No. 629,372. Patented July 25, 1899.

C. W. KENNEDY.

STORAGE BATTERY.

(Application filed Aug. 29, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

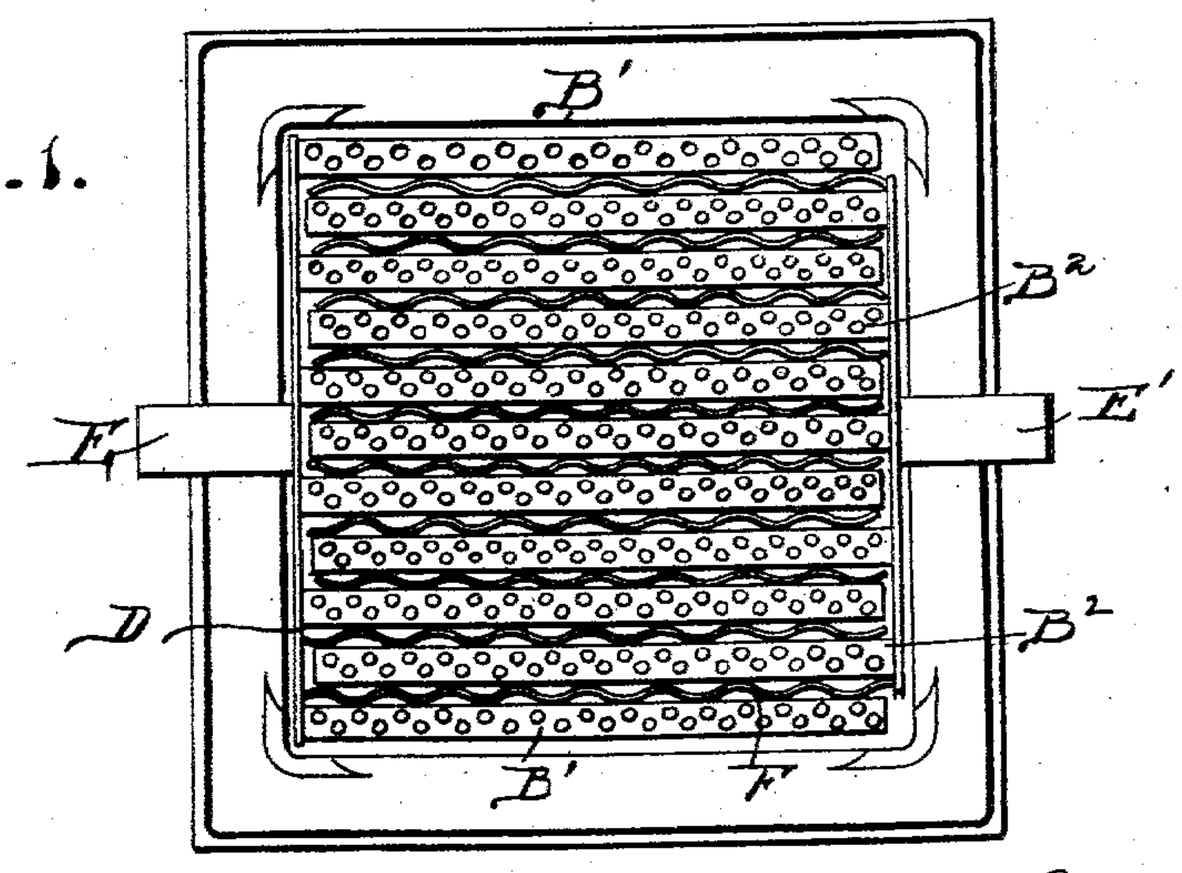


Fig. 2.

