J. B. HERRESHOFF, Jr.

ELECTROLYTIC APPARATUS.

APPLICATION FILED DEC. 4, 1915.

1,262,045. Patented Apr. 9, 1918.

Fig. 1.

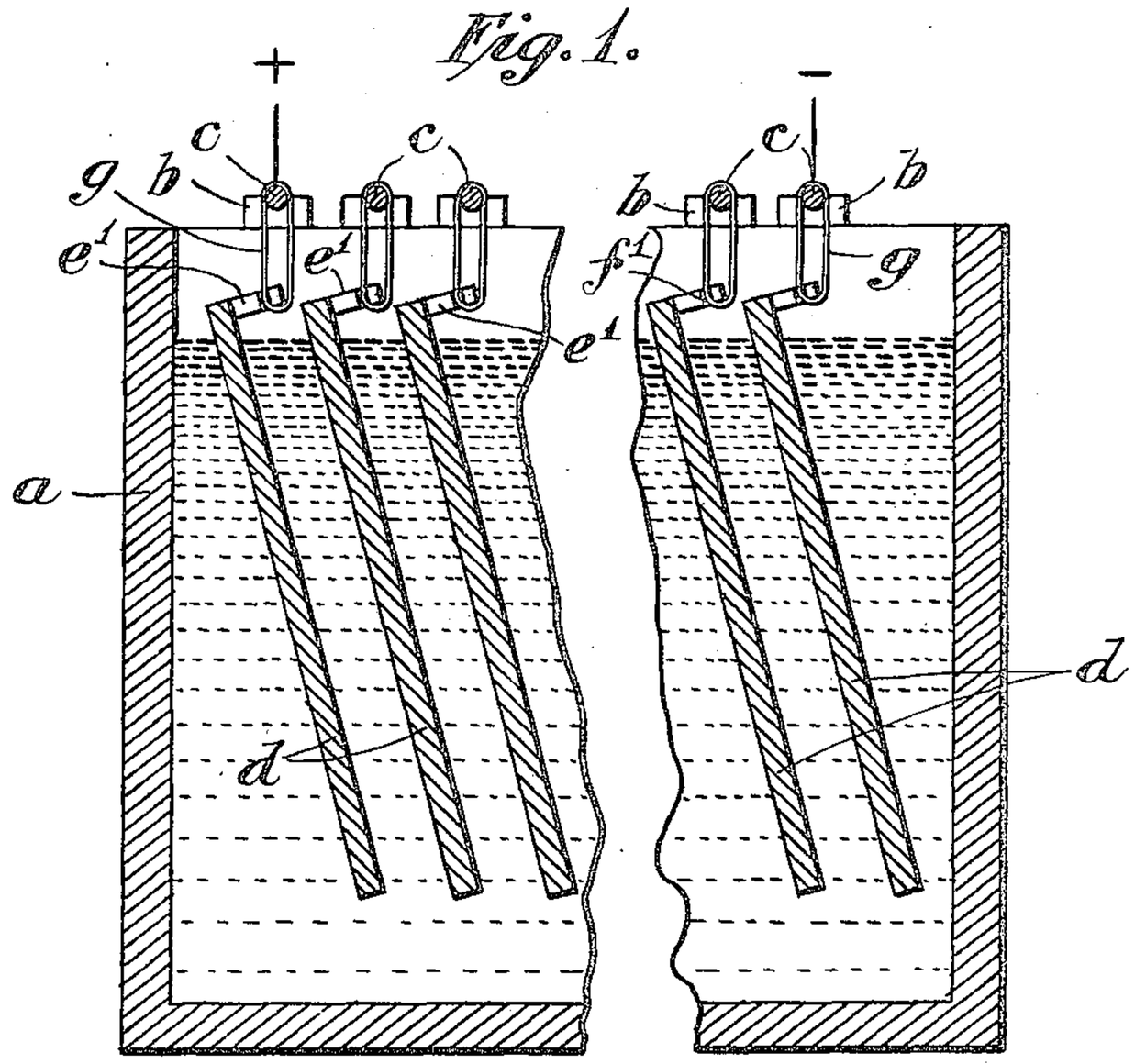


Fig. 2.

