June 17, 1930. J. W. SCOTT 1,764,650

ELECTROLYTIC SYSTEM

Filed Dec. 23, 1926

Fig. 1.

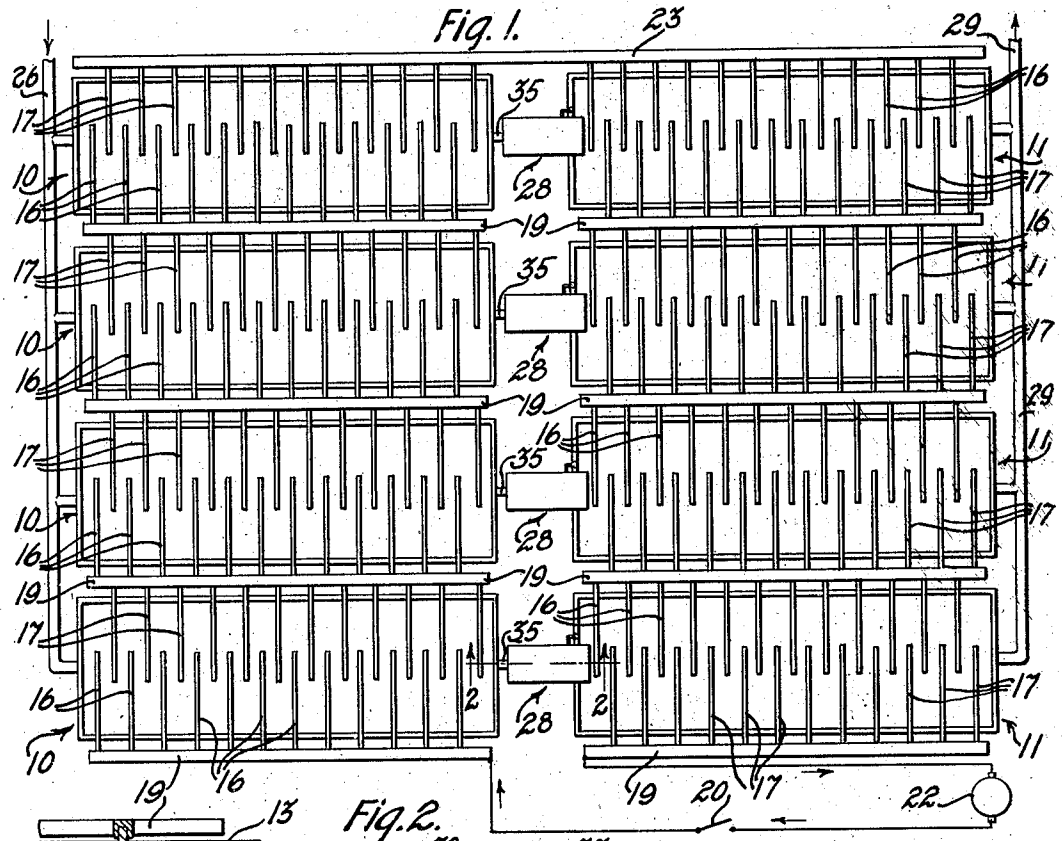


Fig. 2.

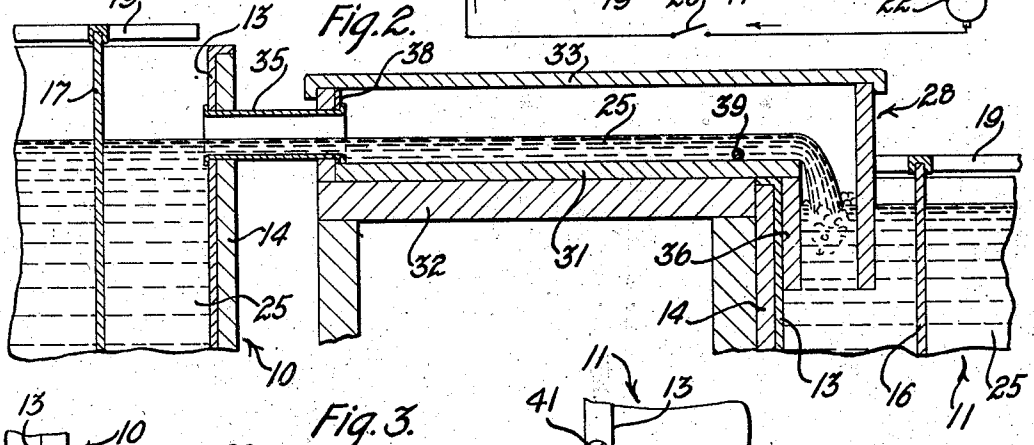
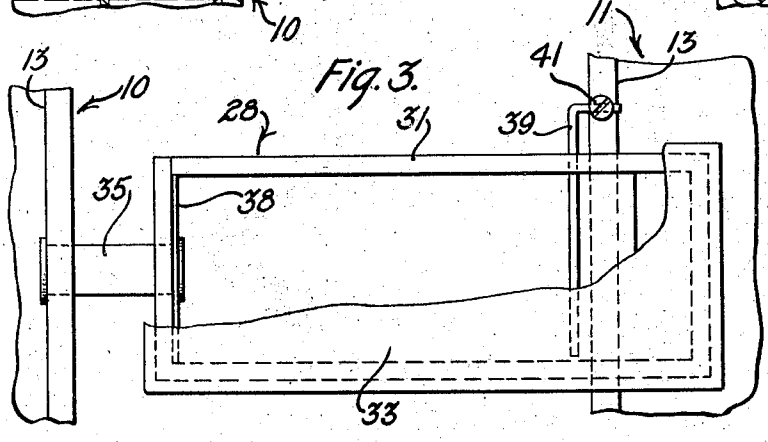


