(No Model.)

C. D. P. GIBSON.

STORAGE BATTERY.

No. 342,594. Patented May 25, 1886.

Fig. 1.

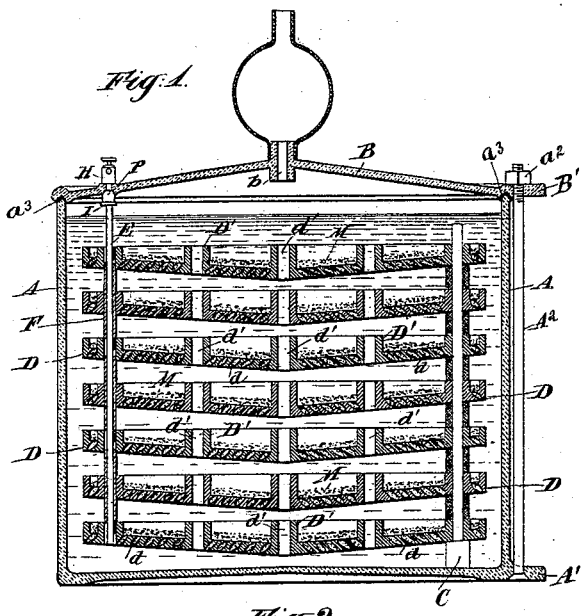


Fig. 4.

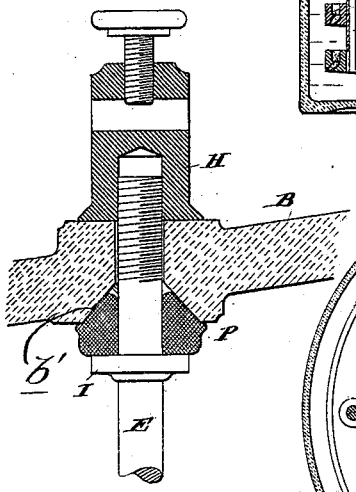


Fig. 2.

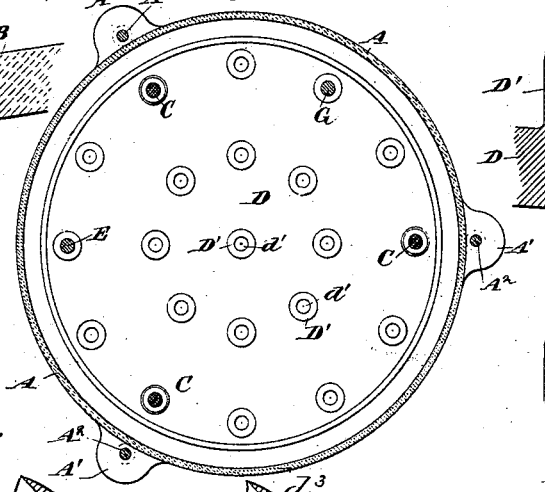


Fig. 3.

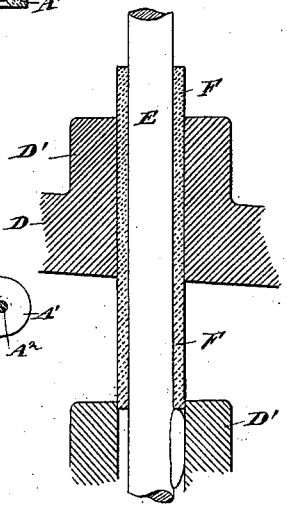


Fig. 5.

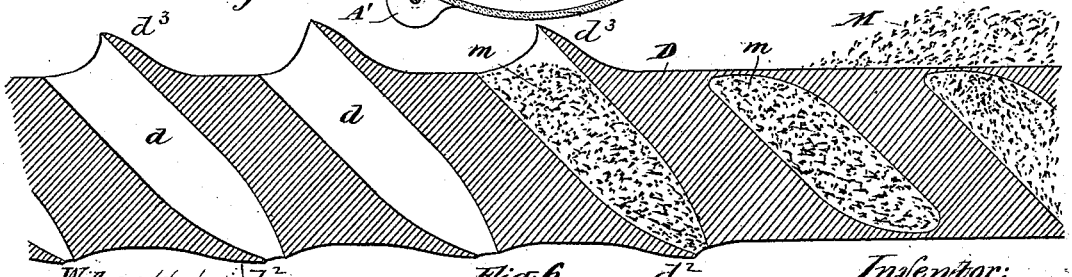
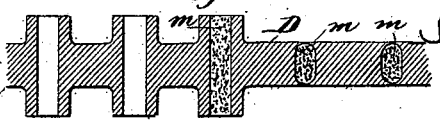


Fig. 6.



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UNITED STATES PATENT OFFICE.

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STORAGE-BATTERY.

SPECIFICATION forming part of Letters Patent No. 342,594, dated May 25, 1886.

Application filed August 31, 1885. Serial No. 175,784. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. P. GIBSON, a citizen of the United States, and a resident of New York City, in the county of New York and State of New York, have invented certain new and useful Improvements relating to Storage-Batteries, of which the following is a specification.