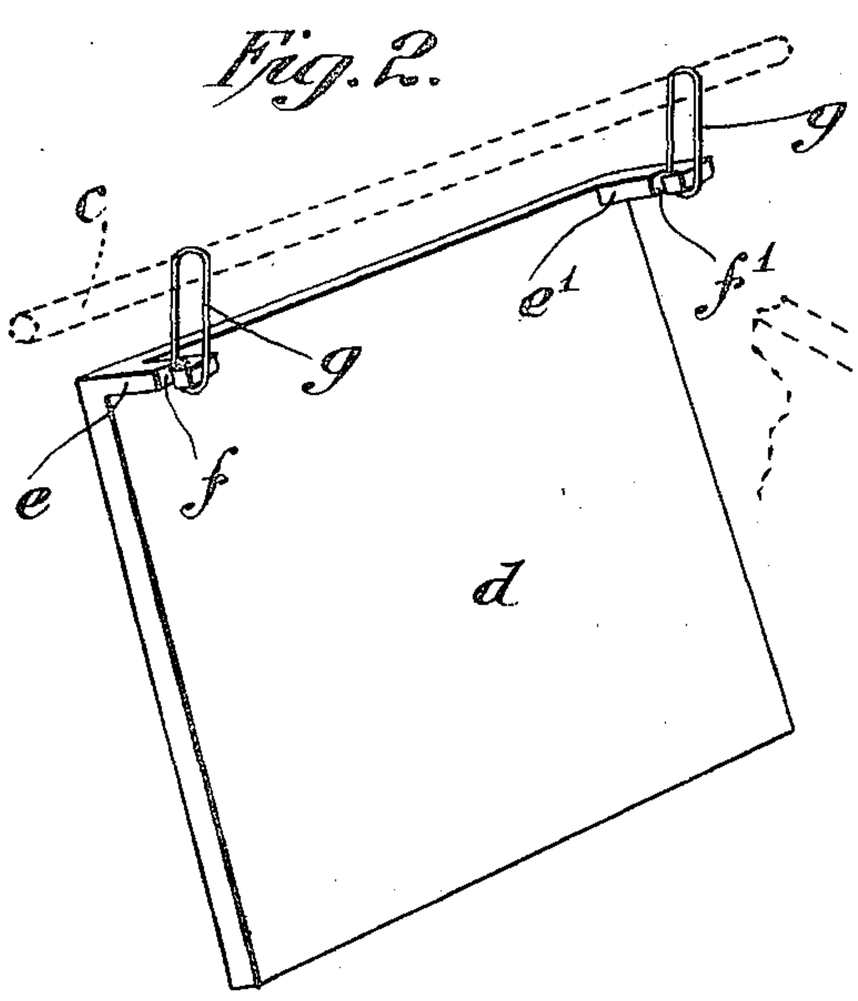
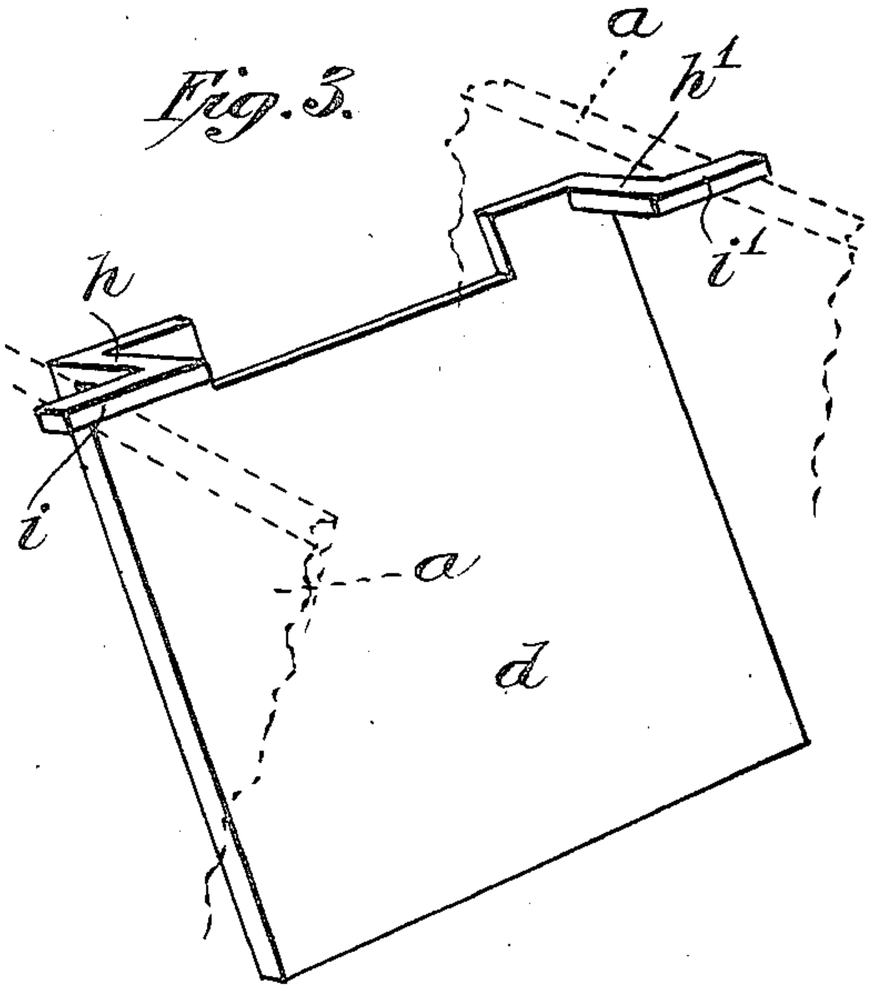


