(No Model.) 2 Sheets—Sheet 1.

W. P. PATTON.

SECONDARY BATTERY PLATE AND METHOD OF PRODUCING SAME.

No. 584,649. Patented June 15, 1897.

Fig: 1.

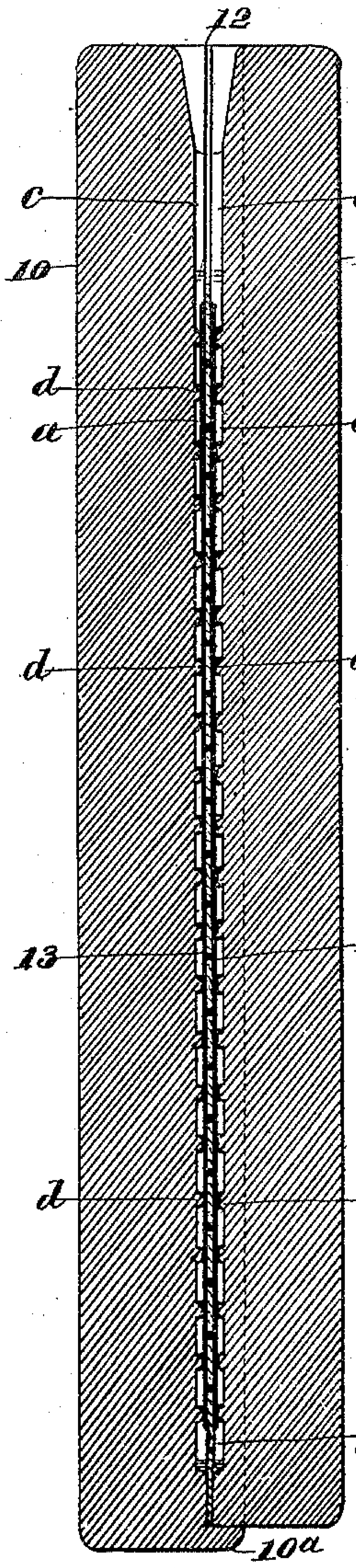


Fig: 2.