The improved battery is adapted to supply a reliable current of electricity with the proper quantity and intensity for a long period, and to be charged by a dynamo or other electrical apparatus of suitable power in a very short period. It works, like the storage-batteries in common use, by the oxidation and deoxidation of lead; but I have devised a mode of construction, as will be fully set forth below, which affords important advantages.

I construct the battery with lead plates, which are inverted cones. A plate twelve inches square may be coned downward to an extent of one inch. The plates are mounted horizontally one above another, with sufficient space between them for the dilute acid to obtain access to all the parts, and for the gas which is set free to flow outward on the slightly-inclined under surfaces. Each plate is thickly perforated with two kinds of apertures. There are inclined perforations of small diameter, inclined to an angle of about forty-five degrees, the inclinations being all in the same direction. The inclined perforations are tightly filled with powdered granulated lead or peroxide of lead, and are nearly closed at both the upper and lower ends, so as to reliably retain the contents. A thick layer of powdered lead is applied over the upper surface of each plate, each plate being provided with a rim along each edge, and a rim or combing around each vertical hole to retain the loose material when first applied. After the battery has been a little time in use the powdered lead is retained by adhesion, due to its oxidation. The vertical holes are used for two purposes. Some are left open to allow a free movement of the gas and a free access for the electric current between the dilute acid and the substance of the lead plate. Others of the vertical holes serve to provide insulated passages for the traverse of the conducting-wires.

I connect all the hydrogen terminals and lead them up through the intermediate oxygen plates, providing short insulating-tubes of glass at the points of passage I correspondingly connect all the terminals of the oxygen plates and lead them through correspondingly-insulated holes in the hydrogen plates. I lead the terminals through corresponding holes in a cover, which protects the whole battery. The points of passage of the terminals through the cover I not only insulate but make gas-tight, providing a separate passage for the free escape of the gases.

I make the hydrogen plates of the same size and prepare each with the same number and style of closed perforations or pockets as the oxygen plates.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a general vertical section through the entire battery complete. Fig. 2 is a plan view of one of the plates. The remaining figures show details on a larger scale. Fig. 3 is a vertical section through a portion of two of the plates, showing the conductor soldered and insulated from the upper of this pair. Fig. 4 is a vertical section showing a portion of the cover. Fig. 5 is on a still larger scale. It is a vertical section through one of the lead plates. It shows some of the inclined holes or pockets before and some after filling and closing. Fig. 6 is a section showing a modification.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

A is a jar of glass or other suitable material, and B a cover.

C are insulating supports of hard rubber, adapted to perform the important function of supporting the plates and holding them the proper distance apart, and binding them together to prevent working.

D are plates of lead, certain portions being designated when necessary by additional

marks, as D′ D². Bosses or combings D′ are provided on the upper side, which surround vertical holes *d′*. The whole body of the plate D between the several coamings D′ is thickly perforated with inclined holes or pockets *d*.

In preparing the battery for use, the inclined holes *d* are filled with granulated or powdered lead, *m*, and dilute acid. After allowing these a little time to dry, the holes are closed at the upper and lower faces by hammering. I prefer to effect this by hammering with a light hammer, so that the effect is felt mainly on the extreme upper surface, and the lead which was raised as a burr, *d*³, in the act of producing the holes *d* being flattened down, reaches across the hole, and closes the upper end. In producing the holes *d*, the awl or other pointed instrument used should not be thrust through to its full extent. It is sufficient to extend its point through, thus raising only a small burr, *d*², through its under side. The hammering or other flattening treatment compresses this burr also. Thus the powdered lead is inclosed in each hole or pocket *d*, and reliably retained with a sufficient quantity of acid to insure effective action.

A thick layer of powdered lead, M, covers the whole upper surface of each plate D, up to or near the tops of the combings D′.

E is a conducting-wire, which may be of lead, soldered or otherwise electrically connected to alternate plates D. This is the positive conductor, and the plates it connects are the positive plates of the battery. At each passage of the wire E through the intermediate plates, D, which are the negative plates, the wire E is insulated by the insertion of a short tube, F, of glass or other insulating material. G is a corresponding conductor connected to the negative plates D, and similarly insulated from the positive plates. At the points where these conductors E and G extend out through the cover B, I provide a packing-ring, P, of soft rubber, which, by the screw-threaded binder-cup H, serving as a nut on the conductor E or G, is compressed between the under face of the cover and a collar, I, soldered or otherwise firmly fixed on the conductor. This insures that no gas shall escape through any looseness around the conducting-wire. The packing P matches in the countersunk lower inclined faces of the hole in the cover which receives the conductor. It serves as a packing and as a means for assuring that the conductor stands in the middle of the hole. It is therefore an insulator. A liberal passage is afforded by an aperture, *b*, in the cover B for the escape of the gases generated by the action.

The above passage is covered by an elastic bulb or small tube, B², of rubber, with a small aperture in the top, which prevents any slopping of the solution.