Fig. 3.



Inventor
James W. Scott
by H. C. Patterson Atty.

Patented June 17, 1930 1.764,650

UNITED STATES PATENT OFFICE

JAMES WALTER SCOTT, OF CHICAGO, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

ELECTROLYTIC SYSTEM

Application filed December 23, 1926. Serial No. 156,588.

This invention relates to electrolytic systems, and more particularly to electrolytic systems employed in connection with the recovery of metals.

It is the practice in some instances in the process of recovering certain metals, such as copper, from an electrolytic solution, to circulate the electrolyte through a series of interconnected containers or tanks. If a difference in electrical potential exists between these interconnected tanks, there will necessarily be a certain amount of current flow in the portion of the electrolytic solution which passes through the couplings interconnecting these tanks. Under such conditions electrolytic decomposition of the portion of the solution passing through the couplings takes place, which in some instances results in the formation of a metallic deposit which deleteriously affects the operative effectiveness of the entire electrolytic system.

The primary object of this invention is to provide a simple and effective system of interconnected electrolyte retainers which obviates the aforementioned difficulty.

In accordance with the general features of the invention one embodiment thereof comprises a plurality of pairs of electrolyte tanks supplied with suitable anodes and cathodes connected in series with a source of electrical current supply and designed to decompose an electrolytic solution, as for example an aqueous solution of copper sulphate, within the tanks to recover copper therefrom. Each pair of tanks is interconnected by a coupling which permits the passage therethrough of the electrolyte from one tank to another, and which in itself constitutes an auxiliary eletrolytic cell as cathode and anode electrodes electrically connected to the respective interconnected cells are provided therein. A copper cathode within the auxiliary cell serves to recover copper from the solution passing through the cell, this copper being liberated due to the current flow occasioned by the difference in electrical potential between the interconnected tanks.

These and other objects will be apparent from the following detailed description and the accompanying drawing, wherein

Fig. 1 discloses a plan view of a series of electrolyte tanks provided with couplings of a type which are representative of one embodiment of the invention;

Fig. 2 is a vertical sectional view taken longitudinally of one of the tank couplings on the line 2—2 of Fig. 1, and

Fig. 3 is a plan view of the coupling disclosed in Fig. 2, the cover thereof being broken away to disclose parts otherwise hidden.

Referring now to the drawing wherein like numerals have been employed to designate similar parts throughout the various figures, it will be observed that a series of elongated tanks 10 and a series of similar companion tanks 11 in alignment therewith are provided with linings 13 of lead or other suitable material (Fig. 2). These lead linings 13 are enclosed within suitable casings 14, and positioned within each tank are a plurality of anode plates 16 and companion cathode plates 17. The anode plates 16 comprise a sheet of lead or other suitable material, and the cathode plates 17 preferably comprise sheets of copper which extend downwardly into their respective tanks, these anode and cathode plates being supported at one extremity by and electrically connected with copper bus bars 19, which are positioned adjacent to and extend longitudinally on the upper sides of each tank. As disclosed in Fig. 1, one of the copper bus bars 19 adjacent to the foremost tank 10 is electrically connected through a switch 20 to one terminal of a suitable source of current supply, such as a generator 22, and the opposite terminal of said generator is connected with one of the bus bars positioned adjacent the foremost tank 11. The rear companion tanks 10 and 11 are electrically connected by a bus bar 23 which extends therebetween, and thus it will be clear that when an electrolyte 25, such as copper sulphate, is supplied to the tanks and the switch 20 is closed the tanks will be connected in series, the current from the generator 22 flows from one terminal thereof in a direction indicated by arrows in Fig. 1, through the entire series of tanks and then back to the opposite generator terminal.

