No. 712,316. Patented Oct. 28, 1902.

F. LOPPÉ, H. P. MORIN, G. J. A. GRINER & D. P. MARTIN.

ELECTRIC ACCUMULATOR.

(Application filed Oct. 26, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

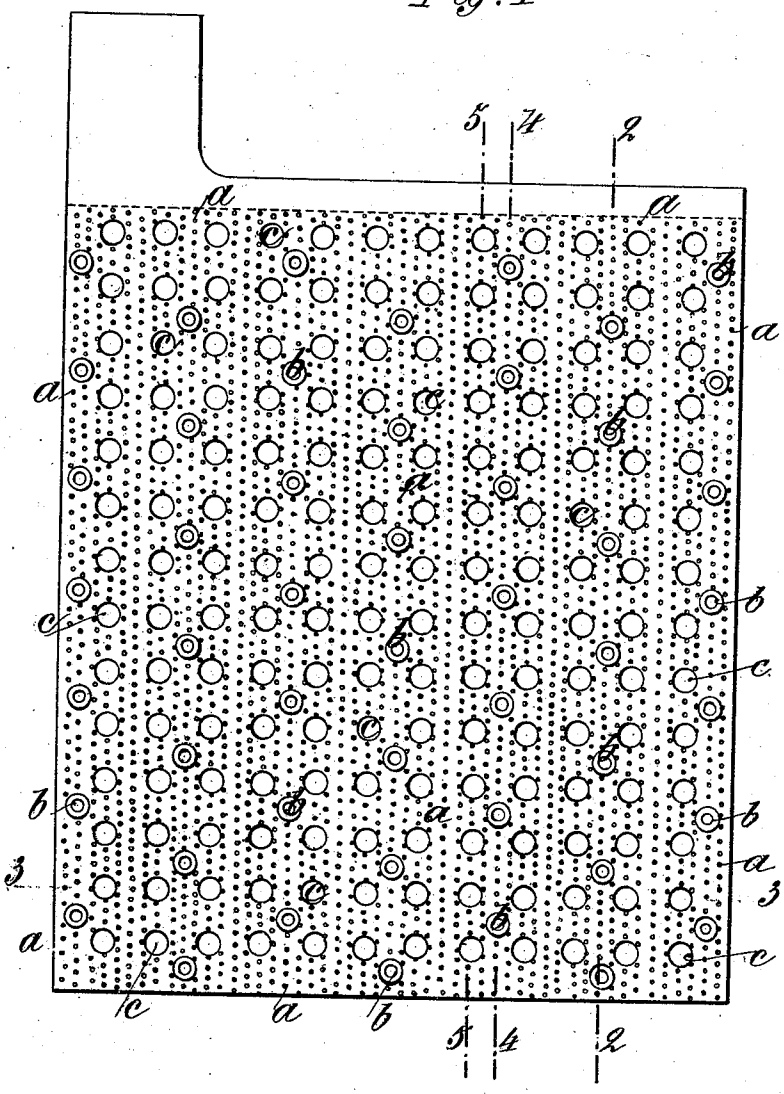


Fig. 2

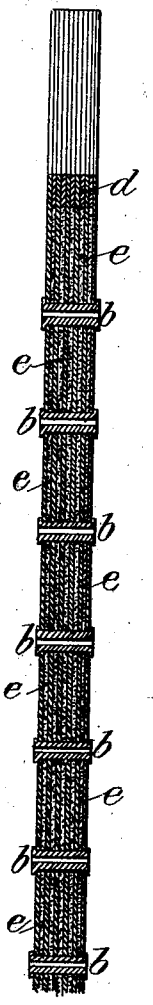


Fig. 3



WITNESSES:

W M Avery

C R Ingwersen

INVENTORS

François Loppé

Henry P. Morin

Georges J. A. Griner

Denis P. Martin

BY Munn & Co

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 712,316. Patented Oct. 28, 1902.

F. LOPPÉ, H. P. MORIN, G. J. A. GRINER & D. P. MARTIN.

ELECTRIC ACCUMULATOR.