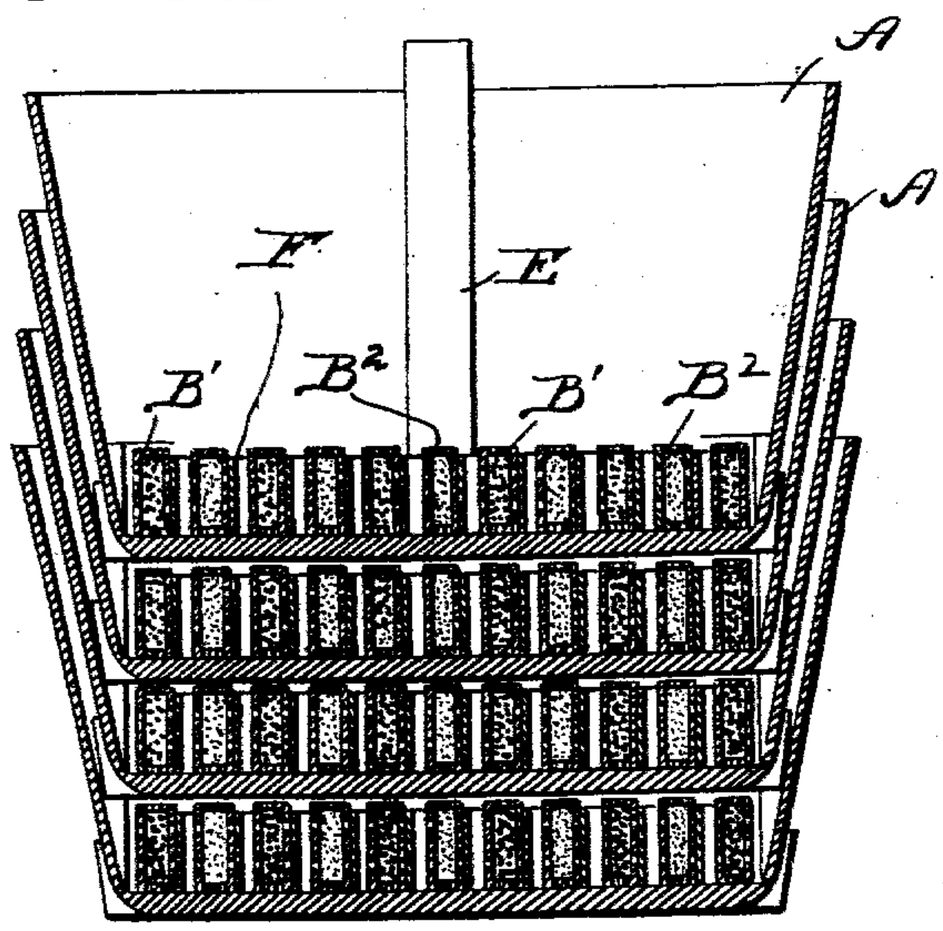