The passage of the current through the electrolyte 25 will effect the ionization or decomposition thereof, which will result in a deposit of copper upon the cathode plates 17 in each of the tanks.

The electrolyte 25 is conducted from a suitable source of supply (not shown) through a lead pipe 26, which serves to direct the solution into each of the tanks 10 at one extremity thereof. These tanks are connected at their opposite extremities with the tanks 11 by means of an interconnector or coupling denoted generally by the numeral 28, and it will be observed that the tanks 11 are positioned at a lower level than the tanks 10 to permit the free passage or overflow of the electrolyte 25 from the tanks 10 into the tanks 11. The electrolyte from the tanks 11 is returned through a pipe 29 to the original source of the electrolyte supply (not shown), and thus the continuous passage or circulation of the electrolyte through the tanks is effected. The continued circulation of the electrolyte through the tanks in the above described manner serves to more effectively render possible a complete recovery of metallic copper from the electrolytic sulphate solution.

Each of the interconnectors or couplings 28 comprises a box-like conduit 31, preferably comprised of wood or any other suitable non-conducting material, supported by a frame 32, and is provided with a removable cover 33. One end of each conduit 31 is connected with a companion tank 10 by means of a lead connector 35, while the opposite end of the conduit is provided with a depending portion 36 which opens downwardly into a companion tank 11. The lead connector 35 contacts at one extremity with the lead lining 13 of the tank 10, and the opposite end of the connector contacts with a lead plate 38 positioned in the conduit 31. Traversing and resting upon the bottom portion of the conduit 31 at the end adjacent the tanks 11 is a copper rod 39 which extends through the wall of the conduit (Fig. 3) and is suitably connected as by means of a terminal post 41 with the lining 13 of the tank 11.

By reason of the fact that the tanks are electrically connected in series it will be obvious that the voltage impressed upon the electrolyte contained within the foremost tank 10 will be higher than the voltage impressed upon the electrolyte contained within its companion rear tank 11, and hence there will be a tendency for a current to flow from the tank 10 to the tank 11 through the portion of the electrolyte passing through the coupling 28. By having the lead plate 38 within the conduit 31 electrically connected with the lining of the tank 10 through the connector 35, as described, this plate will serve as an auxiliary anode for the electrolyte flowing through the conduit. Likewise the copper rod 39 positioned at the extremity of the conduit 31 opposite from the plate 38 will serve as a cathode, and hence electrolytic decomposition which will consequently take place within this portion of the electrolyte will cause metallic copper to be deposited upon the rod 39. By this construction it will be understood that the wooden conduit 31 and the above mentioned auxiliary anode and cathode which comprise the coupling 28 will constitute an auxiliary electrolytic cell, which will operate to localize the deposition of copper recovered from the solution passing therethrough.

Experience has shown that when conventional types of couplings are employed to connect electrolyte retainers, such as the tanks 10 and 11, without the provision of an auxiliary anode and cathode, electrolytic decomposition of the solution passing through the coupling results in a deposition of metallic copper within the couplings and also upon the lining of the tanks 11. Under such conditions the lead lining as in the tank 10 serves as an anode and the lead lining as in the tank 11 serves as a cathode, and the copper is not deposited in a localized area such as upon the rod 39, as hereinbefore described, but the deposit thus produced forms a spongy mass throughout the length of the coupling which not only presents an obstruction to the free flow of electrolyte from one tank to another as the size of the deposit increases but which also tends to decrease the electrical resistance between the tanks, and hence cause a corresponding increase in current flow or leakage therebetween.