Fig. 3.



Attest:

E. Whitaker

Inventor:

James B. Herreshoff, Jr.

by Arthur L. Reed his Atty

UNITED STATES PATENT OFFICE.

JAMES B. HERRESHOFF, JR., OF RICHMOND HILL, NEW YORK.

ELECTROLYTIC APPARATUS.

1,262,045. Specification of Letters Patent. Patented Apr. 9, 1918.

Application filed December 4, 1915. Serial No. 65,002.

To all whom it may concern:

Be it known that I, JAMES B. HERRESHOFF, Jr., a citizen of the United States, residing at Richmond Hill, in the county of Queens and State of New York, have invented certain new and useful Improvements in Electrolytic Apparatus, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates to electrolytic apparatus and more particularly to an apparatus of this character for use in refining copper.

In the refining of copper by electrolysis, two general types of apparatus are used, one employing uni-polar electrodes in separate cells, and another employing a plurality of bi-polar electrodes in a single cell. My invention relates to improvements in the latter type of apparatus.

In apparatus of this character, the foreign substances in the metal of the anode, when released by the decomposition of the anode surface of the electrode, fall toward the bottom of the cell in the form of a slime, and heretofore more or less trouble has resulted from the fact that the circulation or drift of the electrolyte between the anode and the cathode tended to carry these substances toward and deposit them upon the cathode with a resultant introduction of impurities in the electrolytic copper produced by the apparatus. To obviate this condition and preserve the desired high percentage of purity in the product, the various electrodes have been held by means of inclined supports or by means of stay pieces positioned between the tank and one end electrode and between adjacent electrodes, the inclination being from the top of each anode side toward the bottom of the cathode side of the adjacent electrode. Great difficulty has been experienced, however, in securing the desired efficiency in apparatus so constructed, because of the tendency of short-circuiting throughout the apparatus when inclined supports or stay pieces are used, since the supports or stay pieces present obstructions which result in the accumulation of slime adjacent the anode surface with a resultant reduction in the effective area of the anode and a corresponding irregularity in the deposition of copper on the cathode.

By my present invention, I am enabled to provide an electrolytic apparatus of the character herein referred to, wherein the several bi-polar electrodes are so suspended or supported as to assume and maintain an inclined position which will prevent the deposition on the cathode side of foreign substances released from the anode side, and allow a substantially clear unobstructed passage through which said impurities may fall and accumulate, in the form of slime, at the bottom of the cell. In the apparatus embodying my invention, the entire surface of each electrode is subjected to the electrolyte, as in the ordinary cell of this character, no obstruction or supports about which impurities may collect being present in the structure, and the electrodes being so supported as to minimize likelihood of short-circuiting of the apparatus.

The invention consists primarily in an electrolytic apparatus embodying therein a tank or cell adapted to receive electrolyte, a plurality of bi-polar electrodes each of which, at the top thereof, is provided with spaced suspension means, offset with relation to the average plane of the electrode, and supporting means for said suspension means respectively, whereby when said electrodes are assembled in said tank or cell they will hang in inclined positions with the surfaces of succeeding electrodes substantially parallel; and in such other novel features of construction and combination of parts as are hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

Referring to the drawings:—

Figure 1 is a longitudinal section of an electrolytic apparatus embodying my invention;

Fig. 2 is a perspective view of the preferred form of bi-polar electrode; and

Fig. 3 is a perspective view of a modified form thereof.