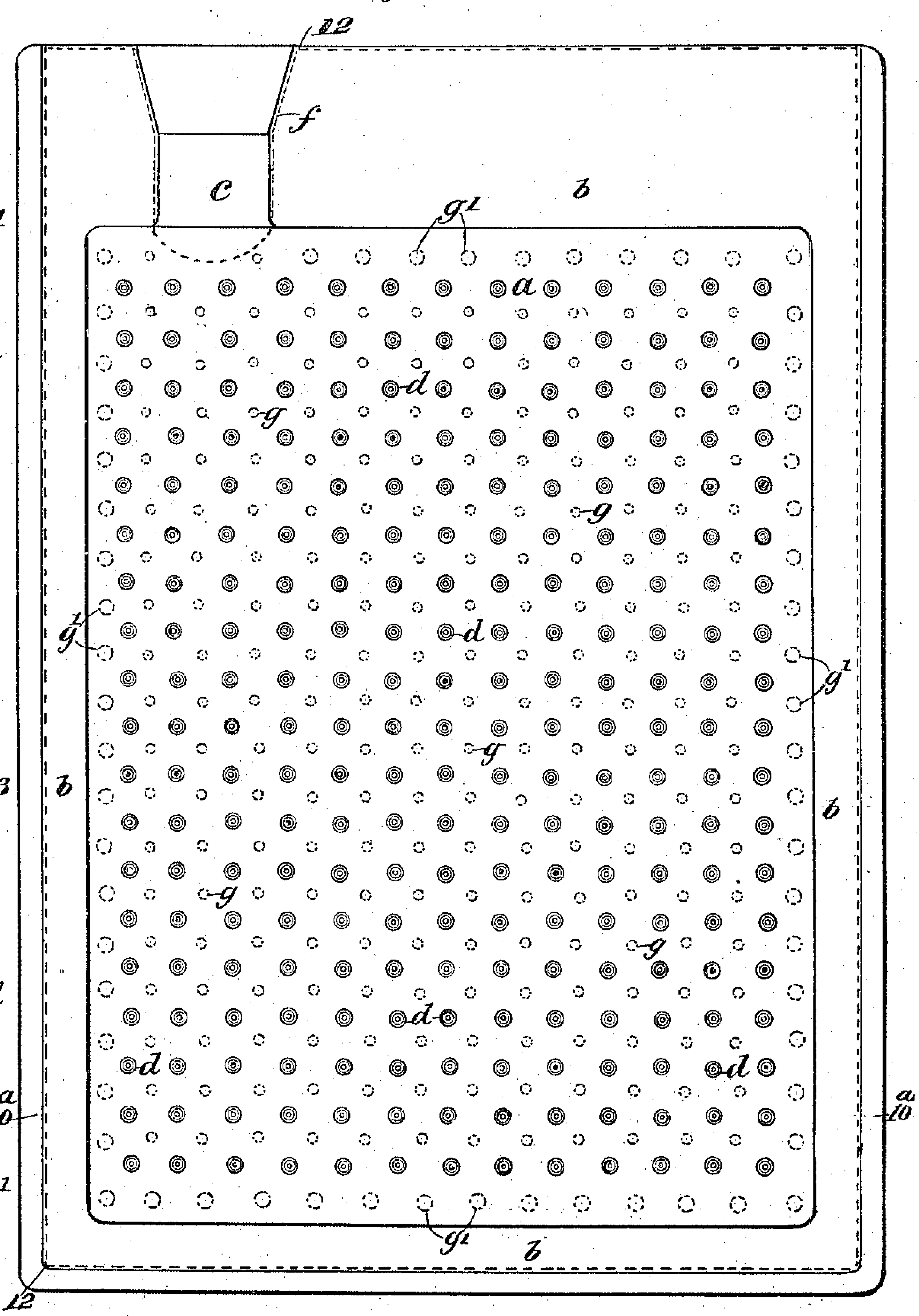
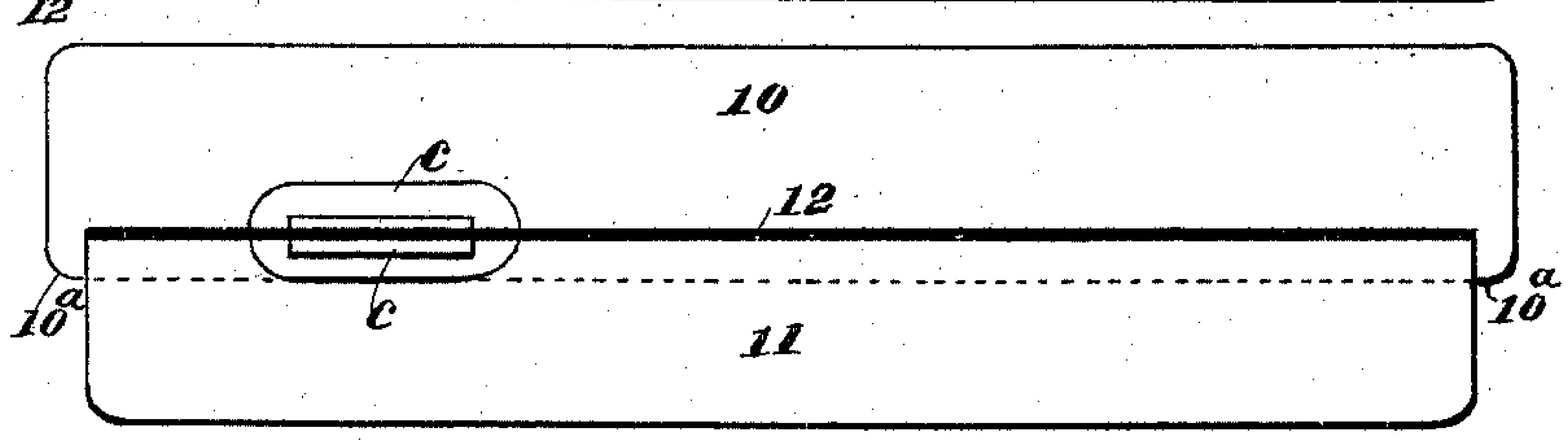


Fig: 3.



