

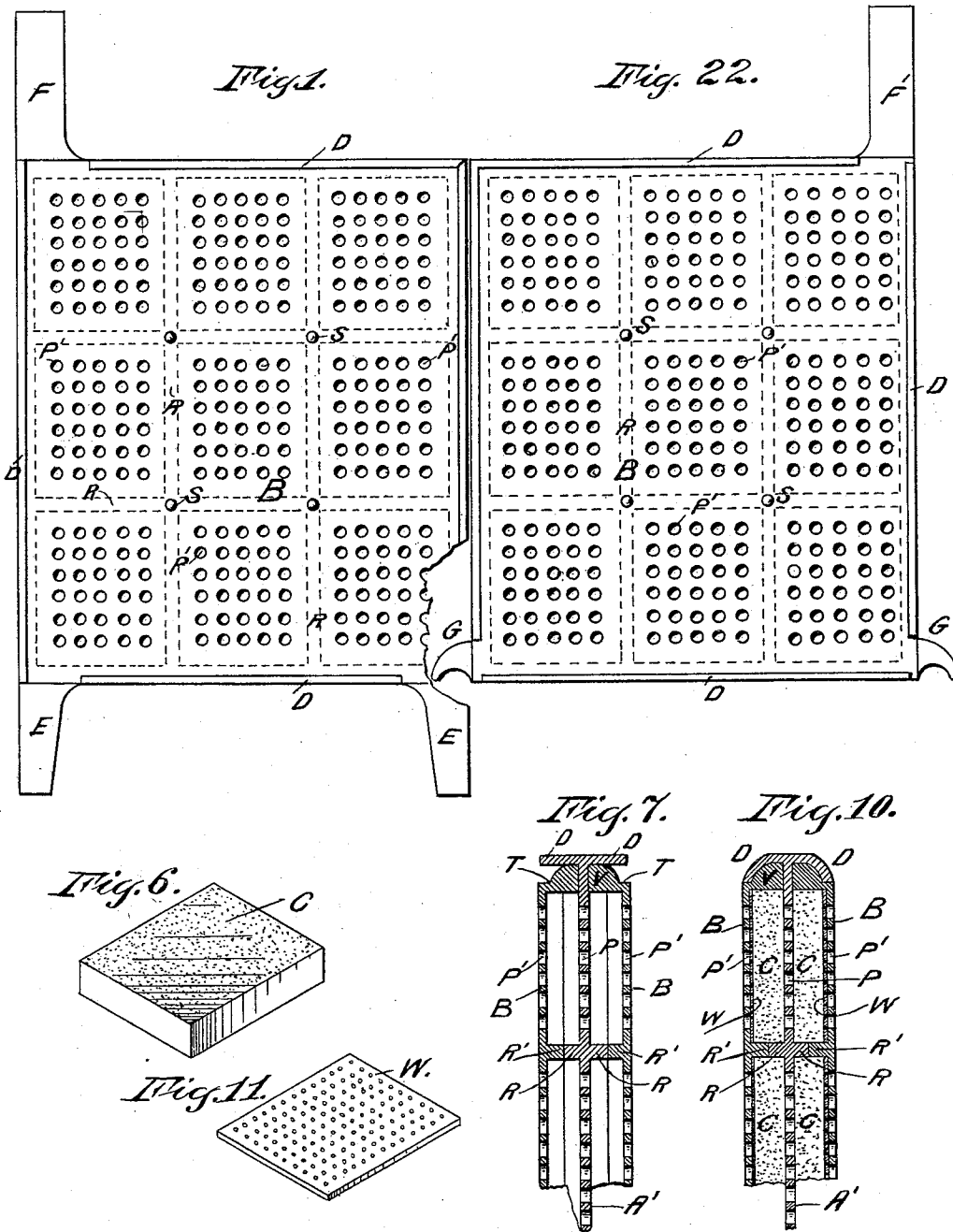
(No Model.)

3 Sheets—Sheet 1.

E. R. KNOWLES.
STORAGE BATTERY.

No. 482,979.

Patented Sept. 20, 1892.