In the embodiment of my invention shown in the accompanying drawings, *a* indicates the tank or cell for the electrolyte, which in apparatus of this character is ordinarily made of wood. Upon each side of said tank are a series of stirrups *b* supporting cross

rods *c*, ordinarily of iron. The tank itself forms an insulation for said rods. Suspended from the rods *c* are a plurality of bipolar electrodes *d* composed of the copper to be refined, said electrodes being of sufficient bulk to insure the desired economy and duration in the run of the apparatus.

The several electrodes are so formed that the surfaces of adjacent electrodes will be substantially parallel in order to insure substantially the same resistance throughout the entire surface of each electrode, and succeeding electrodes are spaced substantially the same distance apart in order to insure a substantially uniform resistance between the anode side and cathode side of succeeding electrodes. To prevent the deposition on the cathode sides of impurities from the anode sides by the circulation or drift of the electrolyte intermediate succeeding anodes and their cathodes, I so construct each electrode that it will be suspended in the electrolyte in the tank *a* at such an angle that all such impurities, released from an anode, will fall between the plates to the bottom of the tank and accumulate therein in the form of slime. The inclination of the electrode brings the vertical plane of the bottom of the cathode sufficiently remote from the vertical plane of the top of the anode, to avoid any likelihood of the impurities being carried a sufficient distance by the electrolyte to lodge upon the cathode, and the downward facing of the cathode sides makes it unlikely that any impurities which may come in contact therewith will stick thereto. At the same time the construction of each electrode is such that it hangs entirely clear of the tank, and has no obstructions thereon which would tend to accumulate upon the anode side the impurities freed as a result of the decomposition of the anode surface.

In the preferred form of my invention, I secure the desired result, by providing the upper or top edge of the electrode with oppositely disposed or spaced lugs or extensions *e*—*e'* projecting from the anode side thereof, the length of said lugs being determined by the length of the electrode and the desired pitch of the electrode while in the bath. Each of these lugs or extensions has an opening *f*—*f'* therethrough adapted to receive a link *g* of metal or any other desired material passing over and engaging one of the bars *c*. The lugs or extensions *e*—*e'* being offset with relation to the average plane of the electrode, it is apparent that the electrode will hang in an inclined position with its center of gravity in a vertical plane passing through the line of suspension, or the rod *d*, and that the electrode will thus take and maintain a suitably inclined position without supports or stays of any kind within the bath. This inclination will have the effect of increasing the horizontal distance between the upper portion of each anode surface and the lower portion of the opposed cathode surface, so that the slow circulation or drift of the electrolyte, will not ordinarily be sufficiently great to carry impurities from the anode surfaces to the cathode surfaces during the interval required for the released particles to fall from the point of separating from the anode to a point below the lower edge of the adjacent electrode. Furthermore, the downward inclination of the cathode surface will minimize a tendency of such impurities to adhere to the surface of the cathode in the event that they are carried by the electrolyte into contact therewith because of the clear vertical fall from every portion of the face of the cathode.

In the modification shown in Fig. 3 the construction and operative effect is substantially identical with that heretofore described except as to the suspension means. This form of the invention is designed to obviate the use of the bars *c* and links *g* and to permit each electrode to be suspended directly from the sides of the tank *a*. In this form of the invention, I provide, in lieu of the lugs or extensions *e*—*e'* with their offset points of suspension *f*—*f'* for the links *g*, angular extensions *h*—*h'*, one arm of each of which projects from the anode side of the plate and the other arm of which is extended laterally outward beyond the side edge of the plate and provided with a pintle or edge bearing *i*—*i'* to rest on the top of the side of the tank, whereby the plate will be pivotally supported and will assume the desired inclined position in the bath.

The form of the invention shown in Figs. 1 and 2 of the drawings is especially adapted for use where two or more electrodes are to be suspended from a single rod *c*, while the form of the invention shown in Fig. 3 is especially adapted for use where a single series of electrodes is used in the tank. It is apparent, however, that if desired, the form shown in Figs. 1 and 2 may be used where only a single series of electrodes is used. It will be observed that with the structure herein shown and described, the relative positions of the electrodes will be maintained substantially the same during the transfer of metal from plate to plate, since the plates will all automatically adjust themselves as their centers of gravitv change by reason of the decomposition of the anode face of each electrode and the deposition of the copper upon the cathode face thereof.

A substantially parallel relation of the surfaces of all of the electrodes is secured by having these electrodes all of the same shape and dimensions. The term "average plane of the electrodes" is used herein because the anode and cathode surfaces of the electrode need not be plane surfaces.

