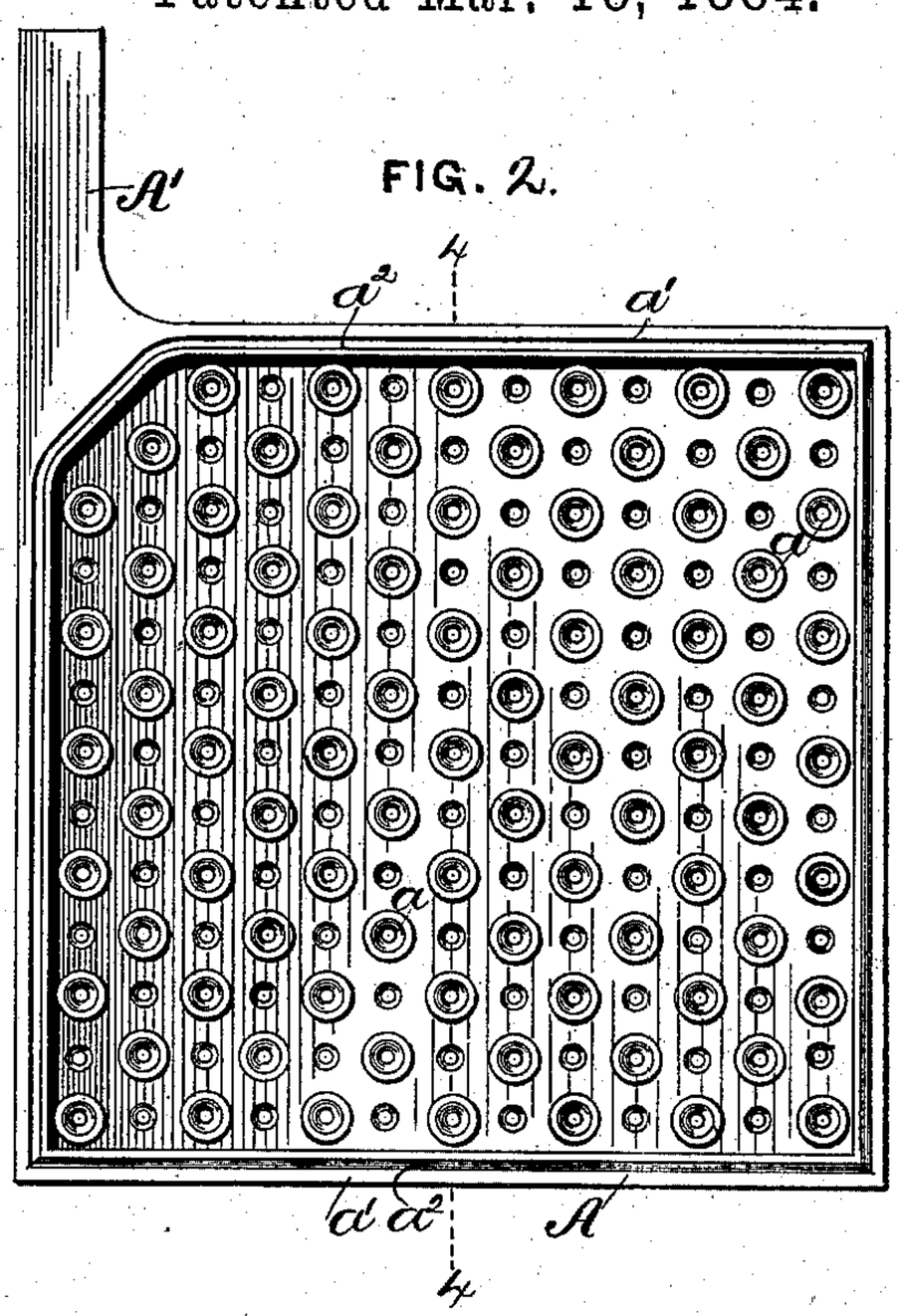


FIG. 3.

