A. LEUCHTER.

APPARATUS FOR ELECTRODEPOSITION OF METALS.

APPLICATION FILED OCT. 5, 1916.

1,249,787.

Patented Dec. 11, 1917.

2 SHEETS—SHEET 1.

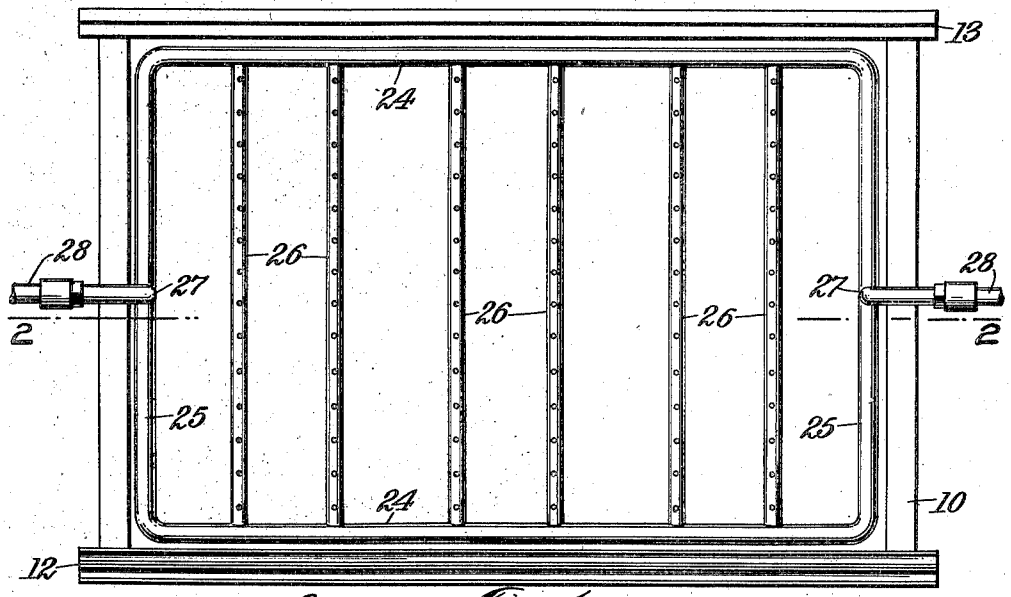


Fig. 1.