It is desired to emphasize the fact that in an electrode made in accordance with my invention, the points of suspension of the electrode being offset with relation to the average plane of the anode surface in a direction toward the cathode surface of the succeeding electrode, gives the desired angle of inclination to the electrode and permits the electrode to hang perfectly clear of all obstructions in the bath, thus avoiding loss of efficiency through the obstruction of the anode surface or of the cathode surface by reason of the accumulation or deposition of slime thereon. This condition preserves substantial equality in the resistance at all points of the anode surface and avoids the presence of impurities in the copper deposited upon the cathode surface.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawings, it being apparent that the essential characteristics of the invention may be preserved even though changes in the design of the electrode may be made.

Having described the invention what I claim as new and desire to have protected by Letters Patent is:—

1. An electrolytic apparatus embodying therein a tank or cell adapted to receive electrolyte, a plurality of bi-polar electrodes each of which at the top thereof is provided with suspension means offset with relation to the average plane of the electrode, and supporting means for said suspension means, whereby when the electrodes are assembled in the tank or cell they will be sustained in inclined positions and the surfaces of succeeding electrodes will be substantially parallel.

2. An electrolytic apparatus embodying therein a tank or cell adapted to receive electrolyte, a plurality of bi-polar electrodes each of which at the top thereof is provided with spaced lugs or extensions projecting from the average plane of the anode side of the electrode, and means operative with relation to said lugs adjacent the ends thereof, whereby when the electrodes are assembled in the tank or cell they are freely suspended and take inclined positions with the surfaces of adjacent electrodes substantially parallel.

3. An electrolytic apparatus embodying therein a tank or cell adapted to receive electrolyte, a plurality of bi-polar electrodes each of which at the top thereof is provided with spaced lugs or extensions projecting from the average plane of the electrode, flexible links operatively connected adjacent the ends of said lugs, and a plurality of cross bars supported from the sides of said tank or cell and adapted to be engaged by said links, whereby when the electrodes are assembled in the tank or cell they are freely suspended and take inclined positions with the surfaces of adjacent electrodes substantially parallel.

4. In an electrolytic apparatus, a bi-polar electrode comprising a sheet of metal to be refined, and having at the top thereof offset suspension means whereby said electrode may be suspended in a cell or tank and when so suspended will assume an inclined position.

5. In an electrolytic apparatus, a bi-polar electrode comprising a sheet of metal to be refined, and having at the top thereof spaced lugs projecting angularly from the anode side thereof, said lugs being provided with means adjacent the end thereof whereby the electrode may be suspended within a tank or cell, the offset relation of said point of suspension to the anode side of the electrode causing said electrode to automatically assume an inclined position and said position to vary with the shifting of the center of gravity of the electrode.

6. In an electrolytic apparatus, an electrode comprising a body portion formed by a plate of metal to be refined, and suspending means offset from the anode surface of the electrode, said suspending means being offset to such extent that the electrode when suspended in the cell will assume an inclined position at such an angle that impurities or slime will not adhere to either the anode or cathode surfaces.

7. An electrolytic apparatus embodying therein a tank or cell adapted to receive electrolyte, a plurality of bi-polar electrodes each of which, at the top thereof, is provided with oppositely disposed suspension means, offset with relation to the center of the electrode, and supporting means for said suspension means respectively, whereby when said electrodes are assembled in said tank or cell, a vertical line will extend through said supporting means and the center of gravity of the electrode, said electrode will be sustained at an angle, and the surfaces of succeeding electrodes will be substantially parallel.

8. In an electrolytic apparatus, a bi-polar electrode comprising a sheet of metal to be refined, having at the top thereof oppositely disposed lugs projecting angularly with relation to one operative surface thereof, said lugs being provided with means adjacent the end thereof whereby the electrode may be suspended within a tank or cell, the offset relation of said point of suspension with the anode side of the electrode causing said electrode to automatically assume an inclined position and to vary said position with the shifting of the center of gravity in the electrode and said electrode is so maintained that a vertical line will, at all times pass through the line of suspension thereof and the center of gravity of the electrode,

with the surfaces thereof substantially parallel with those of adjacent electrodes.

9. An electrode comprising a flat sheet provided with laterally projecting supporting lugs at the top and at opposite edges thereof, said lugs extending at an angle to the plane of said sheet.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES B. HERRESHOFF, JR.

Witnesses:

A. L. KENT,

Jos. F. A. O'DONNELL.