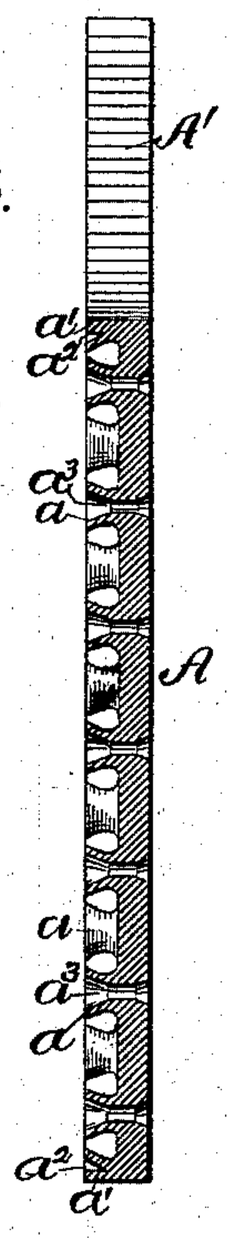
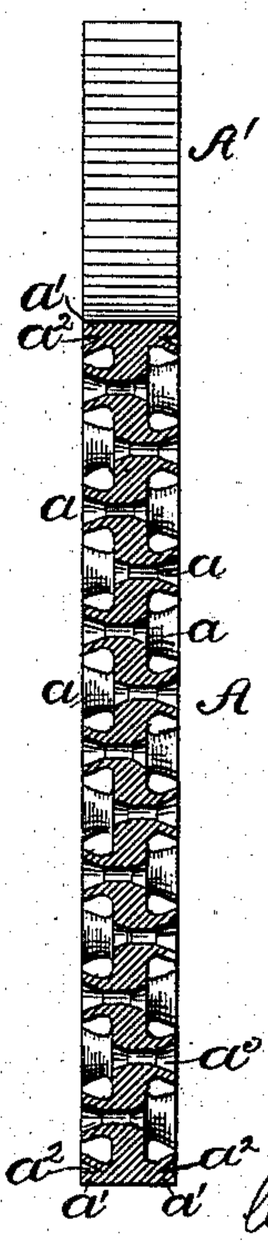


FIG. 4.



WITNESSES:

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James Young.

INVENTOR;

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by his atty

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UNITED STATES PATENT OFFICE.

ELI T. STARR, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO WILLIAM J. PEYTON, OF WASHINGTON, DISTRICT OF COLUMBIA, AND H. M. LEWIS AND JAMES W. WHITE, OF PHILADELPHIA, PENNSYLVANIA.

SECONDARY-BATTERY PLATE OR ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 295,455, dated March 18, 1884.

Application filed September 8, 1883. (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 Secondary-Battery Plates or Electrodes, of which the following is a specification.

My invention relates to electric-battery plates or electrodes for use more especially in secondary batteries, and its objects are to provide an improved form of plate or electrode possessing great durability, strength, and efficiency.

The subject-matter claimed herein as my invention is first fully described, and then particularly pointed out at the close of the specification.

In the accompanying drawings, Figure 1 is a side or face view of my improved plate, having one side formed with projecting retaining devices or surfaces, hereinafter fully described; and Fig. 2 is a similar view of the plate, having both sides formed with said retaining-surfaces. Fig. 3 is a vertical sectional view through the plate or electrode shown in Fig. 1, on the line 3 3 of said figure; and Fig. 4 is a similar view through the plate or electrode shown in Fig. 2, on the line 4 4 of said figure.

The plate A (shown in Figs. 1 and 3) is preferably a cast plate, and of lead. Projecting lugs or pins *a* are formed on one side or face of the plate, and a projecting rim or border, *a'*, is also formed on the plate, projecting, preferably, to the same extent as the lugs or pins *a*—say one-eighth of an inch from the side or face of the plate. A groove, a^2, is subsequently formed in the face of the raised rim or border *a'*, and the inner edge of said rim thereby bent inwardly, as shown in the sectional views, whereby said inner edge of the raised rim *a'* forms a dovetailed, tapered, or undercut space or chamber on the side of the plate, with the broadest side of the recess or widest part of the chamber next the body of the plate. The plate A is thus formed, as stated, with a recessed or chambered face or side, while the lugs or pins *a* constitute retaining-surfaces in said recess or chamber all over said face or side. It will be understood, of course, that the beveled, undercut, or tapered rim or border surrounding the chambered or recessed side of the plate may be cast or otherwise formed and the groove a^2 dispensed with.

The lugs or pins *a* are preferably cast solid, and then punched or bored so as to form an opening or hole, a^3, therethrough and through the body of the plate; but the lugs or pins and plate may be cast with the holes therethrough. The holes are tapered inwardly from both sides of the plate, as clearly shown in Fig. 2 and the sectional views of the drawings. If the punching and tapering of the holes in the lugs or pins *a* are done after the plate is formed, this may be accomplished by means of a tapered punch, which spreads or heads the outer ends of the lugs or pins, as clearly shown in the drawings; but it will be understood that the lugs or pins may be cast with the enlarged or tapered heads.

