

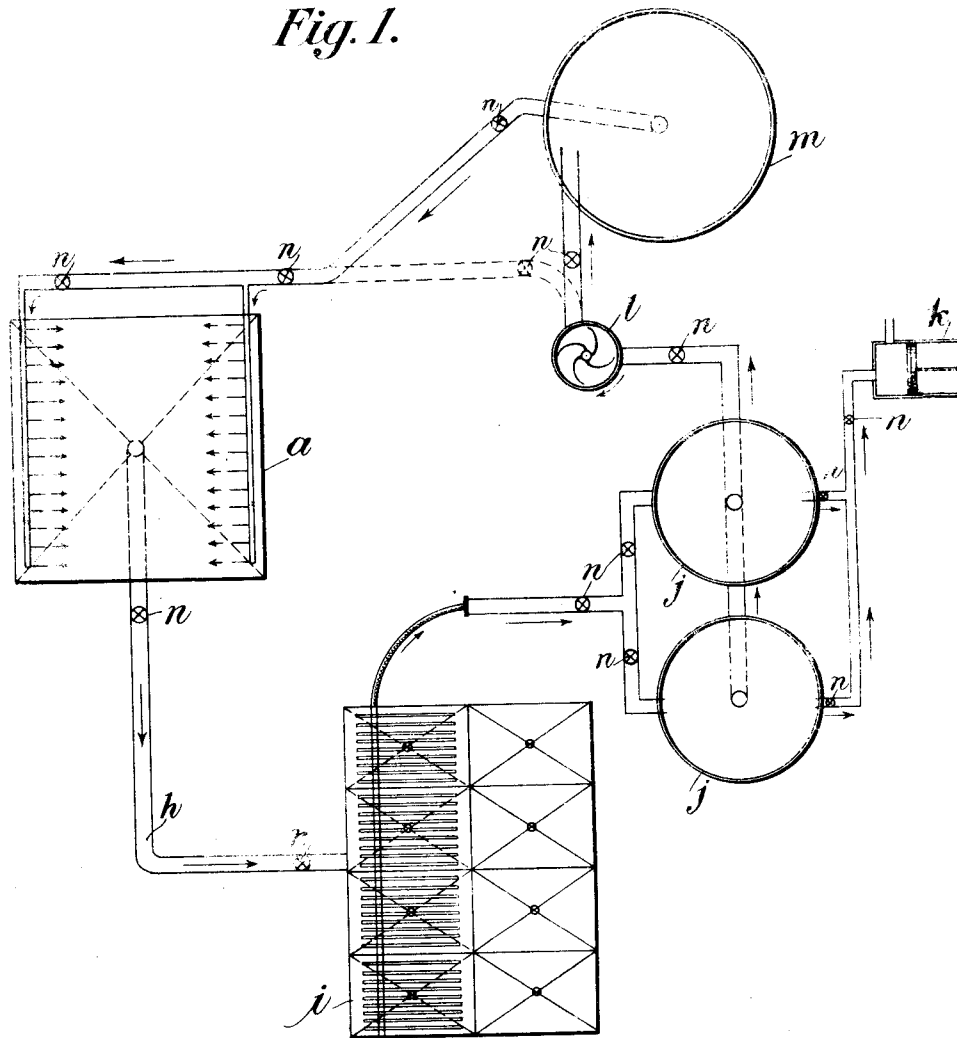
K. S. GUITERMAN.
 PROCESS OF ELECTROLYSIS AND APPARATUS THEREFOR.
 APPLICATION FILED NOV. 21, 1912.

1,062,966.

Patented May 27, 1918.

2 SHEETS-SHEET 1

Fig. 1.