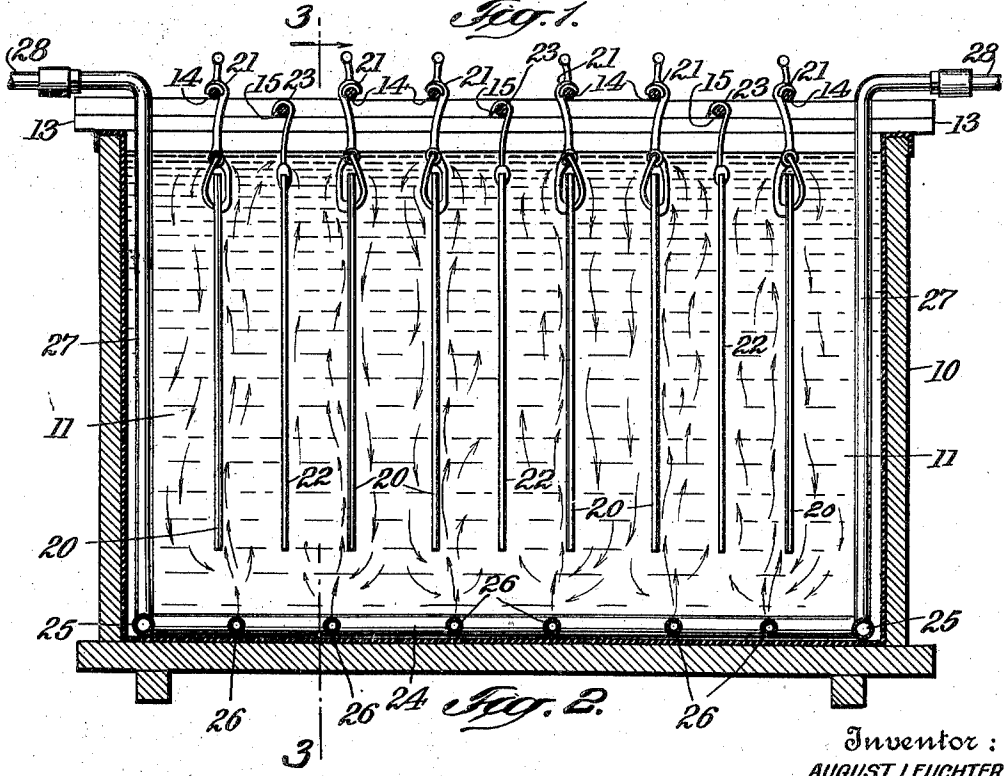


Fig. 2.

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By his Attorney,
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2 SHEETS—SHEET 2.

Fig. 3.

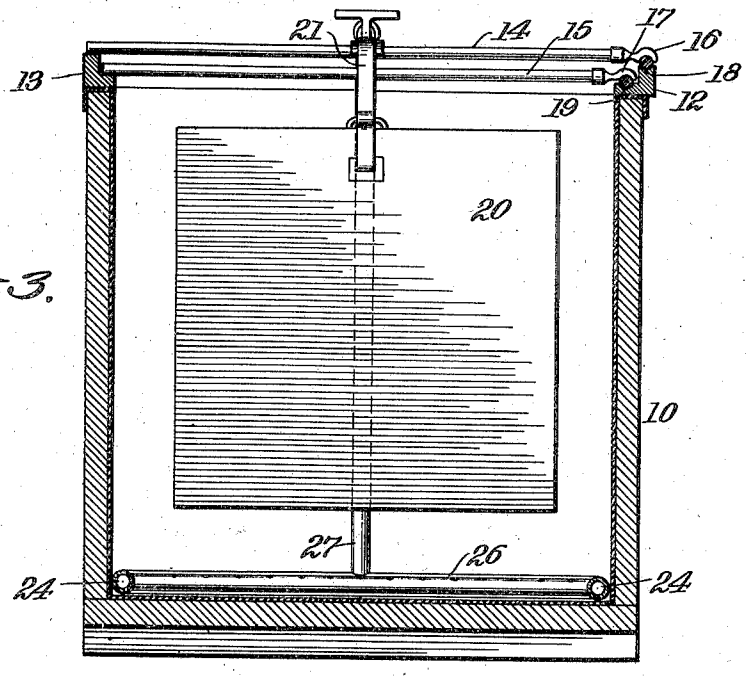
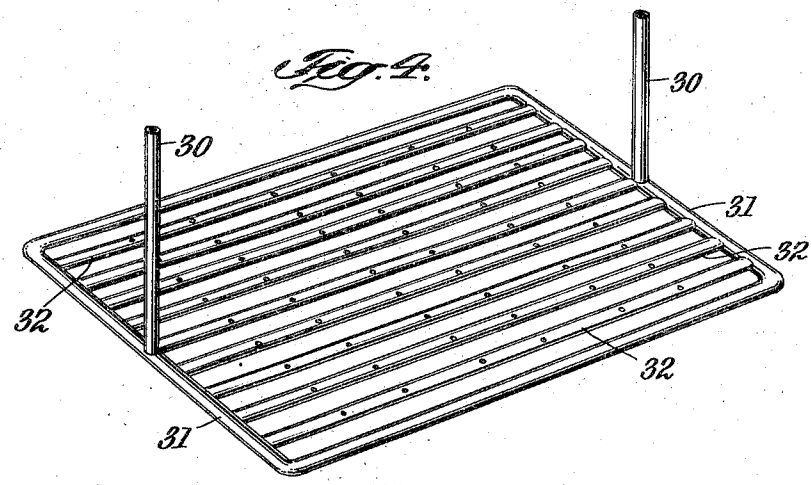


Fig. 4.



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UNITED STATES PATENT OFFICE.

AUGUST LEUCHTER, OF BROOKLYN, NEW YORK.

APPARATUS FOR ELECTRODEPOSITION OF METALS.

1,249,787. Specification of Letters Patent. Patented Dec. 11, 1917.