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(No Model.) 2 Sheets—Sheet 2.

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SECONDARY BATTERY PLATE AND METHOD OF PRODUCING SAME.

No. 584,649. Patented June 15, 1897.

Fig: 4. Fig: 5. Fig: 6.

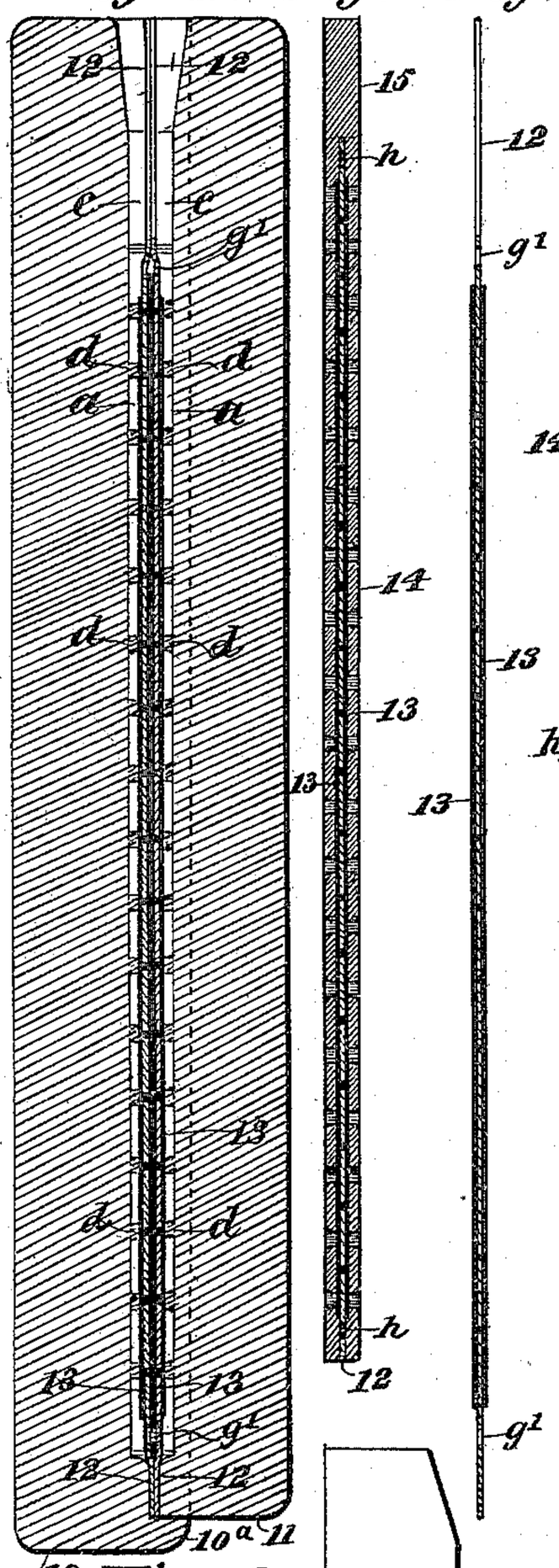


Fig: 8.

Fig: 7.