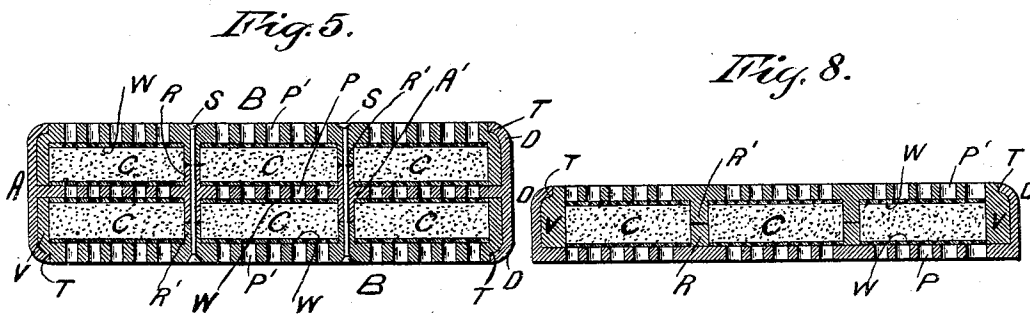
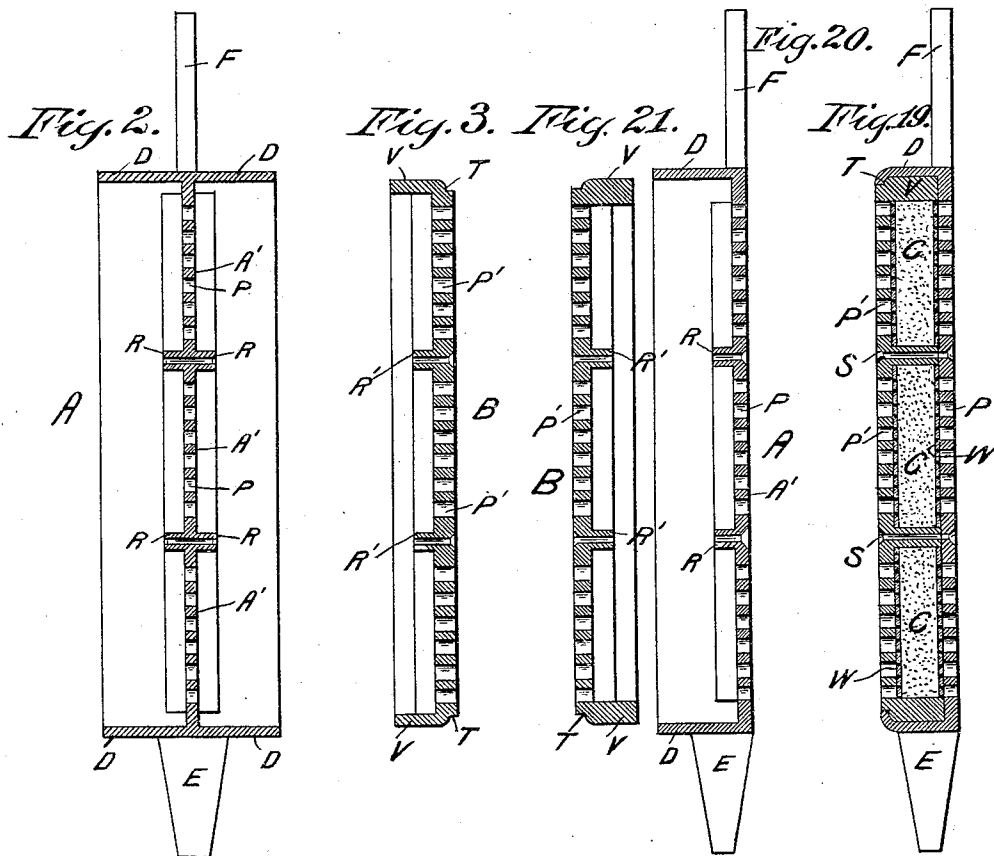
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Inventor:
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by
C. L. Buehler
att'y.

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(No Model.)