Application filed October 5, 1916. Serial No. 123,800.

To all whom it may concern:

Be it known that I, AUGUST LEUCHTER, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Apparatus for Electrodeposition of Metals, of which the following is a specification.

The invention relates more especially to apparatus of the character employed in electro-plating and resides in novel means whereby with great efficiency and entire success the deposit may be carried on at a much greater speed than has heretofore been usual, without increasing the electro-motive force. With the use of my invention a highly ionized solution or electrolyte may be employed and a continuous and sound deposition of the metal (copper or nickel) efficiently secured at more than the normal rate of speed incident to processes as heretofore practised.

The invention resides more particularly in novel means within the tank of electrolyte and arranged with relation to the cathode and anode rods, whereby an efficient and special agitation of the electrolyte takes place and the electrolyte is placed in steady circulation immediately adjacent to the cathode surfaces. With my invention I maintain the solution throughout the tank in substantially uniform condition by constantly moving the electrolyte upwardly along the cathode surfaces and bringing fresh electrolyte to said surfaces, not allowing the electrolyte to form into layers of different composition. Various means have heretofore been employed to effect a gentle agitation of the electrolyte in the tank, and while they have been more or less beneficial in their use, it has not, I believe, been possible heretofore to secure a continuous and sound deposition of the metal in a highly ionized solution.

My invention provides within the tank containing the electrolyte and having anode and cathode rods in proper distribution for supporting the anodes and cathodes, a series of perforated pipes to which air under pressure in constant and proper quantity is supplied and which pipes are arranged at the bottom of the tank and in such relation to the anode and cathode rods that the air brings about a steady and constant agitation of the electrolyte as well as the movement thereof along the cathode surfaces, moving away from the cathodes the exhausted or impoverished portions of the solution and creating a steady flow of the inexhausted portions of the solution at the cathode surfaces.

My invention involves a new construction of apparatus and a novel method of procedure in the use thereof, whereby high efficiency and very beneficial results are attained.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Figure 1 is a top view of a tank embodying the features of my invention;

Fig. 2 is a vertical longitudinal section through the same, taken on the dotted line 2—2 of Fig. 1, the electrolyte being represented as in the tank and the arrows indicating, as nearly as may be, the movement of the electrolyte along the cathode surfaces under the force created by the air issuing from a series of air pipes located at the bottom of the tank with due regard to the location of the cathodes and anodes;

Fig. 3 is a transverse section through the tank; and

Fig. 4 is a perspective view, partly broken away, of a modified arrangement of piping incorporating some of the features of my invention.

In the drawings, 10 designates a customary lead-lined tank for holding the electrolyte 11. The tank 10 will vary in size in accordance with the capacity desired for it. Upon the upper longitudinal edges of the sides of the tank 10 are the customary supporting bars 12, 13 for the cathode and anode rods 14, 15, respectively. The free ends of the rods 14, 15 bear upon the bar 13 and the other ends of the rods 14, 15 are provided respectively with hook members 16, 17 which engage upon metallic conducting rods 18, 19, respectively, which carry the current, as usual. The cathodes, diagrammatically indicated in Fig. 2, and numbered 20 are suspended by the usual hook-members 21 from the rods 14; and the anodes 22 are suspended by customary hook-members 23 from the anode rods 15. I do not claim that there is anything new in the specific construction of the bars 12, 13, cathode and anode rods 14, 15 and hook members 21, 23, since these parts are individually of customary character. I employ a series of the rods 14, 15