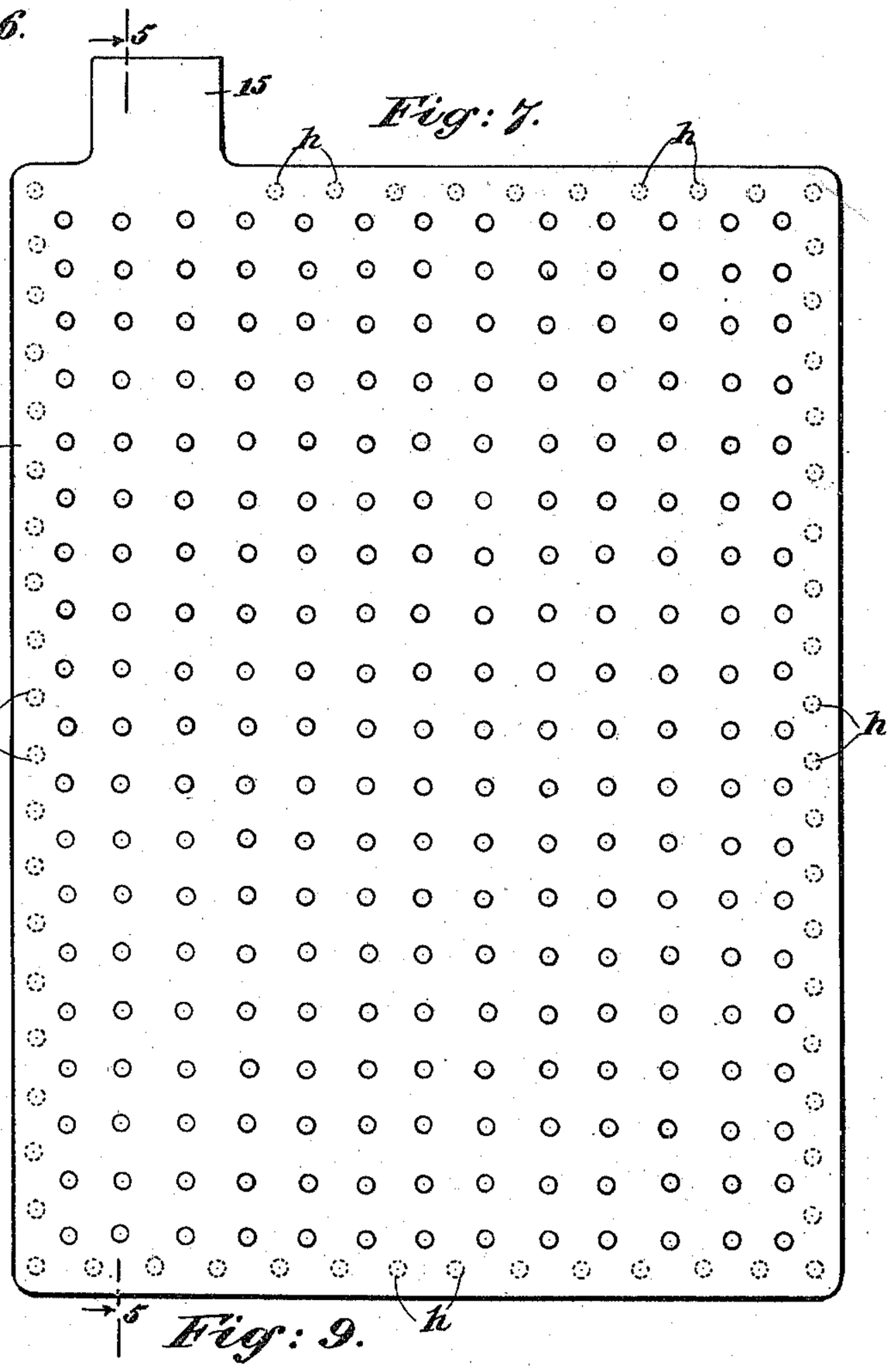
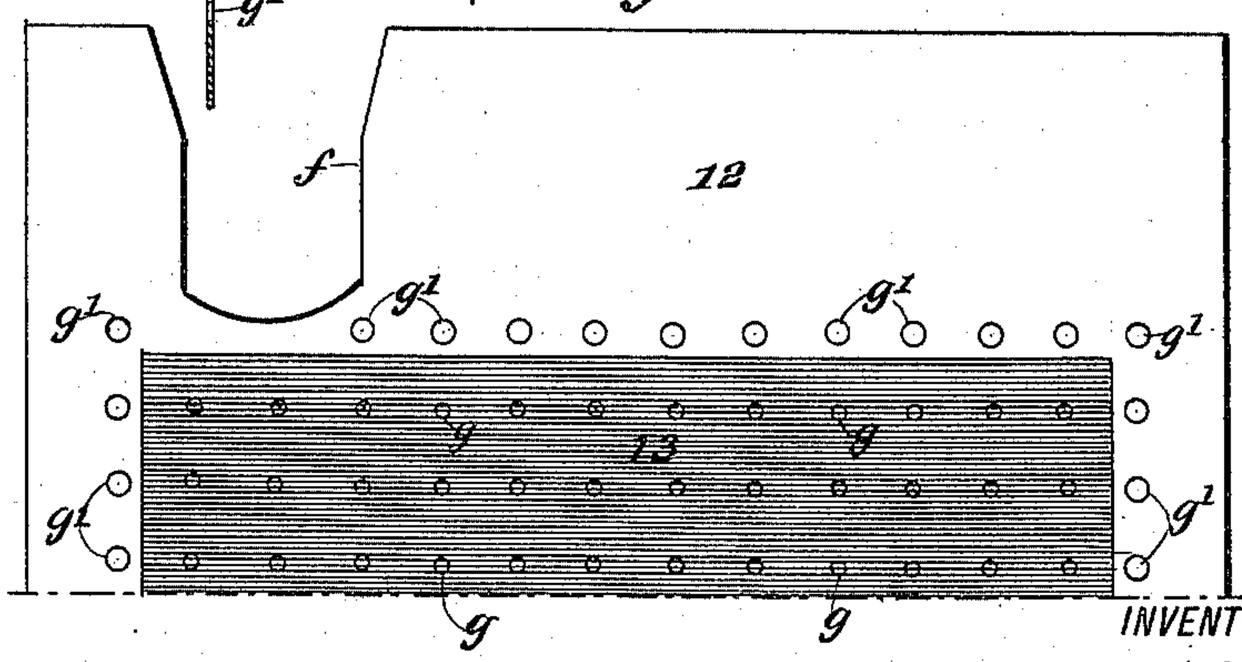
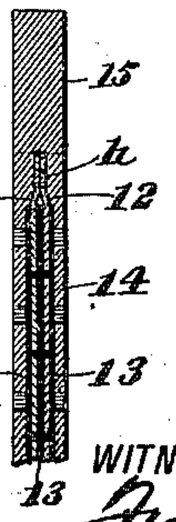