WITNESSES

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INVENTOR

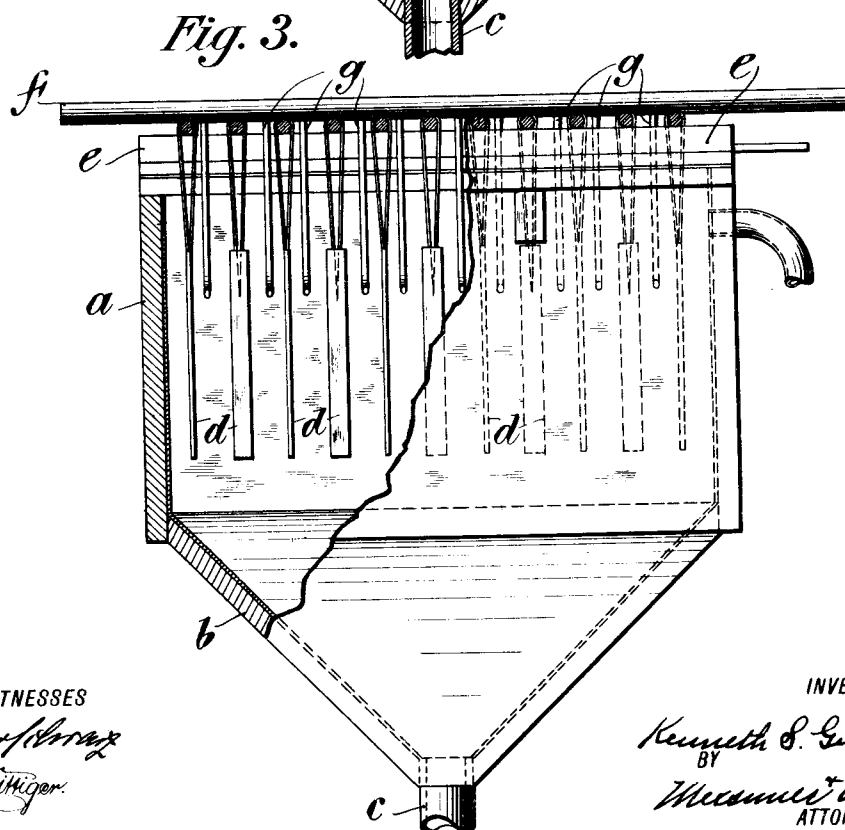
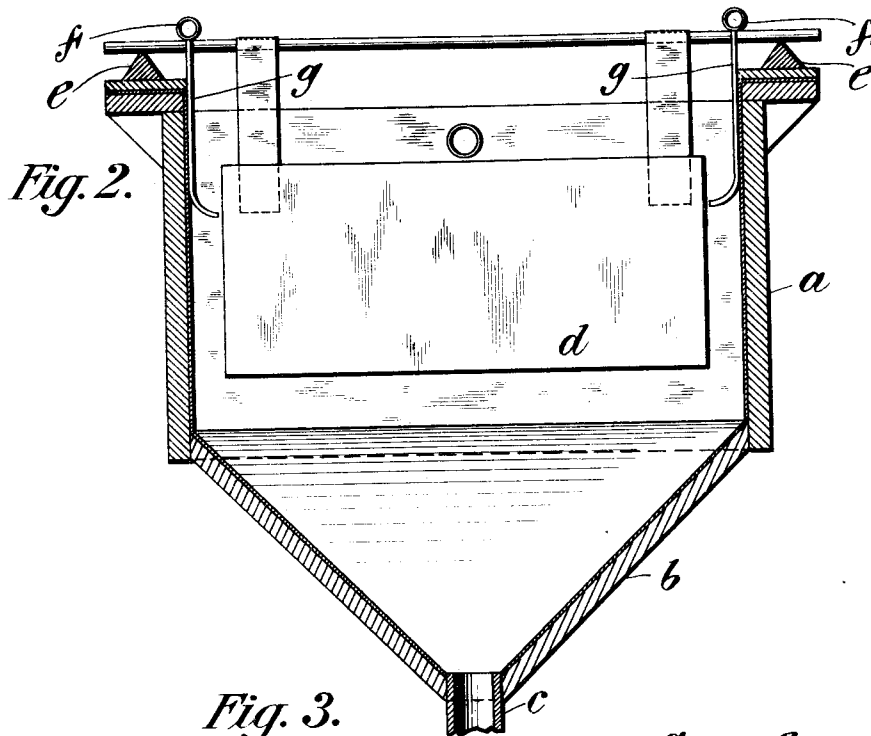
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K. S. GUITERMAN.
 PROCESS OF ELECTROLYSIS AND APPARATUS THEREFOR.
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2 SHEETS—SHEET 2.



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PROCESS OF ELECTROLYSIS AND APPARATUS THEREFOR.

1,062,966.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, KENNETH S. GUTTERMAN, a citizen of the United States, residing at No. 465 West End avenue, in the borough of Manhattan of the city of New York and State of New York, have invented certain new and useful Improvements in Processes of Electrolysis and Apparatus Therefor, of which the following is a specification.

My invention relates to an improved process of electrolysis and relates particularly to a process in which high current densities may be employed.

Heretofore the desirability of maintaining a constant agitation of the electrolyte in the presence of high current densities has been recognized, but in practice the necessary circulation has been impractical, because by so doing the anode slimes were kept in suspension and mechanically contaminated the cathode deposit. If, on the other hand, high current densities were employed without circulation, then the cathode deposits became very uneven and developed so-called sprouts, which not only produced short circuits, but also collected much slime and impurities.