3 Sheets—Sheet 3.

E. R. KNOWLES.
STORAGE BATTERY.

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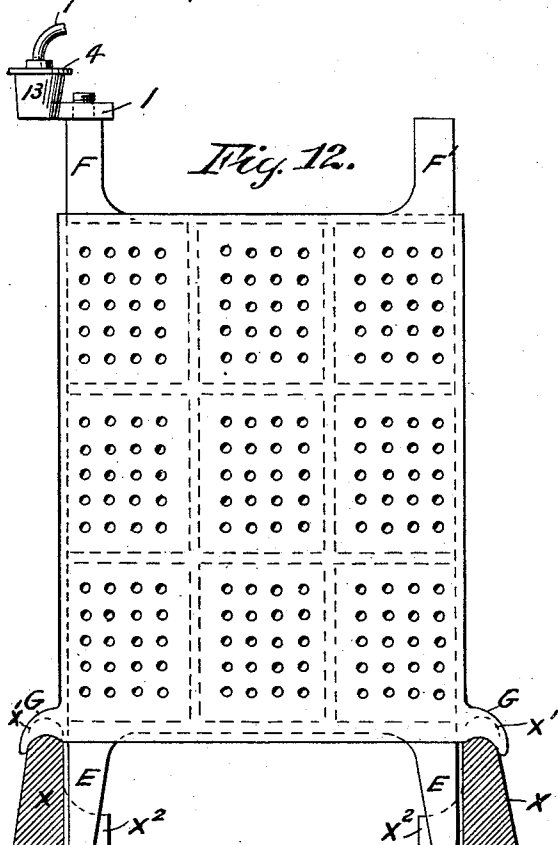


Fig. 13.

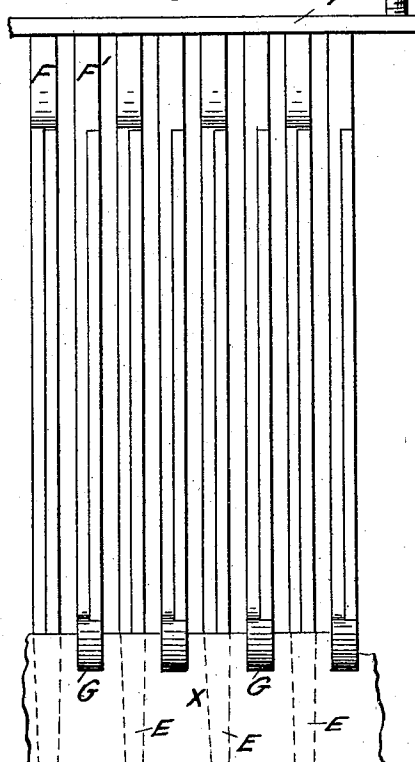
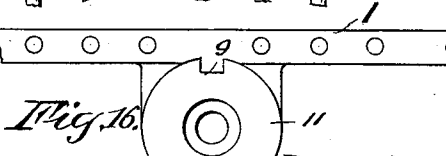
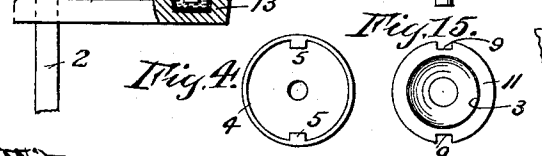
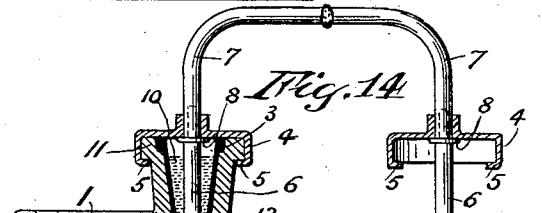
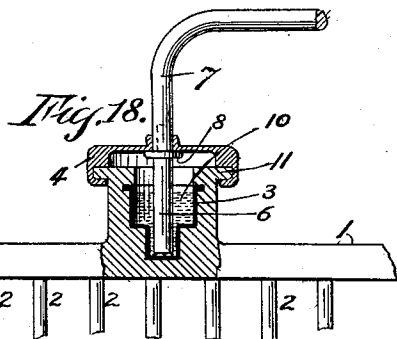
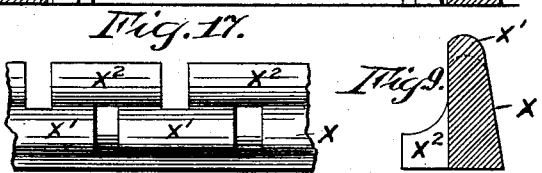


Fig. 17.