Fig: 9.





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UNITED STATES PATENT OFFICE.

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SECONDARY-BATTERY PLATE AND METHOD OF PRODUCING SAME.

SPECIFICATION forming part of Letters Patent No. 584,649, dated June 15, 1897.

Application filed February 15, 1897. Serial No. 623,413. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. PATTON, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Secondary-Battery Plate and Method of Producing the Same, of which the following is a full, clear, and exact description.

This invention relates to plates or elements for secondary batteries of the Planté type.

The objects of my invention are to provide a battery-plate of the indicated type which is light, strong, has great surface for the formation of an active coating, is simple in construction, and adapted for quick and cheap production.

To these ends my invention consists in the novelly-constructed battery-plate and also in the method for producing said plate, as is hereinafter described, and indicated in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a transverse sectional view of the plate-mold longitudinally considered and also of a partition that becomes a part of the battery-plate when the latter is formed in the mold. Fig. 2 is a side elevation of one half-section of the two-part mold, showing its interior surface, a partition for the battery-plate being indicated by dotted lines as imposed upon the half-section of the mold. Fig. 3 is an end view of the two-part mold complete, showing a gate-orifice therein and also exposing an end of a contained partition which becomes part of the battery-plate when cast in the mold. Fig. 4 is a transverse sectional view of the two-part mold and of two similar partitions for a battery-plate that may be cast in the mold. Fig. 5 is a transverse sectional view of a battery-plate embodying features of the improvement, taken longitudinally through the gate member, essentially on the line 5 5 in Fig. 7. Fig. 6 is a longitudinal sectional view of a partition-plate for the improved secondary-battery element prepared for introduction within the mold. Fig. 7 is a side view of the improved battery-plate. Fig. 8 is a transverse sectional view of the upper portion of a battery-plate containing two spaced partitions and which has been cast in the mold represented in Fig. 4, and Fig. 9 is a side view of an upper end portion of the partition shown in Fig. 6.

The salient features of this improvement in secondary-battery plates consists, essentially, in forming the rectangular body of the plate hollow, but intact at all its edges, and in providing one or more perforated thin metal partitions which are held within the cavity of the plate by engagement therewith at the edges. Said partition or duplicate partitions are clamped at all the edges between two sections of a mold, wherein the side walls and edges of the battery-plate are cast into form from molten metal that passes through perforations in the partitions near their edges, whereby the cast sides of the battery-plate are integrally joined together.

In the drawings which illustrate the mold and the battery-plate, as well as the metal partitions that are held in the mold to be incorporated with the battery-plate when cast, 10 11 indicate the two sections of the mold preferably employed as a matrix wherein to cast the outer walls of the battery-plate and its edges. The half-sections 10 11 of the mold are essentially alike in their matrix-recesses *a*, so that each represents equal cavities for the reception of liquid metal.

As best shown in Fig. 2, the shallow matrix-cavity *a* in each mold-section 10 11 is so proportioned to the whole area of said parts that a marginal portion *b* will be afforded around all the edges of the cavity, and preferably the marginal portions of the mold-sections that are uppermost when the mold is in position forreceiving molten metal are made of greater width, vertically considered. In the upper marginal portions of the mold-sections 10 11 equal gate-recesses *c* are produced, which may be flared near their upper edges to adapt these similar and oppositely-disposed gate-recesses to readily receive melted metal that is to be introduced within the matrix. Around three edges of the mold-section 10 low flanges 10^a are preferably projected at right angles on the inner faces thereof with the level surface of the marginal portions *a* of the mold-section mentioned.

The breadth and length of the mold-section

11 is so proportioned that it will loosely fit between the opposite side flanges 10^a when the two mold-sections are placed together with the matrix-cavities opposite each other and have their top edges flush. The provision of the flanges named affords convenient means to insure the disposal of said matrix-cavities with similar edges thereof coincident, whereby the mold is rendered available for the production of a battery-plate having its edges measurably true, as the end flange 10^a further contributes to the proper imposition of one mold-section upon the other.

It is to be understood that any other available means for properly effecting the disposal of one mold-section upon the other may be utilized.

On the side surfaces of the matrix-cavities *a* numerous spaced stud-like projections *d* are formed or secured having equal length, and these projections may be slightly tapered toward their free ends; but this is not imperative.

Any preferred means may be employed to detachably hold the mold-sections 10 11 closely clamped together when in use as a matrix for casting the molten portions of the improved battery-plate.

The most essential feature of this invention comprises the provision of one or more partitions 12, which, as before indicated, are separately formed of sheet metal, such as sheet-lead, and held in position within the two-part mold 10 11 to become incorporated with the sides and edges of the cast portions of the plate, thereby producing a practically integral battery-plate of much greater internal area than can be effected without such a provision.