(Application filed Oct. 26, 1899.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 4

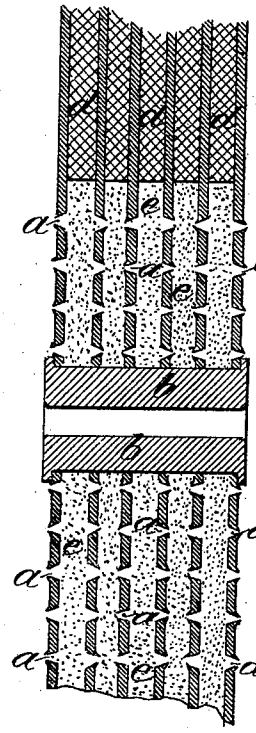


Fig. 5.

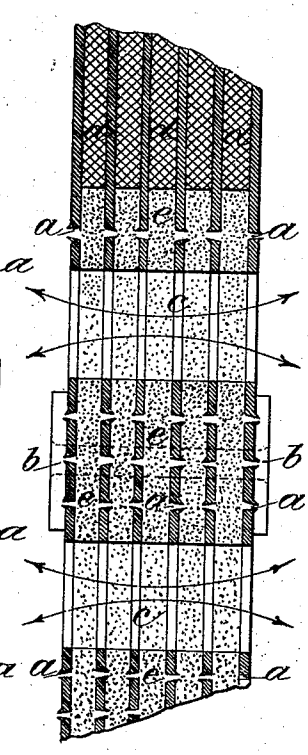


Fig. 9

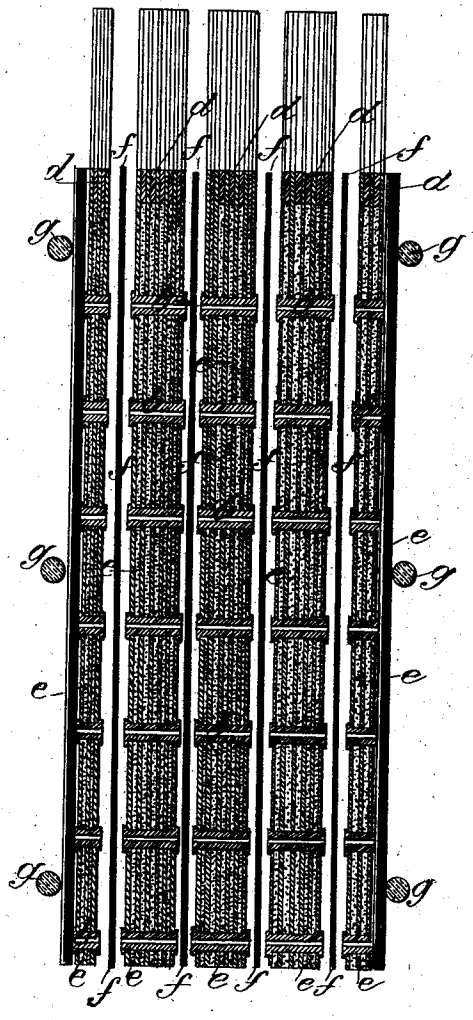
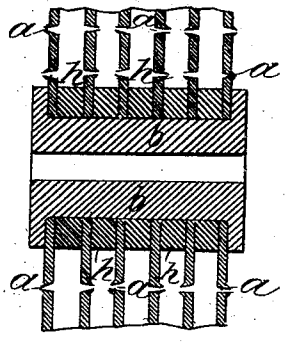


Fig. 6.



WITNESSES :

W. M. Avery

C. R. Ferguson

INVENTORS

François Loppé

Henry P. Morin

Georges J. A. Griner

Denis P. Martin

BY

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 712,316. Patented Oct. 28, 1902.

F. LOPPÉ, H. P. MORIN, G. J. A. GRINER & D. P. MARTIN.

ELECTRIC ACCUMULATOR.