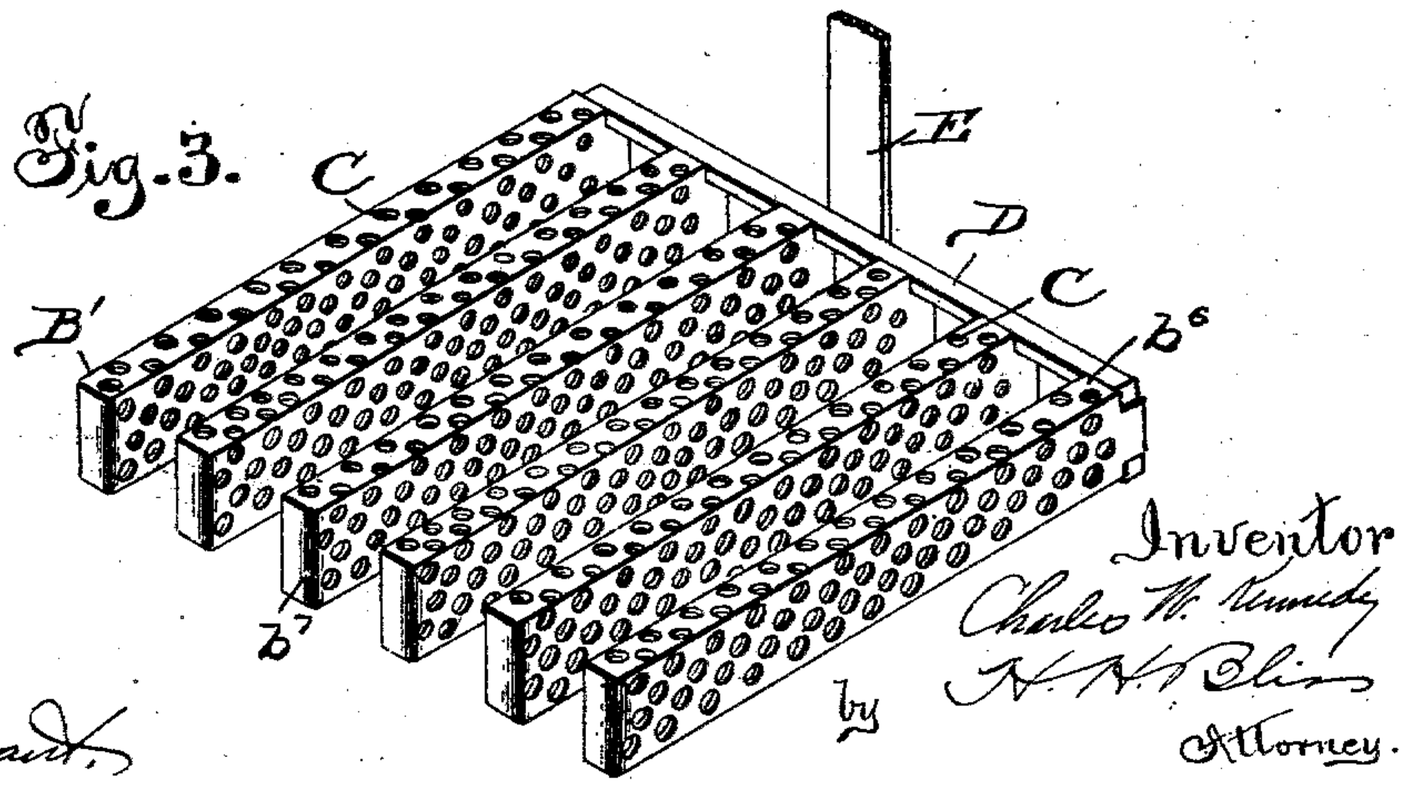