One of the primary objects of this invention is to maintain constant agitation of the electrolyte while using a high current density and without contamination of the cathode deposit.

A further object of the invention is to effect removal of the anode slimes while maintaining a practically continuous agitation of the electrolyte in the electrolytic vat, thus avoiding the contamination of the cathode deposit.

Another object of the invention is to provide an improved form of apparatus for carrying out the said process.

The various other objects of the invention will be more fully set forth in the accompanying description of my improved process and one form of apparatus adapted for use in carrying out the same.

In the accompanying drawings:—Figure 1 is a diagrammatic plan view of an apparatus for carrying out my improved process. Fig. 2 is an end elevation in section of the electrolytic vat. Fig. 3 is a side elevation of the vat, partly in section, showing the arrangement of the electrodes and the feed pipes.

In carrying out my improved process, the terminal plates or electrodes are arranged parallel to each other in a suitable retaining

vessel or a vat with an inlet for a continuous supply of electrolyte between the members of each pair of electrodes. The electrolyte flows in a practically continuous stream from the inlets and passes between and in contact with the electrodes, so that the entire surface of each electrode is washed and thereby scoured of slimes by the flowing stream. The velocity of the stream may be controlled in any desired manner and is always sufficient to prevent the deposition of suspended slime. Preferably, the direction of flow is substantially downward and transverse to the faces of the electrodes. It is not essential however that the supply of electrolyte should be directed initially in an approximately horizontal path, since substantially the same results can be accomplished by spraying or otherwise feeding the electrolyte so that it will flow vertically across the faces of the plates.

After passing the electrodes, a portion of the electrolyte is continuously withdrawn from the vat or other retaining vessel. Preferably, the outlet is located at a point below the bottoms of the electrodes, so that the flow of electrolyte with respect to the electrodes will be in approximately the same path as the naturally falling slimes. That portion of the electrolyte which has been removed from the vat is then cleansed from anode slimes. This may be accomplished in any desired manner, for example, by causing the electrolyte to pass through a vacuum filter, which may be connected with a tank in communication with a vacuum pump, so that a practically continuous supply may be maintained in said tank. The cleansed electrolyte which has been freed from anode slimes by the filter or other means is then returned to the vat through the inlets, as hereinbefore described.

In the particular apparatus shown in the accompanying drawings, the vat *a* may be of rectangular sections and is provided with a hopper bottom *b* having an outlet *c* at its lowest point. Electrodes *d* are suspended in the upper portion of the vat by bus-bars *e* in the usual manner. Supply pipes *f* are preferably supported upon the upper part of the vat, which have a plurality of feeder pipes *g* communicating beneath. The outlet ends of said feed pipes are arranged between the pairs of electrodes in a preferably horizontal plane. The outlet pipe *h* communicates with a suitable filter *i* that may

be connected with one or more receiving tanks *j* that are connected with a vacuum pump *k*. The receiving tanks are also connected with a suitable pump, preferably a centrifugal pump *l*, which in turn may be connected with the inlet pipes, either directly or through a suitable storage reservoir *m*. The flow of the electrolyte through the various parts of the apparatus may be controlled as desired by the valves *n*.

In operation, a continuous circulation of the electrolyte is kept up by the several pumps which draw the electrolyte from the vat, through the filter into the receiving tanks, and thence it is forced into the reservoir *m* which may be elevated to supply to feed pipes under pressure of gravity or it is forced under pressure by the pump *l* directly into the separate feed pipes which direct the electrolyte in streams between each pair of electrodes.

By means of my improved process, a high rate of circulation is constantly maintained between the electrodes where it is required, so that concentration of the electrolyte at the cathode surface may be maintained at a constant, thereby preventing impoverishment no matter how great the current density, and also permitting extremely high current densities to be employed without mechanical contamination of the cathodes. The slime is removed practically as fast as it is formed, not only on account of the shape of the vat, but also on account of the flow of the electrolyte, which prevents the slime from settling on the cathode and accelerates its movement in a substantially vertical plane downward, which is its natural falling direction. Since the slimes are removed, a smooth dense cathode deposit is attained, resulting from the constantly maintained concentration of the electrolyte at the cathode and from the washing and scouring action of the flowing electrolyte on the cathode faces. Furthermore, the elimination of short circuits resulting from slime accumulation or the formation of trees or sprouts, together with a decrease of polarization as a result of the increased circulation, and less temperature drop in the electrolyte, effect a considerable saving in power. By my improved process also, the most impure and slime forming material may be rapidly treated and there is a great increase in the capacity of a plant having a given surface area, together with increased facility in handling, since the slime is removed practically continuously and it is unnecessary to permit the slime to settle in and to drain the same from the electrolyzing vat.

