

The form and arrangement of the depositing-vats is not material, but one arrangement which I have found suitable is shown in the accompanying drawings. Any suitable number of such sets of apparatus may be employed, and the connection and arrangement of the same may be varied to suit particular conditions and requirements.

Figure 1 is a section of a leaching-vat with stirrers. Figure 2 shows the arrangement of electro-depositing vats in a cascade, and the reservoir. Figure 3 is a general plan of the electrolysis plant.

The electro-depositing vats are arranged in such a manner, and with such pipe- and trough-connections between them, that a continual circulation of solution in three separate stages of progress is maintained in the system, the liquids being preferably circulated at sufficient speed to insure a brisk and continual motion at every part of the plates.

The depositing apparatus consists of a series of any number of electrolysis vats— $A^1, A^2, A^3, A^4, A^5, A^6, A^7, A^8, A^9$ —preferably arranged as shown in Figures 2 and 3; and a number of reservoirs— $B^1, B^2, B^3, B^4, B^5, B^6$ . Each of the vats is divided by diaphragms  $C$  of filter-cloth or other suitable material into a number of compartments, each of which has an inlet-pipe  $D$ , entering near the bottom, and an outlet-pipe  $E$ , discharging near the top. Each of the vats  $A^1, A^2, A^3, A^4, A^5, A^6$  contains three copper and iron anodes  $H$ , and two metallic cathodes  $K$ ; while each of the vats  $A^7, A^8, A^9$ , contains three carbon anodes  $M$ , and two cathodes  $K$ .

The electrical connections may be made in any suitable manner, all the plates in the same vat being connected in parallel, and the plates of successive vats being connected in series.

The reservoir  $B^1$  has a number of exit-pipes which discharge into the inlets of the cathode compartments of the three upper vats  $A^1, A^4$ , and  $A^7$ . The outlet-pipes of these compartments discharge into the inlets of the cathode compartments of the vats  $A^2, A^5$ , and  $A^8$ . The outlet-pipes of these compartments discharge into the inlets of the cathode compartments of the vats  $A^3, A^6$ , and  $A^9$ , and the outlet-pipes of these compartments discharge into the reservoir  $B^2$ . The reservoir  $B^3$  has a number of exit-pipes which discharge into the inlets of the anode compartments of the vats  $A^1$  and  $A^4$ . The outlet-pipes of these compartments discharge into the inlets of the anode compartments of the next vats,  $A^2$  and  $A^5$ . The outlet-pipes of these compartments discharge into the anode compartments of the vats  $A^3$  and  $A^6$ , and the outlet-pipes of these compartments discharge into the reservoir  $B^4$ . The reservoir  $B^5$  has exit-pipes which discharge into the inlets of the carbon-anode compartments of the vat  $A^7$ . The outlet-pipes of these compartments discharge into the inlets of the carbon-anode compartments of the vat  $A^8$ . The outlet-pipes of these compartments discharge into the outlets of the carbon-anode compartments of the vat  $A^9$ , and the outlet-pipes of these compartments discharge into the reservoir  $B^6$ . For the above-described operations one of several solutions of different, though analogous, compositions may be employed according to varying circumstances: No. 1, zinc-chloride mixed with sodium-, potassium-, magnesium-, or ammonium-sulphate. No. 2, zinc-chloride mixed with sodium-, potassium-, magnesium-, or ammonium-chloride. No. 3, zinc-sulphate mixed with sodium-, potassium-, magnesium-, or ammonium-sulphate. The ferric salt required in each of the above solutions in order to effect the solution of the zinc is generated in the electro-depositing plant as hereinbefore described.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is,—

1. The improved process whereby a solution containing copper and iron is obtained electrolytically by employing in a zinc-depositing vat an anode consisting of the products resulting from the preliminary furnace-treatment of products or ores containing copper and iron, substantially as described.

2. The improved process whereby from a solution obtained by the process claimed in the first claim hereof the copper is deposited and the dissolved iron simultaneously raised to the ferric state by the use, in an electrolytic vat, of copper or other cathodes in conjunction with carbon or other insoluble anodes, substantially as described.

3. The improved process consisting in including in one and the same electrical circuit vats in which the electro-deposition of zinc is proceeding, and vats provided with anodes of metallic iron and cathodes of metallic copper or otherwise in which copper is being electrolytically deposited from a solution obtained by the process claimed in the first claim, substantially as described.

4. The method of preparing from copper and other mattes containing iron a solution of a ferric salt for leaching roasted zinc-ore, substantially as described.

Dated this 23rd day of October, 1896.

W. E. HUGHES,  
Agent for the Applicant.

#### IMPROVEMENT IN THE TREATMENT OF COMPOUNDS OR ORES CONTAINING ZINC.

I, Edgar Arthur Ashcroft, of 34, Queen Street, Melbourne, in the Colony of Victoria, electrical engineer, do hereby declare the nature of my invention for "Improvement in the Treatment of Compounds or Ores containing Zinc," and in what manner the same is to be used and performed, to be particularly described and ascertained in and by the following statement:—

The object of my invention is to obtain zinc from ores or compounds containing it in a cheaper and more convenient manner than heretofore by the aid of electrolysis.

It is well known that zinc presents great difficulties in electro-deposition, inasmuch as it is liable to form irregular and spongy deposits. Acids or salts of the anode metal are set free at the anode, and must be either separated by porous diaphragms from the liquid around the cathode, or the solution must be continuously and rapidly changed in the electrolysis vats, and free acid or metal salts removed. I have discovered that the above hampering tendencies can be corrected by depositing zinc from solutions in which oxysalts are present to a sufficient amount. I have also discovered that precipitation of zinc from these solutions can be conveniently and more