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UNITED STATES PATENT OFFICE.

EDWARD R. KNOWLES, OF BROOKLYN, NEW YORK.

STORAGE-BATTERY.

SPECIFICATION forming part of Letters Patent No. 482,979, dated September 20, 1892.

Application filed October 15, 1891. Serial No. 408 824. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. KNOWLES, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Storage-Batteries, of which the following is a specification.

My invention relates to improvements in electric accumulators or storage-batteries, and has for its object the making and arranging of the various parts of an electric accumulator in such a manner as to minimize the amount of labor necessary for making the same, to simplify their construction, and to so make the several parts that it will be impossible for the active material to become loosened or forced out of the containing-plates, either by mechanical shock or by a too heavy electrical discharge, and also to prevent curling or buckling of the plates by over-discharge or sulphating of the active material, and to so arrange the parts that it will be impossible for anything to lodge between the plates and so short-circuit the cell and destroy its usefulness. I attain these objects by the mechanism represented in the accompanying drawings, in which—

Figure 1 is a side view of a complete negative plate (double type.) Fig. 2 is a section of the central portion of the same. Fig. 3 is a section of the outside portions of the same. Fig. 4 is a bottom view of the cover for the connector. Fig. 5 is a section of a complete double plate. Fig. 6 is a view of one of the cakes of active material. Fig. 7 is a section of the edge of the plate, showing the parts before being fastened together. Fig. 8 is a section of a complete single plate. Fig. 9 is a sectional view of one of the separators. Fig. 10 is a section of the edge of the plate, showing the parts folded together. Fig. 11 is a view of the retaining-plate. Fig. 12 is an end view of the complete cell, showing the separators and supports for the plates. Fig. 13 is a side view of the same. Fig. 14 is a sectional view of my improved connector. Fig. 15 is a top view of the cap of the connector; Fig. 16, a view of the connecting-strip for holding the plates together; Fig. 17, a plan view of the separator and plate-support. Fig. 18 is a sectional view of another form of connector. Fig. 19 is a sectional view of single

plate. Fig. 20 is a sectional view of one part of single plate. Fig. 21 is a sectional view of other part of single plate. Fig. 22 is a side view of a complete positive plate.

My plate, as shown in Figs. 1, 2, 3, 5, 7, 8, 10, 19, 20, 21, and 22, is compound, being composed of a number of plates of metal, of which three are shown in Figs. 2, 3, 5, 7, and 10 and two in Figs. 8, 19, 20, and 21.

The central plate A', as shown in section in Fig. 2, consists of a thin central plate of metal A', which may or may not be perforated, as shown. This plate has ribs R R, as shown, dividing its surface up into cells, as shown. Extending around the edge of this central plate A' is the flange D D. This central plate A' also carries all of the connecting-lugs F and feet E E. The outer plates B, as shown in Fig. 3, consists of a thin perforated plate of metal, on whose inner surface are ribs R' R', dividing its surface into cells, as shown, which match with those on the surface of A'. The edges of plate B are returned all around, as shown at V V, with a small recess T at its outer edge. All of these parts A B B may be made of any suitable material, but preferably of an inoxidizable alloy of lead and other suitable metals. When these parts are placed together, they occupy the positions shown in Fig. 7, and when in this position they are riveted together by the rivets S S, and the edges D of A are folded down on B B and fit into the recess T, as shown in Fig. 10. This forms a hollow box, as shown, and all of the ribs R' R' come together and divide the inside of the plate into a number of similar cells or recesses, into which the absorptive material is placed before the parts A B B are put together. The active material C is preferably formed into blocks or plates, as shown in Fig. 6, although it may be placed in the cells or cavities by pasting it in or by compression. Placed in the recesses in the plates and next the perforations are the thin sheets W, of any suitable material, which is easily oxidized, preferably of lead, which are very finely perforated, as shown. In assembling the plate together the retaining sheets W are placed in the cavities or cells in the plates B B, then the blocks of absorptive material C are placed on top of them, and these parts are then brought against the central plates, and