By using this auxiliary electrolytic cell or coupling 28, deposition of copper from the electrolyte flowing between the tanks is positively controlled and the above mentioned deleterious effects are precluded. When the copper rod 39 is increased to a predetermined size as a result of the deposit of copper thereon it may easily be removed and replaced by another rod, and this convenient method of removing the deposited copper should be distinguished from the difficulty and inconvenience necessarily incident to the frequent removal of an accumulated mass of spongy copper deposit. In a process of copper recovery from a group of electrolyte tanks electrically connected in series as disclosed in Fig. 1, the greatest amount of copper recovery within the couplings 28 between each pair of tanks obviously takes place in the coupling between the two foremost tanks 10 and 11, because the largest difference in electrical potentials exists between the electrolytes in these tanks as distinguished from a considerably smaller difference in potential which exists between the two companion rearward tanks 10 and 11. Thus the use of the described interconnecting auxiliary cell renders possible the practice of a continuous and uninterrupted process of electrolysis by insuring the continued free passage of elec-

trolytic solution between the tanks and positively precluding the formation of any injurious metallic deposits throughout the electrolytic system.

It is to be understood that the invention is not limited to the exact construction of the electrical circuit arrangement herein described, and that the appended claims have been drawn to define modifications which come within the true spirit and scope of the invention.

What is claimed is:

1. In a system for the electrolytic deposition of metals, a plurality of tanks for containing an electrolyte, the portion of the electrolyte in one tank being maintained at a higher potential than the portion in the other, means interconnecting the tanks to direct the passage of the electrolyte therebetween, and means associated with the interconnecting means to control electrolytic deposition occasioned by the current flow in the portion of the electrolyte which passes through the interconnecting means.

2. In a coupling for systems for the electrolytic deposition of metals, an electrolyte conduit, and means within the conduit for controlling electrolytic deposition within an electrolyte passing therethrough.

3. In a coupling for systems for the electrolytic deposition of metals, an electrolyte conduit, an anode at the ingress of the conduit, and a cathode at the egress thereof, the anode and cathode being located within the conduit and connected with a source of electrical current supply.

4. In a coupling for systems for the electrolytic deposition of metals, an electrolyte conduit composed of electrical and non-electrical conducting materials at the ingress and egress thereof, respectively, an anode within the electrical conducting portion of the conduit at the ingress thereof, and an elongated cathode adjacent the bottom of the non-electrical portion at the egress of the conduit, said anode and cathode being connected with a source of electrical current supply.

5. In a system for the electrolytic deposition of metals, a plurality of electrolytic cells, means electrically connecting the cells in series to produce electrolysis therein, and an interconnecting electrolytic cell to direct the passage of an electrolyte between the first mentioned cells and to control within the interconnecting cell any electrolytic deposition within the portion of the electrolyte which passes between said cells caused by a difference in potential between said cells.

6. In a system for the electrolytic deposition of metals, a plurality of electrolytic cells, a conducting lining within each of the cells, means electrically connecting the cells in series to produce electrolysis therein, connecting means to direct the passage of an electrolyte between the cells, an anode positioned within the connecting means and electrically connected with the lining of one cell, and a cathode positioned within the connecting means and connected with the lining of another cell, the anode and cathode serving to control electrolytic deposition in the portion of the electrolyte within the connecting means.

7. In a system for the electrolytic deposition of metals, a plurality of electrolytic cells, a conducting lining for each of the cells, means electrically connecting the cells in series to produce electrolysis therein, a conduit to direct the continuous flow of an electrolyte from one cell to another, an anode within the conduit electrically connected with the lining of one of the cells, and a cathode within the conduit electrically connected with the lining of the other cell.

8. In a system for the electrolytic deposition of metals, a plurality of electrolytic cells, means electrically connecting the cells in series to produce electrolysis therein, a conduit to permit the flow of an electrolyte from one cell to another, an anode within the conduit at the ingress thereof, and a cathode within the conduit at the egress thereof, said anode and cathode serving to effect a localized metal deposition from the electrolyte flowing through the conduit.

9. In a system for the electrolytic deposition of metals, tanks for containing an electrolyte, and means interconnecting the tanks including elements acting to effect localized metal deposition within the interconnecting means from the electrolyte flowing between the tanks.

10. In a system for the electrolytic deposition of metals, interconnected tanks for containing an electrolyte, and means between the tanks for regulating therebetween the electrolytic decomposition of the portion of the electrolyte between the tanks.

11. In a system for the electrolytic deposition of metals, interconnected tanks for containing an electrolyte, and means for localizing between the tanks an electrolytic deposition from the portion of the electrolyte between the tanks.

12. In a system for the electrolytic deposition of metals, tanks for containing an electrolyte which circulates through the tanks, and interconnecting means between the tanks for controlling the electrolytic deposition therein of the electrolyte passing therethrough.

In witness whereof, I hereunto subscribe my name this 8th day of December, A. D. 1926.

JAMES WALTER SCOTT.