Fig. 3.



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No. 629,372. Patented July 25, 1899.

C. W. KENNEDY.

STORAGE BATTERY.

(Application filed Aug. 29, 1898.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 4

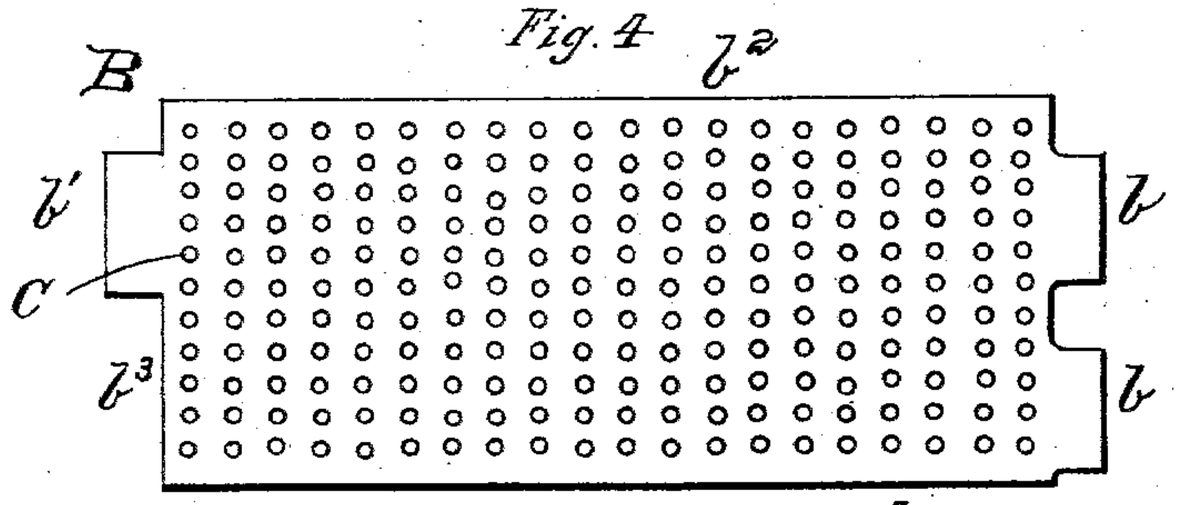


Fig. 5

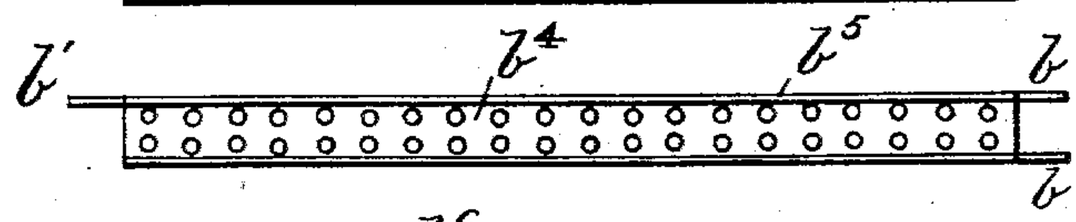


Fig. 6

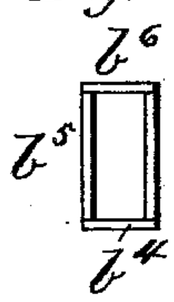


Fig. 7.

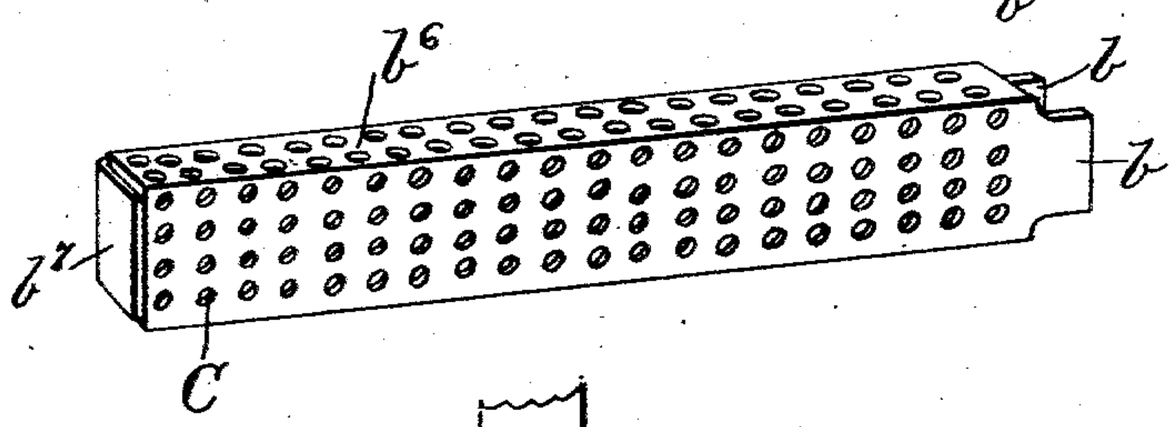


Fig. 8.