the whole riveted together at S S and the edges folded at T T, the whole forming a compound plate, as shown in section in Figs. 5 and 10. The negative element, as shown in Fig. 1, is of the same general construction, as described, but is provided with projecting feet E E, on which it rests, and the positive element, as shown in Fig. 22, is of the same general construction, but has no supporting feet E E, and has brackets G G at its lower end turned down, as shown. It will be seen that by this arrangement of the several parts of the plate none of the active material C can possibly get out of the plate by any action which may be brought to bear upon it, either by mechanical shock or electrical or chemical action. At the same time the plates are sufficiently porous to allow access of the electrolyte in which they are subsequently immersed, and also to allow a maximum amount of active material with a minimum amount of inactive material. This plate is light and at the same time so rigid in its form and construction that it cannot curl or buckle from any deleterious action to which it may be subjected. The thin finely-perforated plates W W are made of a metal which is easily oxidized—such as lead—and are primarily inserted to retain the absorptive material in place until by electric action it has become firmly knit together, and, secondarily, to form a union between the absorptive material and the plate itself. After the plate has been acted upon by an electric current for a short time these thin plates become oxidized and changed into absorptive material and form a close union between the rest of the absorptive material and the support-plate itself.

The complete cell is shown assembled in Figs. 12 and 13. The supports and separators X X, also shown in Fig. 17, are made of any suitable insulating material, preferably of a soft elastic nature and of the form shown, so that the feet E E of the negative plates pass in between the inner projecting flanges X' X'', and the hooks G G of the positive plates rest upon the pieces X X and in the grooves between the projections X' X'. By this arrangement the plates are kept separated from each other and so supported that anything falling into the cell and between the plates will fall to the bottom and cannot form a connection or short circuit between the positive and negative plates. The lugs F F' are connected by the metal strips I I. (Shown in Figs. 14 and 16.) The means for connecting one cell with another is also shown in Figs. 4, 14, 15, 16, and 18. 1 is a cross-bar of any suitable metal or alloy, preferably one which is not easily oxidized, connecting a number of plates together by means of the lugs 2 2 2. On the cross-bar 1 is formed the projecting cup 13. This cup may be made integral with cross-bar 1, or it may be made separately and fastened to 1 in any suitable manner. The cup 1 is lined with a lining 3, which is of a metal not acted upon by mercury,

such as iron. 4 is a cover of the same metal or alloy of which the cross-bar 1 is composed. It has a downwardly-projecting rim 4 and a pair of inwardly-projecting ears 5 5. The top of cup 13 is provided with a rim 11, through which is cut two slots 9 9. 7 7 is a connecting-piece of any suitable metal, furnished at its two ends with terminals 6 6 of a metal other than that of which 7 is composed and which is not acted upon by mercury, such as iron. These terminals pass through holes in the covers 4 4, which are prevented from slipping off by the stops 8 8.

To connect one cell to another, the connector 7 7, with the terminals 6 6 and its covers 4 4, is first made. Some mercury 10 is then placed in the cup 13. The terminal 6 is then inserted into cup 13 and the cover 4 is placed over cup 13, its ears 5 5 passing through slots 9 9. The cover is then given a quarter-turn, carrying the lugs 5 5 around under the rim 11, thus locking the parts together and retaining terminal 6 in good electrical contact with 13 by means of mercury 10. By these means there is obtained a connector which can be quickly put together and taken apart, one which is certain to make and keep a perfect electrical contact, and yet one which is sufficiently flexible and yielding in character so that it will adapt itself to any change of position which may occur without there being any break in its continuity.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A support-plate for the absorptive material of a storage-battery, consisting of three parts, to wit: a central part, both of whose surfaces are divided by projections or ribs into a number of recesses or cavities, two outer parts, each of whose inner surfaces are divided by projections or ribs into a number of recesses or cavities, said recesses or cavities on the two outside parts being arranged to register with the recesses or cavities on the central part, so that when the three parts are put together the interior of the plate so formed will be substantially hollow and cellular in structure, all the parts being perforated and riveted together substantially as described.

