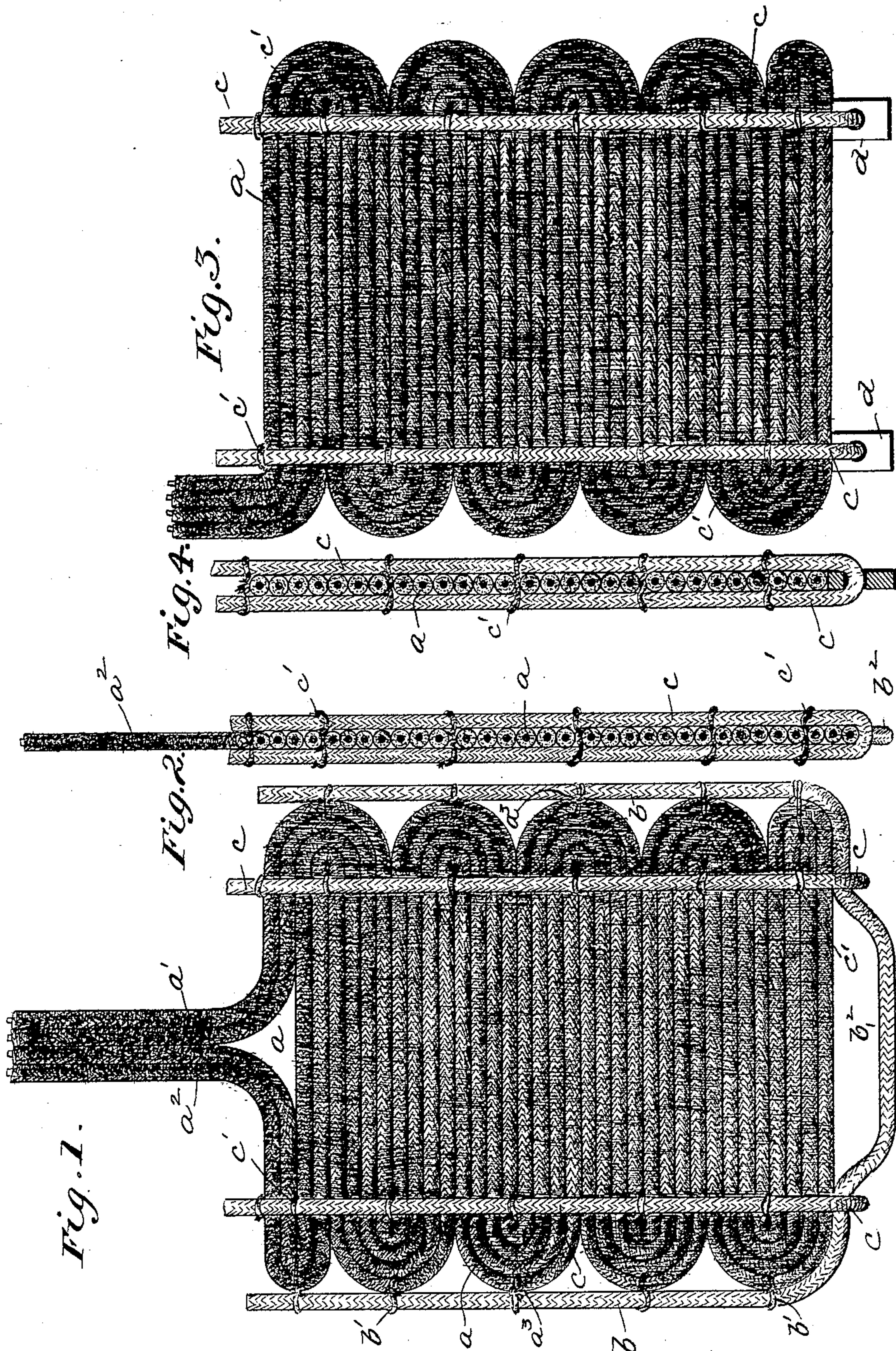


(No Model.)

J. B. ENTZ & W. A. PHILLIPS.  
SECONDARY BATTERY ELECTRODE.

No. 461,823.

Patented Oct. 27, 1891.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

JUSTUS B. ENTZ, OF NEW YORK, AND WILLIAM A. PHILLIPS, OF BROOKLYN,  
ASSIGNORS TO THE WADDELL-ENTZ ELECTRIC COMPANY, OF NEW YORK,  
N. Y.,

## SECONDARY-BATTERY ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 461,823, dated October 27, 1891.

Application filed October 31, 1890. Serial No. 369,918. (No model.)

