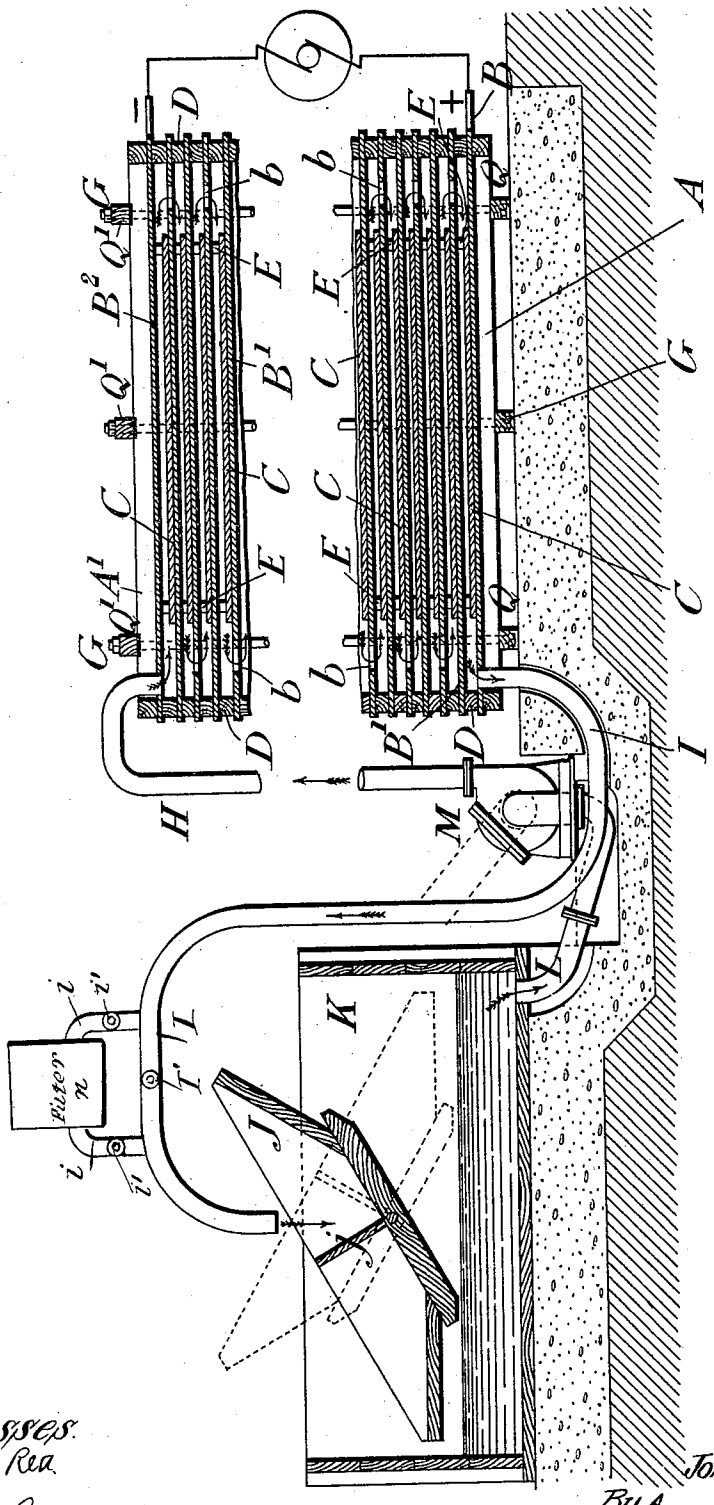
(No Model.)

J. O. S. ELMORE.

APPARATUS FOR REFINING METALS BY ELECTROLYSIS.

No. 589,251. Patented Aug. 31, 1897.



Witnesses:
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR REFINING METALS BY ELECTROLYSIS.

SPECIFICATION forming part of Letters Patent No. 589,251, dated August 31, 1897.

Application filed August 17, 1896. Serial No. 603,013. (No model.)

To all whom it may concern:

Be it known that I, JOHN OLIVER SURTEES ELMORE, a citizen of England, residing at Kapurthala, Punjaub, in the Empire of India, have invented a certain new and useful Improvement in Apparatus for Refining Metals by Electrolysis, of which the following is a specification.

Hitherto metals, particularly copper, have been refined or purified by electrolysis, effecting solution and deposit at a very slow rate, and therefore requiring a very large stock of the metal to be kept on hand and extensive and costly plants and buildings.