and, as shown in Fig. 2, locate one of the anode rods 15 between each two of the cathode rods 14, this arrangement being preferred because it brings one anode 22 between the front faces of two cathodes on which it is desired to deposit. In Fig. 2 I show a series of three units each composed of an anode with one cathode at each side thereof, but of course as many units of this character as may be desired may be employed, in accordance with the size of the tank 10, and further so long as the more essential features of my invention are preserved I do not limit myself to the special arrangement of the anodes and cathodes illustrated, since with less advantage it is obvious that one anode may be employed for each cathode, instead of, as I illustrate, one anode for two cathodes. I would call attention to the fact, however, that in the most efficient practice of my invention the cathodes and anodes must be independent of and separated from each other in series, that they must be suspended vertically, that they must be submerged in the electrolyte and that there must be adequate free spaces at the bottom, top and side edges of the cathodes and anodes for that character of circulation of the electrolyte which permits of the use of a more highly ionized solution or electrolyte than it has heretofore been thought possible to employ and assures the sound deposition of the metal (copper or nickel) at greater speed than has heretofore been thought possible or accomplished; and all this without increasing the electro-motive force. It may be seen on reference to Fig. 2, that the cathodes and anodes are submerged and vertical and separated from and independent of each other, and on reference to Fig. 3 it may be seen that abundant free space is provided between the bottom and side edges of the cathodes and anodes and the bottom and sides of the tank.

Upon or adjacent to the bottom of the tank 10 I provide a set of piping, preferably lead, comprising pipe sections 24 extending along the inner lower edges of the sides of the tank, pipe sections 25 extending along the lower inner edges of the ends of the tank and being in communication with the pipe sections 24 and transverse perforated pipe sections 26 connecting the aforesaid pipe sections 24. The pipe sections 25 are connected by vertical piping 27 with other piping 28 leading from any suitable source of supply, not shown, of air under pressure. The pipe sections 24, 25 are not perforated and all of the pipe sections 26 are perforated and supplied with air under pressure from the pipe sections 24, and it is my purpose that the pipe sections 26 shall be supplied with a substantially constant volume of air under uniform pressure, so that the air issuing from the perforations in said pipe sections 26 may act with uniformity on the electrolyte 11. The fact that the pipe sections 24, 25, 27 are imperforate, permits me to discharge air under adequate pressure and in sufficient quantity for the purposes of my invention through the perforations in the pipe sections 26.

An important feature of my invention is that the pipe sections 26 are so disposed with respect to the locations for the anode and cathode rods 14, 15 that, as shown in Fig. 2, the air issuing from the perforations in the pipe sections 26 set up upward currents of the electrolyte between the cathodes and anodes. I preferably locate the pipe sections 26 so that in the arrangement of the anode and cathode rods and the anodes and cathodes suspended by them, said pipe sections 26 shall be slightly offset from the vertical plane of the faces of the cathodes on which the deposit is to take place, said pipe sections 26 thus being nearer to the cathodes than to the anodes, and this arrangement I deem highly desirable so as to obtain a greater agitation or a greater movement of the electrolyte along the cathode surfaces than along the anode surfaces. The more or less impoverished or exhausted electrolyte is naturally at or adjacent to the cathode surfaces, and for this reason I so dispose the pipe sections 26 that the air forcibly issuing from the perforations thereof may act against the electrolyte in close proximity to the cathode surfaces, said air operating to move the more or less impoverished or exhausted electrolyte from the front faces of the cathodes and causing the same to pass over the cathodes and to the back thereof or to the spaces holding electrolyte which is in a less impoverished or exhausted state, whereby the electrolyte which has moved along the cathode surfaces becomes renewed and the electrolyte at the back of the cathodes is caused to flow up in between the cathodes and anodes and be efficient in the process being carried out.

My invention, regardless of the special character of the piping at the bottom of the tank, does, in respect to the perforations through which the air is forced, conform to the arrangement of the anode and cathode rods, the feature of the invention, regardless of the special piping, being that the air shall issue through a series of perforations directing it upwardly betwen the anodes and cathodes and preferably more closely along the front faces of the cathode than against the adjacent faces of the anodes, so that there may be a constant upward flow of the electrolyte along the front faces of the anodes, this flow or movement carrying away the partly exhausted or impoverished solution and replacing it with those parts of the solution which have not become so nearly exhausted or impoverished, and the

constant change in the solution due to its agitation and flow, rendering the solution substantially uniform, since as portions of the the solution become exhausted and move upwardly and over to the back of the cathodes, such portions become renewed by their intermingling with other portions of the solution.