(Application filed Oct. 26, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 7

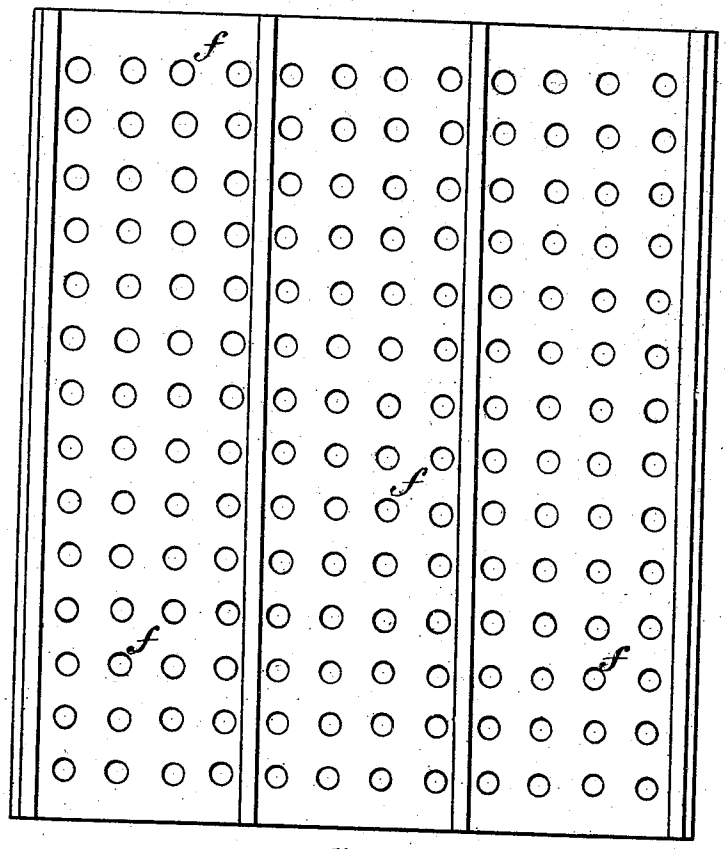


Fig. 8



WITNESSES

W. M. Avery

C. R. Ferguson

INVENTORS

François Loppé

Henry P. Morin

Georges J. A. Griner

Denis P. Martin

BY

ATTORNEYS.

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANÇOIS LOPPÉ, HENRY PAUL MORIN, GEORGES JEAN ADOLPHE GRINER, AND DENIS PHILIPPE MARTIN, OF PARIS, FRANCE.

ELECTRIC ACCUMULATOR.

SPECIFICATION forming part of Letters Patent No. 712,316, dated October 28, 1902.

Application filed October 26, 1899. Serial No. 734,875. (No model.)

To all whom it may concern:

Be it known that we, FRANÇOIS LOPPÉ, HENRY PAUL MORIN, GEORGES JEAN ADOLPHE GRINER, and DENIS PHILIPPE MARTIN, engineers, citizens of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Electric Accumulators, of which the following is a specification.

Our invention relates to certain improvements in and connected with electric accumulators, and the following is the description and method of constructing the same.

The annexed drawings show the various parts of an accumulator constructed in accordance with our invention.

Figure 1 represents a front elevation of an electrode. Fig. 2 is a vertical section through the line 2 2 of Fig. 1. Fig. 3 is a horizontal section on line 3 3 of Fig. 1. Fig. 4 is a portion of a vertical section, drawn to an enlarged scale, on line 4 4 of Fig. 1. Fig. 5 is a portion of a vertical section, also on an enlarged scale, on line 5 5 of Fig. 1. Fig. 6 is a portion of a vertical section similar to Fig. 5, but on a larger scale, and in this case its plate is fixed on the Planté system. Fig. 7 shows an elevation of an insulating perforated plate or separator. Fig. 8 is a horizontal section through the same. Fig. 9 is a vertical sectional elevation of a mounted accumulator.