2. A support-plate for the absorptive material of a storage-battery, consisting of three parts, to wit: a central part provided with a connecting-lug and downwardly-turned flanges and two outside parts, the downwardly-turned flanges holding the three parts together, substantially as described.

3. A support-plate for the absorptive material of a storage-battery, consisting of three parts, to wit: a central part, both of whose surfaces are divided by projections or ribs into a number of recesses or cavities and provided with a projecting rim or flange on both sides of and around its outer edge, two outside parts, each provided with a projecting rim or flange around its edge and upon its inner side, said rims or flanges upon the edges of the two out-

side parts being adapted to fit inside the rim or flange upon the edge of the central part, all the parts being perforated and riveted together substantially as described.

5 4. A support-plate for the absorptive material of a storage-battery, consisting of three parts, to wit: a central part provided with a connecting-lug and downwardly-turned brackets, both of whose surfaces are divided
10 by projections or ribs into a number of recesses or cavities and provided with a projecting rim or flange on both sides of and around its outer edge, two outside parts, each
15 of whose inner surfaces are divided by projections or ribs into a number of recesses or cavities and each provided with a projecting rim or flange around its edge and upon its inner side, said recesses or cavities on the two
20 outside parts being arranged to register with the recesses or cavities on the central part, so that when the three parts are put together the inside of the plate will be substantially hollow and cellular in structure, said rims or flanges
25 upon the edges of the two outside parts being adapted to fit inside the rim or flange upon the edge of the central part, all of the parts being perforated and riveted together substantially as described.

5 5. A support-plate for the absorptive material of a storage-battery, consisting of three parts, to wit: a central part provided with a connecting-lug and downwardly-projecting support-feet, both of whose surfaces are divided
30 by projections or ribs into a number of recesses or cavities and provided with a projecting rim or flange on both sides of and around its outer edge, two outside parts, each
35 of whose inner surfaces are divided by projections or ribs into a number of recesses or cavities and each provided with a projecting rim or flange around its edge and upon its inner side, said recesses or cavities on the
40 two outside parts being arranged to register with the recesses or cavities on the central part, so that when the three parts are put together the inside of the plate will be substantially hollow and cellular in structure, said
45 rims or flanges upon the edges of the two outside parts being adapted to fit inside the rims or flanges upon the edge of the central part, all the parts being perforated and riveted together substantially as described.

5 6. A support-plate for the absorptive material of a storage-battery, consisting of three
55 parts, to wit: a central part provided with a connecting-lug and downwardly-turned brackets, both of whose surfaces are divided by projections or ribs into a number of recesses or cavities and provided with a projecting
60 rim or flange on both sides of and around its outer edge, two outside parts, each of whose inner surfaces are divided into a number of recesses or cavities and each provided with a projecting rim or flange around its
65 edge and upon its inner side, said recesses or cavities on the two outside parts being arranged to register with the recesses or cavi-

ties on the central part, so that when the three parts are put together the inside of the plate will be substantially hollow and cellular
70 in structure, said rims or flanges upon the edges of the two outside parts being adapted to fit inside the rim or flange upon the edge of the central part, said rim or flange upon the central part being folded down over the
75 rims or flanges upon the two outside parts, and all the parts being perforated and riveted together substantially as described.

7. A support-plate for the absorptive material of a storage-battery, consisting of three
80 parts, to wit: a central part provided with a connecting-lug and downwardly-projecting support-feet, both of whose surfaces are divided by projections or ribs into a number of recesses or cavities and provided with a projection
85 or flange on both sides of and around its outer edge, two outside parts, each of whose inner surfaces are divided by projections or ribs into a number of recesses or cavities and each provided with a projecting rim or flange
90 around its edge and upon its inner side, said recesses or cavities on the two outside parts being arranged to register with the recesses or cavities on the central part, so that when the three parts are put together the inside of
95 the plate will be substantially hollow and cellular in structure, said rims or flanges upon the edges of the two outside parts being adapted to fit inside the rim or flange upon the edge of the central part, said rim or flange
100 upon the central part being folded down and over the rims or flanges upon the two outside parts, and all the parts being perforated and riveted together substantially as described.