Although I have described the various steps in my improved process, it is obvious that various departures therefrom within the knowledge of those skilled in the art may be made without departing from the spirit of

the invention, provided the means set forth in the following claims be employed. It is also obvious that numerous modifications may be made in the particular form of apparatus herein shown and described, which changes and modifications are within the scope of the invention.

I claim as my invention:—

1. The process of electrolysis which consists in arranging the electrodes in pairs, washing the slime from the electrodes as formed into a body of bath below the electrodes, keeping the slimes in suspension out of contact with the electrodes and causing the same to accumulate at a predetermined point, and then continuously removing said slimes with a portion of the bath.

2. The process of electrolysis which consists in subjecting each pair of electrodes to a continuous current of electrolyte, providing a body of electrolyte below the electrodes, producing currents having a definite directional flow through said bath to accelerate the normal fall of the slimes and prevent same from coming into contact with the electrodes, collecting the slimes at a point remote from the electrodes, removing the slimes with a portion of the electrolyte, separating the slimes from said removed portion of the electrolyte, and then returning said electrolyte to the bath.

3. A process of electrolysis which consists in washing the slime from the electrodes, causing a current of electrolyte having a definite directional velocity between each pair of electrodes to wash the slime from the surface of the electrodes and hold the slime out of contact therewith, maintaining said current in a direction away from the electrodes to collect the suspended slime, removing the slimes and a portion of the electrolyte, separating the slimes from said removed portion of the electrolyte and then returning the electrolyte to the bath.

4. A process of electrolysis which consists in causing a current of electrolyte between each pair of electrodes, directing each of said currents in a downward direction at substantially uniform velocity to carry the slimes out of contact with the electrodes, then gradually directing said currents toward an outlet relatively remote from the electrodes, removing the slimes and a portion of the electrolyte through said outlet, filtering said portion of the electrolyte to separate the suspended slimes and then returning said portion of the electrolyte to the bath.

5. A process of electrolysis which consists in causing a current of electrolyte between each pair of electrodes having sufficient velocity to wash the slimes from the surface of the electrodes and prevent eddy currents, keeping the slimes in suspension out of contact with the electrodes, causing the slimes to accumulate at a predetermined point rela-

tively remote from the electrodes, and then removing said slimes and a portion of the electrolyte, separating the slimes from the electrolyte and then returning said electrolyte to the bath.

6. A process of electrolysis which consists in washing the slimes from the electrodes as formed into a body of bath below the electrodes, producing currents having a definite directional flow through said bath to accelerate the normal fall of the slimes and prevent contamination of the electrodes, directing said currents toward an outlet relatively remote from the electrodes, removing the slimes with a portion of the electrolyte, separating the slimes from said electrolyte and then returning the electrolyte to the bath.

7. A process of electrolysis with high current densities which consists in arranging the electrodes in pairs opposite each other, continuously scouring the faces of each pair of electrodes with a current of filtered electrolyte, washing the slimes as formed into a body of bath below the electrodes, maintaining currents having a definite directional velocity in said bath, directing said currents away from said electrodes toward an outlet relatively remote from the electrodes, continuously removing said slimes and a portion of the electrolyte through said outlet, separating the slimes from said removed portion of the electrolyte and returning said electrolyte to the bath.

8. In an electrolytic apparatus, the combi-

nation with a rectangular settling vat having a sloping bottom converging toward an outlet opening, of a plurality of electrodes supported in the upper portion of said vat arranged in pairs with their faces parallel to each other, a filter communicating with said outlet, and an inlet pipe communicating with the vat and comprising a plurality of feed pipes, one of said feed pipes being placed between each pair of electrodes and adapted to direct a current between the same with a definite directional velocity toward the outlet.

9. In an electrolytic apparatus, the combination with a rectangular settling vat having a sloping bottom converging toward a central outlet opening of a plurality of electrodes supported in the upper portion of said vat arranged in pairs with their faces parallel to each other, a filter communicating with said outlet, a supply tank communicating with the filter, and an inlet pipe communicating with the supply tank and vat and comprising a plurality of feed pipes, one of said feed pipes being placed between each pair of electrodes and means for forcing electrolyte through said feed pipes with a definite directional flow toward the outlet.

This specification signed and witnessed this 9th day of November, A. D. 1912.

KENNETH S. GUITERMAN.

Signed in the presence of—

M. P. WINNE,

MABEL J. COOPER.