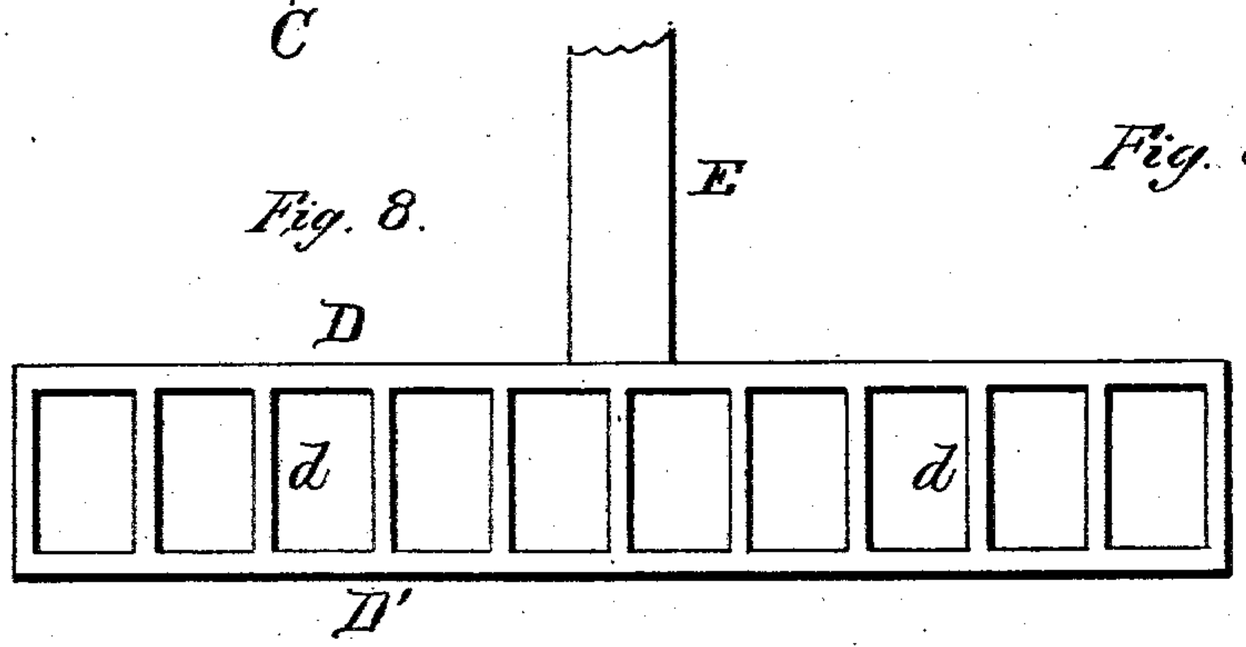
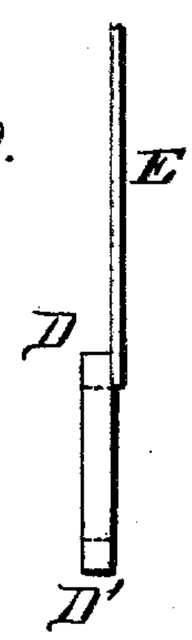


Fig. 9.



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UNITED STATES PATENT OFFICE.

CHARLES W. KENNEDY, OF RUTLEDGE, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE ELECTRIC POWER DEVELOPMENT COMPANY.

STORAGE BATTERY.

SPECIFICATION forming part of Letters Patent No. 629,372, dated July 25, 1899.

Application filed August 29, 1898. Serial No. 689,794. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. KENNEDY, a citizen of the United States, residing at Rutledge, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Storage Batteries, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a plan view of a storage or secondary battery cell having parts embodying my improvements. Fig. 2 is a vertical section of a battery composed of a series of several cells superimposed. Fig. 3 is a perspective of one of the electrodes detached. Fig. 4 is a face view of one of the sheet-metal blanks from which are made the arms of the electrodes. Fig. 5 shows a top view of the blank after it has been partially formed up. Fig. 6 is an end view of the blank at the next step in the shaping. Fig. 7 shows the electrode-arm finished. Figs. 8 and 9 show the support for modified forms of the electrode-arms.

In the drawings I have shown my improvements as applied to a storage or secondary battery cell of a form now well known; but as this present invention relates rather to the manner of constructing and arranging the parts of the electrodes it will be understood that the cells or cups can be of any preferred or well-known form. Those illustrated are cups of hard rubber, as at A, each having their side walls flared upwardly and outwardly and their bottoms arranged to rest directly one upon another. In these cells are placed electrodes having my present features of improvement. A finished electrode is shown in perspective in Fig. 3. Several of the steps followed in the manufacture thereof are illustrated in Figs. 4 to 9.