The partition 12 is loosely fitted in the mold-section 10, so that its side edges and lower edge will nearly contact with the flanges 10^a, if the mold-section has such a provision, the upper edges of the plate and mold-section being flush, or nearly so. A notch *f* is formed in the partition 12 at a proper point extending from its upper edge, said notch being of such dimensions and marginal shape as will adapt it to conform with that of the gate-recesses *c* when the partition is correctly placed in the mold between its sections 10 11. The partition 12 is numerously perforated, said perforations *g* being preferably spaced in regular order, as best shown by dotted lines in Fig. 2.

The perforations in the border row of holes formed in the partition 12 are preferably formed of greater diameter than the others, as shown at *g'* in Figs. 2 and 9, which marginal row of perforations should be so disposed that they will be near the defining edges of the matrix-recesses *a* when the partition is correctly located within the mold.

To prepare the partition 12 for introduction within the mold, it is evenly coated on its sides with a plastic composition 13, that is sufficiently heat-resisting in nature to withstand exposure to contact with melted lead, but which may be readily dissolved with water or other liquid. The composition of matter 13 may be of slaked lime and glue, or chalk and a suitable adhesive substance may be mixed to a paste with water and be used as a coating for the partition 12.

In applying the coating 13 to the partition 12 a margin should be left uncoated on the latter, so that the border row of holes *g'* in it will not be filled up; but the other smaller holes *g* are to be closed up with the coating. The thickness of the coating on each side of the partition 12 should be about equal one with the other, and the length of the projections *d* adapts them to have contact at their ends with said coatings when the partition is clamped in the mold.

Before pouring molten metal in the mold it should be heated sufficiently to avoid suddenly chilling the liquid metal, so as to insure the penetration of the metal—that is, melted lead—into all parts of the matrix which is not occupied by the partition 12 and the side coatings 13 thereon.

It will be evident that the liquid metal will pass down through the gate-orifice of the mold on each side of the partition 12 and run through the border holes *g'*, thus integrally uniting the two side walls of the battery-plate around its all its edges, the web-bars *h* that occupy the perforations *g'* serving to effect such an integral connection of the side walls mentioned.

After the plate has been cast it may be readily removed from the mold-sections 10 11, if these are loosened from each other, said castings 14 being easily separated from the short projections *d*, which will leave perforations in the side walls of the battery-plate. The projecting edge portion of the partition 12 is now removed, which leaves the edges of the battery-plate practically solid and neatly dressed.

The metal gate 15, which projects from the edge of the battery-plate 14, is reduced in length by cutting off the flared end portion, which will leave a coupling-lug thereon, whereby the plate may be connected with a coupling-bar or like means for placing the plate, along with others of a series, in electric connection with a circuit-wire.

In Figs. 4 and 8 there are shown two partitions 12 of like form assembled in a mold and subsequently cast into a battery-plate.

It will be seen that the coatings 13 on adjacent surfaces of the two partitions 12, that are practically like the single partition cast into the battery-plate shown in Fig. 5, will be impinged when placed in the mold-section 10. When the mold-section 11 is forcibly pressed upon the marginal portion of the partition it contacts with, the uncoated edge portions of each partition will be offset slightly, so as to cause these edge portions to intimately engage each other, as shown in Figs. 4 and 8.

It will be seen that the stud-like projections *d* of the mold-sections 10 11 contact at their ends with the outer coatings 13 on the adjacent partitions 12, when the latter are correctly positioned within the two-part mold, previous to pouring the molten metal therein.

When the battery-plate is completed by pouring melted lead in the prepared mold shown in Fig. 4, the metal flows down through the gate-aperture on each side of the pair of partitions 12, occupying all vacant portions of the mold, and of course passing through the opposite marginal holes *g'* in said partitions, producing integral web-bars *h*, as before explained. The battery-plates, provided with duplex partitions, as specified, will have proportionally-increased internal area for formation of an active material therein, such as peroxid of lead.