Lugs A′ are formed on the outside of the jar at the bottom, and corresponding lugs, B′, are formed on the cover B. Long bolts A² extend up from the lugs A′ through the lugs B′, and are secured by nuts *a′*. The upper edge of the jar A is of an inverted-V form, and fits into a corresponding groove on the under face of the cover B. A ring, *a*³, of soft rubber is placed on the V-shaped edge of the jar, and when the cover B is applied and the nuts *a*² are screwed down on the bolts A² insures a water and air tight joint and prevents any possibility of the liquid creeping over the edge of the jar, and it also guards against any escape of gas through such joint.

The battery is filled nearly to the top with dilute acid. The charge is effected by connecting a dynamo or other efficient source of electricity to the conductors and sending a current through the plates and connected powdered lead *m*, which lies imprisoned in the perforations *d*, and also the powdered lead M, which lies in the strata. As in other storage-batteries, the positive current is led in through what I have termed the "negative wire" G—the wire which serves as a negative when the battery is in use—and the negative current is taken out through what I have termed the "positive wire" E. The conditions attained in my construction allow the charging to be effected in much less than the ordinary period.

My battery, which gives off a reliable working-current for two hundred hours, can be charged in ten hours or less.

I am not positive in regard to the theory. I believe that the particles *m*, imprisoned in the holes or pockets *d*, become oxidized and deoxidized at each charging and discharging, sharing this duty with the powdered lead in the strata M.

Modifications may be made in the forms and proportions within wide limits. I can use a greater or less number of plates than are here shown.

There may be a greater or less number of the combings D′ and of the holes *d′*.

I esteem it important that the inclined holes or pockets *d* be arranged as thickly as a due regard to strength in the main plates will allow. I propose in some cases to extend the inclined pockets *d* through the whole or a portion of each of the combings D′.

Parts of the invention may be used without the whole. I can use the perforated plates and the means described for thereby confining a quantity of the pulverized lead without the strata M and without the holes *d′* and the combings D′. I can connect the wires E and G in the space exterior to the plates D, between them and the inner face of the vessel A, and can thus dispense with the insulating-tubes F.

I can use plane plates instead of the inverted conical form shown. I prefer the latter, for the reason that it promotes the rapid traverse of the bubbles of gas to the exterior of the plates and their escape therefrom to the surface.

I have referred to the metal as lead. The lead of commerce with the ordinary amount of impurities serves well. I can alloy it to various degrees.

Approximate results may be obtained by

piercing the plates D only partly through on each side and filling the holes or pockets with peroxide, and closing the same by hammering.

The jar or vessel may be made with lugs on its inner surface to support the plates, wires, and connecting-tubes in the position described, care being taken to correspondingly modify the other parts. I propose to make these plates in the large way by suitable machinery and skill, and to sell them to be aggregated in series by the purchasers. Such plates, ready prepared, may be joined and supplied with proper conductors, insulators, &c., and immersed in the exciting-fluid, as their taste or convenience may dictate.

I believe that nearly the same results may be obtained by molding the plates with projections having perpendicular holes, filling such holes with peroxide, as shown in Fig. 6, and closing them at the upper and lower ends by hammering, casting the plates with small tubes in great number projecting above and below the surface of the plate, and hermetically sealing the peroxide therein by hammering. Such tubes or projections may be on one side only, and serve with some success. I prefer the whole, as shown in the principal figures.

The preferable position of the plates is each horizontal, as described; but I believe a good part of the advantages can be realized with the plates in a variously inclined or in a vertical position. For such arrangement the pockets should be made as described, but the surface-coating M should be omitted.

Instead of the finely-divided lead M and *m* being always in the form of grains, I can use lead-foil in pieces of any desired size, either lying extended or variously crumpled or rolled.

I claim as my invention—

1. In a storage-battery as described, the combination, with plates D, having pockets *d*, of a filling of powdered lead entirely inclosed within the material of said plates, as set forth.

2. A plate, D, having inclined holes formed therein to leave burrs, as d^2 d^3, combined with a filling of powdered lead inclosed within the pockets formed by forcing down the said burrs, as set forth.

3. In a storage-battery, the combination, with plates D, formed with holes *d* and burrs d^2 d^3, of a filling of powdered lead confined in said plates by hammering down the burrs, and a layer of oxidizable material, as M, in powdered form, as set forth, arranged upon the upper surface of the plates, as specified.

4. The plates D, having confined filling *m* and tubular bosses D′, arranged and supported in series one above another, combined with the oxidizable material M, loosely supported on the plates D, conducting-wires E G, and insulating-tubes F, arranged in relation to alternate plates, as set forth, and for the purpose specified.

5. In a storage-battery as described, the combination, with the cover B, having inclined countersink *b′*, of the wire E, having collar I, the nut H, and the flexible packing P, clamped between the collar I and the inclined walls of the countersink, to both insulate the wire and pack the joint, as set forth.

6. The storage-battery described, having the plate D, supports C, conductors E G, collars I, screw-caps H, and insulating-packing P, in combination with each other and with the cover B and vessel A, all adapted for joint operation, substantially as herein specified.

Signed at New York city, in the county of New York and State of New York.

CHAS. D. P. GIBSON.

Witnesses:
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