This improved accumulator or storage battery is formed of a number of plates of lead or lead alloy, the positive and negative electrodes being similarly constituted whether anode or cathode. Each plate or electrode is essentially formed of several sheets placed close together and united. These sheets may be formed of a single plate folded into undulations or of several separate and distinct plates. To construct the electrode in the former case, we take a thin lead plate of suitable shape, preferably rectangular, and this plate is undulated and perforated with a large number of small holes, usually and preferably formed in such a manner that the metal around these holes is *repoussé* in the form of the lower frustum of a cone and jutting out in similar manner. The undulations or corrugations should be numerous and close together. The holes are so formed that the conic projections are distributed over both faces of the plate. We cannot better compare the appearance of each surface than to that of a nutmeg-grater. The sheet so undulated and perforated is folded a certain number of times, so that the folds divide it into equal divisions, and the different sections so formed are folded so as to lie closely together. Extensions are provided for the purpose of taking off the discharges of current, which when placed together unite to form one single lug or projection. The parallel sheets so arranged can thus have within opposite faces and at their ends a coating of some active material—such as oxid of lead, lead salts, pulverulent lead, &c. This coating can be effected by placing or pasting the active material on the sheets at the time that folds are made therein or by electrolytically depositing the spongy lead thereon, these substances at the time of the phenomena termed "formation" being changed into spongy lead and peroxid of lead. The active material may also be provided alone by the metal of the plate in case the accumulator is "formed" according to the Planté system.

To construct the electrode according to the second method, we take several thin sheets of lead of the same size and undulated and perforated, as before, and place them together before applying to their faces layers of the active material selected, either by coating or by electrolytic deposit, or according to Planté's method. We wish to remark, however, that in any case we reserve the right to use sheets of woven lead wire or lattice-work in lieu of the perforated lead plates. The lead plates are then secured together by suitable solder on one or more of their edges or by rivets running through them at suitable points of the surface or otherwise suitably connected together. In these plates so formed, either of a folded single sheet or of sheets joined together by soldering or riveting, holes or apertures of suitable shape are provided. These holes, which run through them from side to side perpendicularly or obliquely, or both, are for the purpose of allowing free circulation of the liquid and also of increasing the surface of the active material.

Figs. 1, 2, 3, 4, and 5 of the annexed

drawings represent an electrode so formed. The small openings, made so that the metal edges are raised, are shown at *a a a*. The rivets are designated *b b b* and the holes for the circulation of the liquid *c c c*. The rivets may themselves be tubular, as shown on the drawings. The different layers forming a plate may be in their upper parts fixed at convenient distances apart by means of distance-pieces of lead *d*. The active material is shown at *e*. The electrodes so formed are arranged parallel to one another in a cell, and between them may be placed plates *f*, of insulating substance, Figs. 7 and 8, perforated with holes which coincide with those in the electrodes. These plates are arranged to prevent all contact of adjacent electrodes with each other and to allow by means of insulating connections *g* the whole to be held together in one piece or block, Fig. 9. These connections should preferably be formed of india-rubber rings, so that the set of electrodes and of insulating-plates will have a certain degree of elasticity, thus permitting the active material to increase in volume, while preventing warping or movement of the plates immersed in the liquid. These insulating connections may be of strips perforated with holes and furnished with ribs or slots. They may also be replaced by combs, clips, or riders slipped or clamped over the plates.

Fig. 6 represents, in the case of an accumulator arranged on the Planté system, the method of joining the sheets forming the electrodes by means of rivets. The separation of these sheets is obtained by means of distance-pieces or packing *h*, surrounding the rivet.

Our accumulator gives rapid charges and discharges, because the active material is compressed between the sheets forming each electrode and because the active material is in very thin layers. Thus the greatest distance between one point of the active material and the lead sheet is reduced to a minimum. The apparatus also possesses very slight resistance. On the other hand, the circulation of the electrolyte is perfect on account of the holes in the plates and the insulators interposed between the latter. This circulation insures the homogeneity of the electrolytic liquid and its thorough use.

On account of the short distance of any point of the active material or mass from the electrolyte this active mass always works under the most favorable conditions.

What we claim as our invention, and desire to secure by Letters Patent, is—

An electric accumulator comprising a plurality of perforated plates, the walls of the perforations having conical projections, an active mass arranged between the plates, metal distance-pieces arranged between the plates at one end, and perforated rivets connecting the several plates.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FRANÇOIS LOPPÉ.
HENRY PAUL MORIN.
GEORGES JEAN ADOLPHE GRINER.
DENIS PHILIPPE MARTIN.

Witnesses:
I. ALLISON BOWEN,
GEORGE E. LIGHT.