By tapering or heading the lugs or pins *a*, they constitute very secure retaining devices for the active material of the plate or electrode which is applied to the recessed or chambered side of the plate, as will be hereinafter sufficiently designated, the spaces between the lugs or pins, it will be obvious, being deeper or wider next the body of the plate, inasmuch as the outer or headed ends of the pins are the largest part thereof. The undercut or tapered border or rim *a'* also constitutes a secure interlocking connection for the active material which is applied to the recessed or chambered side of the plate, and, in addition, said border or rim strengthens the plate very materially, which is an important desideratum.

In Figs. 1 and 3 only one side of the plate is provided with the retaining-surfaces—to wit, the pins or lugs *a* and the recessed, beveled, dovetailed, or undercut border or rim *a'*—while in Figs. 2 and 4 both sides of the plate are provided with said retaining devices. An extension or lug, A', is cast or formed at one corner or edge of the plate for the ready attachment of the circuit-connections.

To the recessed or chambered side of the single plate, Figs. 1 and 3, or to both sides of

the double plate, Figs. 2 and 4, I apply an active material, which may be in the form of a paste or otherwise. Said active material may be oxide of lead, finely-divided metallic lead, or a mixture of the two; or, preferably, the finely-divided active material applied to the side or sides of the plate is a mixture of finely-divided lead, oxide of lead, and mercury in the form of a paste, which is, after its application to the plate, preferably subjected to pressure to express the surplus mercury and permit the amalgam layer to harden and take a firm hold of or interlock with the plate. Of course any suitable active absorbing or porous material may be substituted for those mentioned. The active material is packed in the recessed or chambered side of the plate, between the lugs or pins and under the undercut, dovetailed, or beveled edge of the rim or border *a'*, and the active layer is in some cases preferably extended out a little beyond the outer ends of the lugs or pins of the single plates, so as to be filled in the openings or holes thereof and through the body of the plate, whereby a better hold or lock of the active layer all over the surface of the plate is insured. This will be readily understood from the nature of the holes or openings in the plate, which, as before stated, taper from both sides of the plate, and when the active material is packed therein it is locked to the plate against peeling off or separation. These tapered openings, in connection with the undercut or dovetailed recesses of the plate formed by the lugs or pins *a* and the border or rim *a'*, unite the active layer to the plate, so as to prevent any loose contact or separation, and the charging and discharging, and also the "formation," of the plate or electrode does not loosen said active layer thereon, which, if permitted, would result in bad contact and lessen the conductivity of the plate and its general efficiency. In some cases, where free circulation of the electrolyte is desired, the plugging or filling of the holes through the plate with the material active or to be made active is dispensed with, the undercut border and retaining lugs or pins insuring a firm lock of said material to the plate.

The plate or electrode may be used without the active layer or material applied as above described; that is, it may be "formed" like a Planté element; but I prefer the use of the active layer first mentioned as much better, it both increasing the capacity of the electrode and assisting in its rapid formation, or the placing of it in condition for effective work.

Instead of casting the plate, it may be made of rolled metal—lead, for example—and the recesses and lugs or raised surfaces formed by suitable dies, or by stamping or punching, or otherwise.

The plates or electrodes are assembled in the battery-cell in the usual way, with an electrolytic liquid—dilute sulphuric acid, for example.

I claim herein as my invention—

1. A battery-plate having a body or back with a projecting or raised undercut, dovetailed, or shouldered retaining rim or border surrounding the edges of the plate, whereby a secure retaining-chamber is formed in the side or face of the plate for the retention of the active material thereof, substantially as described.

2. A battery-plate having perforated lugs or pins projecting from the side or face of the plate, and provided with enlarged heads or ends, as described.

3. A battery-plate having lugs or pins projecting from the side or face thereof, and a retaining-rim extending around the edges of said plate, substantially as described.

4. A battery-plate having lugs or pins with enlarged heads or ends, and the undercut or dovetailed rim extending around its edges, substantially as described.

5. A battery-plate having a body or back and a projecting or raised retaining rim or border extending around its edges, with an active material or layer packed in the recessed or chambered side of the plate and interlocking with said retaining rim or border, substantially as described.

6. A battery-plate consisting of a body portion having lugs or pins projecting from the side or face thereof, and provided with a raised or projecting retaining rim or border extending around the edges of the plate, with an active material or layer packed in the recessed or chambered side of the plate and interlocking with said retaining rim or border, substantially as described.

In testimony whereof I have hereunto subscribed my name this 6th day of September, A. D. 1883.

ELI T. STARR.

Witnesses:
WM. J. PEYTON,
FRANK A. MULLIKIN.