I provide for a forcible discharge of the air from the perforation in the air pipes so that there may be a decided agitation of the electrolyte between the cathodes and anodes, and I maintain the discharge of the air from said perforations as nearly constant as possible so that there may be uniformity of movement of the electrolyte in an upward direction along the front faces of the cathodes. I have found from practical experience that with the use of my invention I am enabled to use a more highly ionized electrolyte or solution than has been possible by the methods heretofore practised, and in consequence thereof I am enabled to effect the deposition of the metal (copper or nickel) more rapidly than has been possible heretofore, and I accomplish the deposition of the metal in a very efficient and satisfactory manner, the deposition being uniform and of sound formation. I could not employ my highly ionized solution or electrolyte except for my arrangement of piping for the discharge of the air under pressure in sufficient volume and in proper location to effect the constant and adequate circulation of the solution, and this circulation is so effected as not to disturb the proper deposition of the metal on the cathodes or to cause the re-distribution of the sludge from the anodes into those portions of the solution designed for depositing on the cathodes.

In the modification shown in Fig. 4, 30 indicates the supply pipes for air under pressure, 31 a non-perforated pipe to extend along the edges of the bottom of the tank, and 32 longitudinal perforated pipes connecting the end members of the piping 31. The perforations in the pipes 32 discharge upwardly between the cathodes and anodes and are arranged to imitate, as far as possible, the action of the perforated pipes shown in Fig. 1. Piping arranged as shown in Fig. 4 may be utilized to carry out my invention and effect the upward movement of the solution along the front faces of the cathodes by means of sheets of air bubbles, but it will be observed that in the arrangement shown in Fig. 4 a larger number of pipes 32 must be employed than the pipes 26 required in the arrangement shown in Fig. 1.

What I claim as my invention and desire to secure by Letters Patent, is:

1. Apparatus of the character described for electroplating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof.

2. Apparatus of the character described for electroplating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, the vertical plane of the air-outlets being closer to the plane of the front face of the cathodes than to the adjacent face of the anodes.

3. Apparatus of the character described for electroplating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, and said piping comprising a series of transverse perforated pipes disposed between the vertical planes of the cathodes and anodes.

4. An apparatus of the character described for electro-plating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports

the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, and said piping comprising a series of transverse perforated pipes disposed between the vertical planes of the cathodes and anodes and located closer to the plane of the front face of the cathodes than to the adjacent face of the anodes.

5. Apparatus of the character described for electro-plating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and means at the bottom of said tank below said anodes and cathodes and disposed between the vertical planes of the same for supplying air under pressure and in adequate quantities for acting on the electrolyte between the anodes and cathodes and keeping said electrolyte in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof.

6. Apparatus of the character described for electro-plating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and means at the bottom of said tank below said anodes and cathodes and disposed between the vertical planes of the same for supplying air under pressure and in adequate quantities for acting on the electrolyte between the anodes and cathodes and keeping said electrolyte in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, said air supplying means being disposed closer to the plane of the front face of the cathodes than to the adjacent face of the anodes.

7. Apparatus of the character described for electro-plating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, and said piping comprising a line of imperforate pipe extending along the lower inner edges of the sides and ends of the tank, air supplying pipes connected therewith and perforated pipes communicating with the pipe system and having the aforesaid outlets through which the air is discharged.

8. Apparatus of the character described for electro-plating, comprising a tank for the electrolyte, anode and cathode supports, with their current connections, means for suspending from said supports the anodes and cathodes in vertical position submerged in said electrolyte and free of the inner walls of said tank and spaced apart, and piping at the bottom of said tank below said anodes and cathodes and affording a series of outlets of sufficient area for the discharge of adequate quantities of air upwardly through the spaces separating the cathodes and anodes for acting on the electrolyte and keeping the same in constant upward circulation and moving the impoverished electrolyte from the cathode surfaces and causing the same to pass over to the back thereof, and said piping comprising a line of imperforate pipe extending along the lower inner edges of the sides and ends of the tank, air supplying pipes connected therewith and perforated pipes communicating with the pipe system and having the aforesaid outlets through which the air is discharged and being disposed closer to the vertical plane of the front face of the cathodes than to the adjacent faces of the anodes.

Signed at New York city, in the county of New York and State of New York, this 26th day of September A. D. 1916.

AUGUST LEUCHTER.

Witnesses:

ARTHUR MARION,

CHAS. C. GILL.