*To all whom it may concern:*

Be it known that we, JUSTUS B. ENTZ, a citizen of the United States, residing in New York, county of New York, and WILLIAM A. PHILLIPS, a subject of the Queen of Great Britain, residing in Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Secondary Batteries, of which the following is a specification.

Our invention relates to improvements in the mechanical construction of secondary-battery electrodes, and has particular reference to the form of battery-electrode described in Patent No. 421,916, issued February 26, 1890, to Justus B. Entz and William A. Phillips. The electrode therein described consists of a composite wire made up of a tubular-wire net-work in which is embedded the active material. This invention consists in the peculiar manner of forming the wire into a plate and securing or binding it in that form.

In the accompanying drawings, Figure 1 represents a side view of our electrode; Fig. 2, a vertical section of the same; Fig. 3, a side view of a modified form of electrode, and Fig. 4 a vertical section of same.

$a$  represents the wire of which the electrode is made up. In its preferred form this wire consists of a solid-copper core, then a layer of the oxide of copper, next a copper-wire net-work in the meshes of which the copper oxide is embedded, and, finally, an insulating-sheathing of braided cotton. This wire is taken in two lengths and made into the form of a mat of one layer of wires. The wires are laid horizontally and bent around at the sides to pass back and forth as many times as necessary to form the desired size of plate. In order to bring both ends of the strands up together and have no exposed portions in the body of the plate, the two wires are bent over upon themselves at a point about in the middle, thus making four strands side by side. These four are then carried back and forth from bottom to top. At the top the wires are separated into pairs, one pair  $a'$  passing half-way across the top and then bending upward at right angles to form one-half of the connecting-lug and the

other pair  $a^2$  continuing across the plate, turning at the farther edge, and running back and up beside the pair  $a'$  to complete the connecting-lug. This forms a symmetrical rectangular plate. The wire once in this shape is secured, first, by passing a U-shaped insulated wire  $b$  around the bottom and two side edges of the plate and binding it with twine  $b'$  or other suitable material at the points where it touches the curved projections  $a^3$  of the plate, and, second, by supporting the faces of the plate by two U-shaped stiff insulated wires  $c$ , which pass up the sides of the plate. The legs of these pieces are bound together by bits of twine  $c'$  passing through the plate between the wires at different points, thus clamping the plate and holding its parts together effectually. The binding-wire  $b$ , after turning the lower corners and passing through the wires  $c$ , is offset, as shown at  $b^2$ , to form a place of rest for the plate and at the same time elevate it from the bottom of the cell. The binding-pieces  $b$  and  $c$  are made of any suitable wire, having a coating of braided cotton impregnated with whiting and silicate of soda. Wire thus treated, when put into a solution containing potash, becomes very stiff and durable, the whiting and silicate being transformed into vitreous matter resembling stone. This enhances greatly the durability and insulating properties also.

In the form shown in Figs. 3 and 4 the binding-wire  $b$  is eliminated, and the loops  $c$  carry blocks  $d$ , of insulating material, which elevate the plate. The form first described, however, is preferred. In the drawings the binding-wire is shaded lighter than the electrode proper.

Having thus described our invention, we claim—

1. A battery-electrode made up of wire bent upon itself to form a mat or plate, in combination with wire loops or straps surrounding the same.

2. A battery-electrode made up of wire bent upon itself to form a mat or plate, in combination with wire loops or straps surrounding the same and secured thereto by means of binding devices which pass through the mat.



3. The combination, with a battery-plate, of an insulated wire extending around the side edges and the bottom for the purpose of insulating and supporting the plate.
- 5 4. The combination, with a battery-plate, of a wire extending around the side edges and the bottom, the bottom portion being offset to elevate the plate, substantially as described.
- 10 5. The combination, with a battery-plate, of a wire extending around the side edges and the bottom thereof, and other wires embracing the sides and bottom, for the purpose described.
- 15 6. A supporting and insulating device for battery-plates, consisting of a binding wire

or strap of flexible material covered with textile material impregnated with a suitable insulating material.

7. A supporting and insulating device for battery-plates, consisting of a binding wire or strap of flexible material covered with textile material impregnated with whiting and silicate of soda.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

JUSTUS B. ENTZ.

WILLIAM A. PHILLIPS.

Witnesses:

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