I cut blanks B, Fig. 5, from sheet-lead, each blank having projections at b b at one end and by preference having a projection b' at the other end and each also having an upper edge part b^2. Each is bent so as to form a receptacle or inclose a chamber, the part b^3 being turned so as to form a bottom wall b^4 and a side wall b^5. The part b^2 is turned down to form a top wall b^6. One of the ends is then closed, as by bending over the projection b', forming an end wall b^7. (See Fig. 7.) The blank B before or after it is cut from the sheet is provided with a large number of small perforations C for a purpose to be described, and again the sheet-lead, either prior to bending, as is described, or subsequent thereto, is placed in electrolytic material and subjected to the action of electric current for the purpose of charging it or making it active. Both the inner and the outer faces, in fact, all of the exposed parts of the receptacle-walls, are thus made efficient for battery purposes. The receptacle thus provided and still having one end open is then filled with the active material or material to be made active—as, for instance, the oxid of lead, or whatever form of lead or other material it is desired to use—this being preferably introduced in a granular condition. The receptacle is charged so as to be as full as is desired, care being taken to allow for expansion. After it has been so charged with the active material it is secured to the frame or carrier of the electrode and forms one of the arms thereof. The frame or carrier of the electrode which I prefer is shown detached in Fig. 8, it consisting of horizontal parts D D, with vertical parts d connecting them and spaced a suitable distance apart. The arms of the electrode, each of which as a whole will be now designated by B′, is secured to one of the vertical bars d. This can be readily accomplished by means of the above-described projections b, which after the blank B has been bent, as described, come opposite to each other, as in Fig. 7, and are so disposed as to readily fit against one of the said bars d, and after being placed properly relatively to the bar they are secured by solder or by the application of heat sufficient to soften the lead and cause the bars d and b to readily adhere. After the arms are all in place and fastened the electrode is of the appearance presented in Fig. 3. The arms B′ all project parallel to each other inwardly from the support or frame D d. A conductor E is secured to the carrier or frame D d, and by means of it current can be taken to or from the cell containing the electrode.

The electrode shown in Fig. 3 is the positive one of the couple illustrated in Figs. 1 and 2.

The negative electrode is constructed in a manner substantially similar to that above described for making the positive, though by preference it has one less arm, and for convenience in designation I have indicated its arms in Figs. 1 and 2 by the letter B^2 and its conductor by E'. Its arms when the electrodes are in place in the cell alternate with the arms B' of the positive electrode, they respectively lying midway between two of the positive arms, and in order to prevent the contacting of the negative arms with the positive and the consequent short-circuiting of the cell I employ spacing and holding devices F, preferably made from corrugated and perforated sheet-rubber, as shown in Fig. 1. These electrodes are arranged so that those of each couple lie between the bottom of one cell and the bottom of the one below. The masses of the active material are relatively shallow, as are also the several bodies of the electrolyte liquid. The specific gravity of the latter therefore is substantially the same throughout. The electrolyte has ready access to and circulates through the mass of active material in the arms B B^2. The perforated walls of these arms not only serve as a retaining-envelop for the active material, but also constitute a large factor in the electric efficiency of the cell, inasmuch as, unlike the perforated lead envelops heretofore employed, they are preliminarily rendered highly active by suitable treatment prior to being charged with the granular or other supplemental active material.

The cells may be electrically connected together in any desired way, either in series or in parallel.

What I claim is—

1. In a storage battery having a series of several superimposed cells arranged to hold the entire electrolyte of the battery in a series of relatively shallow bodies one above another, the herein-described pair of electrodes each consisting of a series of parallel perforated sheet-lead tubes, the tubes of one electrode interlapping with the tubes of the other, all the tubes of both electrodes being in the same horizontal plane, and charged with granular active material, two horizontal connecting-bars, one for the outer ends of each series of tubes, the interlapping ends of the tubes being disconnected from each other, and both the electrodes of each pair being adapted to be submerged in one of the said shallow electrolytic masses between the bottom of one cell and the bottom of the one below, substantially as set forth.

2. In an electrode for a storage battery, the combination of the horizontally-arranged frame-bar D having the vertical bars *d*, the perforated sheet-lead tube having the lips or flanges *b b* adapted to be fastened to the said bars *d* and having the longitudinal side, top and bottom walls b^3, b^4, b^6, and the end opposite to the bar D adapted to receive a charge of granular active material, and the closing end wall b^7, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES W. KENNEDY.

Witnesses:
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H. H. BLISS.