This invention relates to apparatus of a cheap and simple character for the refining of metals by electrolysis so operated as to effect very rapidly the solution of the crude metal and the deposit of the pure metal, and so arranged as to give a large output in small compass and in short time. For this purpose I arrange the apparatus as I shall describe, referring to the accompanying drawing, which is a vertical longitudinal section, partly in elevation, of apparatus according to my invention arranged for electrolytically refining copper.

I provide a rectangular wooden frame A as a base, on which I place a sheet B of metal, such as is not acted on by the electrolyte. When copper is refined, the electrolyte is sulfate of copper, and therefore lead is the suitable metal for the sheet B, but when the sheets are of considerable size, requiring strength, I use an iron plate covered all over with lead. On the sheet B, I place a plate C of the crude copper which is to be refined, this plate being shorter than the sheet B. Also on the sheet B, I place a rectangular wooden frame D, the sides and ends of which are thicker than the plate C, and on the plate C, I place several pads E of india-rubber or other elastic insulating material. On these and on the frame D, I place another sheet B′, carrying another plate C of crude copper, and I repeat this, piling a number of sheets B′, frames D, plates C, and pads E above one another, covering the whole with a sheet B^2, over which I place a top frame A′, and I clamp the whole pile firmly by bolts G, passing through holes in battens Q, arranged below the frame A, and corresponding battens Q′, arranged over the frame A′. The uppermost sheet B^2 has a hole for a pipe H, and the lowest sheet B has a hole for a pipe I. Each of the other plates B′ has a hole or set of holes *b* near one end, and when the sheets are placed in position the holes *b* are arranged alternately to the right and to the left.

The pipe I has its mouth over a rocking trough J, which has a cross-partition *j* and is mounted on a horizontal axis within a tank K. From the tank K a pipe L leads to the inlet of a rotary or other pump M, the discharge of which is connected to the pipe H. The lowest plate B is connected to the + terminal and the uppermost plate B^2 is connected to the — terminal of a dynamo-machine or other source of electricity, the tank is supplied with electrolyte liquid, and the pump is connected by suitable gear to any convenient motor.

The pump being worked and the electrical current being switched on the apparatus operates as follows: While a large current of electrolyte is caused to flow in a zigzag course through the alternated openings *b*, thus passing along between each plate C and sheet B′, the copper is rapidly dissolved from each plate C and deposited on the plate B′ above it. The electrolyte after passing the lowest plate C is discharged by the pipe I into the one side of the trough J, on one side of the partition *j*. When that side of the trough has received a certain weight of liquid, it overbalances the other side and descends, delivering its contents into the tank K, the other side of J then receiving liquid until it descends in its turn. The trough J being of wood or other non-conducting material, by thus discharging from each side of it while that side is not receiving supply there is no electrical communication from the liquid discharged to that which is drawn from the tank for supply. It is of advantage to separate impurities suspended in the electrolyte. This may be done by withdrawing from time to time a portion, filtering and returning the filtered liquid, or a portion may be made to flow continually through a filter from either of the pipes H or I, to which the filter may be connected as a by-pass for part of the liquid flowing through the pipes. In the drawing I have illustrated the latter arrangement,

wherein the reference-numeral *n* indicates the filter connected by by-pass pipes *i i* with the discharge-pipe I. By these means a portion of the electrolyte is caused to flow through the filter and be thus deprived of impurities. The by-pass pipes *i i* are provided with valves *i' i'*, by means of which the flow of the electrolyte liquid through the filter may be regulated, or the filter may be cut out altogether, or by means of a valve I' in the pipe I the entire volume of the electrolyte may be caused to flow through the filter in its passage to the tank.

Although I have described the frames A, A', and D as being of wood, they might obviously be of other non-conducting material, wood being generally preferable on account of cheapness.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. The combination of a series of non-conducting frames and sheets of metal carrying plates of the crude material to be refined, said frames and sheets being piled over one another and clamped together, and said sheets having holes arranged in their alternate ends for the passage of an electrolyte liquid in a zigzag course between each plate and the sheet above it, and an electric circuit connected at its terminals to the lowest and uppermost sheet respectively, substantially as described and for the purpose specified.

2. The combination of a series of non-conducting frames and sheets of metal carrying plates of the crude material to be refined, said frames and sheets being piled over one another and clamped together, to form a tortuous passage for an electrolyte fluid, a tank, a rocking trough arranged in said tank, a pump communicating with said tank and with said tortuous passage, a discharge-pipe leading from the said tortuous passage to said rocking trough, and an electric circuit connected at its terminals with upper and lower sheets respectively, substantially as described and for the purpose specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 19th day of June, A. D. 1896.

JOHN OLIVER SURTEES ELMORE.

Witnesses:
I. FAIRWEATHER,
KANMAR BALBEERSINGH.