8. An element for a storage-battery, consisting of a perforated central support-plate, two
105 perforated outside plates, two layers of absorptive material interposed between the outside plates and the central support-plate, and thin perforated sheets of metal interposed between the absorptive material and the outside
110 plates, substantially as described.

9. An element for a storage-battery, consisting of a perforated central support-plate, two
115 perforated outside plates, two layers of absorptive material interposed between the central support-plate and the outside plates, and perforated sheets of a metal which is easily oxidized interposed between the absorptive material and the outside plate, all being united
120 together substantially as described.

10. In an element for a storage-battery, a perforated retaining-sheet of metal interposed between the surfaces of the metallic perforated support-plates and the absorptive
125 material, substantially as described.

11. In an element for a storage-battery, a perforated retaining-sheet of a metal which is easily oxidized interposed between the surfaces of the metallic perforated support-plates
130 and the absorptive material, substantially as described.

12. In a storage-battery, a combined separating and supporting piece for the electrodes,

provided with cavities to separate plates of one electrode and shoulders to support plates of the other electrode, substantially as described.

5 13. In a storage-battery, a combined separating and supporting-piece composed of a soft flexible non-conducting material, adapted to rest upon the bottom of the cell, said
10 supporting-piece being provided with separating-cavities and supporting-shoulders for the respective electrodes of the cell, substantially as described.

14. In a storage-battery, the combined supporting and separating piece X, having the
15 grooves X' in its upper surface and the projecting flanges X'' upon its inner surface, as and for the purpose set forth.

15. In a storage-battery, the combined separating and supporting piece X, having the
20 grooves X' upon its upper surface and the flanges X'' upon its inner surface, composed of a soft flexible non-conducting material, substantially as described.

16. In a storage-battery, the combination of
25 a series of positive elements provided with side extensions, a series of negative elements provided with supporting-feet, and a separating and supporting piece interposed between the extensions on the positive elements and
30 the feet upon the negative elements, substantially as described.

17. In a storage-battery, the combination of a series of positive elements provided with side extensions, a series of negative elements
35 provided with supporting-feet and a separating and supporting piece composed of soft flexible non-conducting material, all being so united and arranged that the positive elements are supported by their side extensions
40 upon and separated by the supporting-feet separated by the separating-piece, substantially as described.

18. In an electrical connector, the combination, with the cross-bar 1, of the cups 13, and
45 a removable metallic cover 4, and means for locking, unlocking, and removing the same, substantially as described.

19. In an electrical connector, the combination, with the cross-bar 1, of the cup 13, provided with the flange 11 and slots 9 9, and a
50 cover 4, provided with the ears 5 5, substantially as described.

20. In an electrical connector, the combination, with the cross-bar 1, of the cup 13, provided with the flange 11 and slots 9 9, a lining 3, and a cover 4, provided with the ears
55 5 5, substantially as described.

21. In an electrical connector, the combination, with the cup 13, provided with a rim 11 and slots 9 9, of a cover 4, provided with ears
60 5 5, and a rod 7, passing through said cover, said cover being held in place upon said rod by a stop 8, substantially as described.

22. In an electrical connector, the combination, with cups 13, provided with a rim 11 and slots 9 9, of a lining 3, a cover 4, provided
65 with ears 5 5, and a metallic rod 7, passing through said cover, the end 6 of said rod being composed of a metal not attacked by mercury, said cover being held in place upon said
70 rod by a stop 8, substantially as described.

23. In an electrical connector, the combination of a metallic conductor 7, provided with terminals 6 6 of a metal other than that of which 7 is composed, and cup 13, with covers
75 4 4 and stops 8 8, substantially as described.

24. In an electrical connector, the combination of a metallic conductor 7, provided with terminals 6 6 of a metal not attacked by mercury, and cups 13, with covers 4 4 and stops
80 8 8, substantially as described.

25. An element for a storage-battery, consisting of a metallic plate provided with a cavity or cavities for an active material, the metallic walls of said cavity or cavities being
85 lined with an easily-oxidizable metal, as and for the purpose set forth.

Signed at New York, in the county of New York and State of New York, this 10th day of May, A. D. 1891.

EDWARD R. KNOWLES.

Witnesses:

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J. B. SABINE.