When the projecting edges of the two partitions are trimmed off, as already explained with regard to the plate having a single partition, and the flaring portion of the gate is removed, the plate is completed mechanically.

To fit the improved battery-plates in proper number for receiving electrolytic treatment to produce peroxid of lead within and upon them, these plates are immersed in water or other suitable liquid to dissolve and remove the coatings 13 from the inner surfaces of the battery-plates. When the plates are thus cleaned, the removal of the coatings will leave spaces between the partitions and also between them and the side walls of the plates, which will permit free access of the electrolytic liquid to all interior surfaces, as well as the exteriors of the battery-plates, and it will be apparent that the perforations *g* in the single partition or duplex partitions of a battery-plate will be cleansed so as to permit a free circulation of the acid solution throughout each plate when exposed thereto. The improved battery-plates are to be coupled in positive and negative series when set up for deposition or formation of peroxid of lead within them.

Any approved solution of suitable acids and water may be used, a strong solution of sulfuric acid being preferred, after the proper number of plates for a battery are electrically connected and insulated from each other within a battery-cell, as usual.

It will be apparent that when the active coating on the inner and exterior surfaces of the battery-plates is formed by electrolysis that a compact powerful electric accumulator will be afforded that will have great capacity for storing and discharging electricity for actuation of mechanical devices.

The most notable points of excellence pertaining to the improvements that have been described comprise great internal area for a battery-plate of moderate dimensions. The provision of separated partitions that are practically united at their edges with the outer walls of the plate affords great strength, while extreme lightness is secured. Furthermore, the junction of the edges of the cast portion of the plate with the internal partitions at the edges of the latter, and the provision of a coupling-lug in assured electric connection with the partitions as well as the cast sides of the plate, insures a reliable action and continuous maximum charging and discharging of a battery composed of the improved elements that have been shown and described, and avoids the objectionable internal resistance incidental to composite battery-plates that have their parts loosely connected.

The construction shown in Fig. 8 may be preferred on account of greater area afforded within the battery-plate; but excellent results are secured by the slightly-changed construction shown in the other example of my improvement in secondary-battery plates.

The particular construction of the mold herein shown and described is necessary for the proper production of the novel battery-plate, and is therefore embodied in the specification to render it complete, no claim being made for said mold as a part of the invention.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A secondary-battery plate comprising a sheet-metal partition coated with soluble inert material on each side, and having openings along the edges, and cast-metal perforated sides which are integrally united through the openings in the partition, as specified.

2. A hollow secondary-battery plate, comprising duplicate perforated metal partitions, held united at their edges between joined metal perforated side walls, said partitions being spaced from each other and also from the side walls, as specified.

3. A secondary-battery plate, comprising a hollow perforated cast-metal body, an integral coupling projection thereon united with both side walls of the plate, and spaced perforated partitions in the hollow body, held at their edges by the edge portions of said side walls, and also by spaced web-bars integral with the side walls and extending through perforations in said partitions, as specified.

4. A secondary-battery plate, comprising a hollow perforated metal body integrally joined along all its edges by spaced web-bars, and a sheet-metal partition within the hollow body, bound at the edges therein by integral web-bars of the body that pass through marginal perforations of the partition, as specified.

5. A metal partition for cast-metal secondary-battery plates, consisting of a thin metallic sheet, numerously perforated and coated on each side with a soluble and inert, heat-resisting material, as specified.

6. The method for producing a secondary-battery plate, consisting in holding a sheet-metal partition which is coated with soluble,

inert and heat-resisting material between two parts of a mold leaving spaces, then introducing molten metal such as lead in the mold so as to occupy said spaces, then removing the soluble coatings from the partition, and finally forming electrically-active coatings on the exterior and interior sides of a series of the battery-plates, by electrolytic action while said plates are immersed in a suitable acid bath, as specified.

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Witnesses:
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