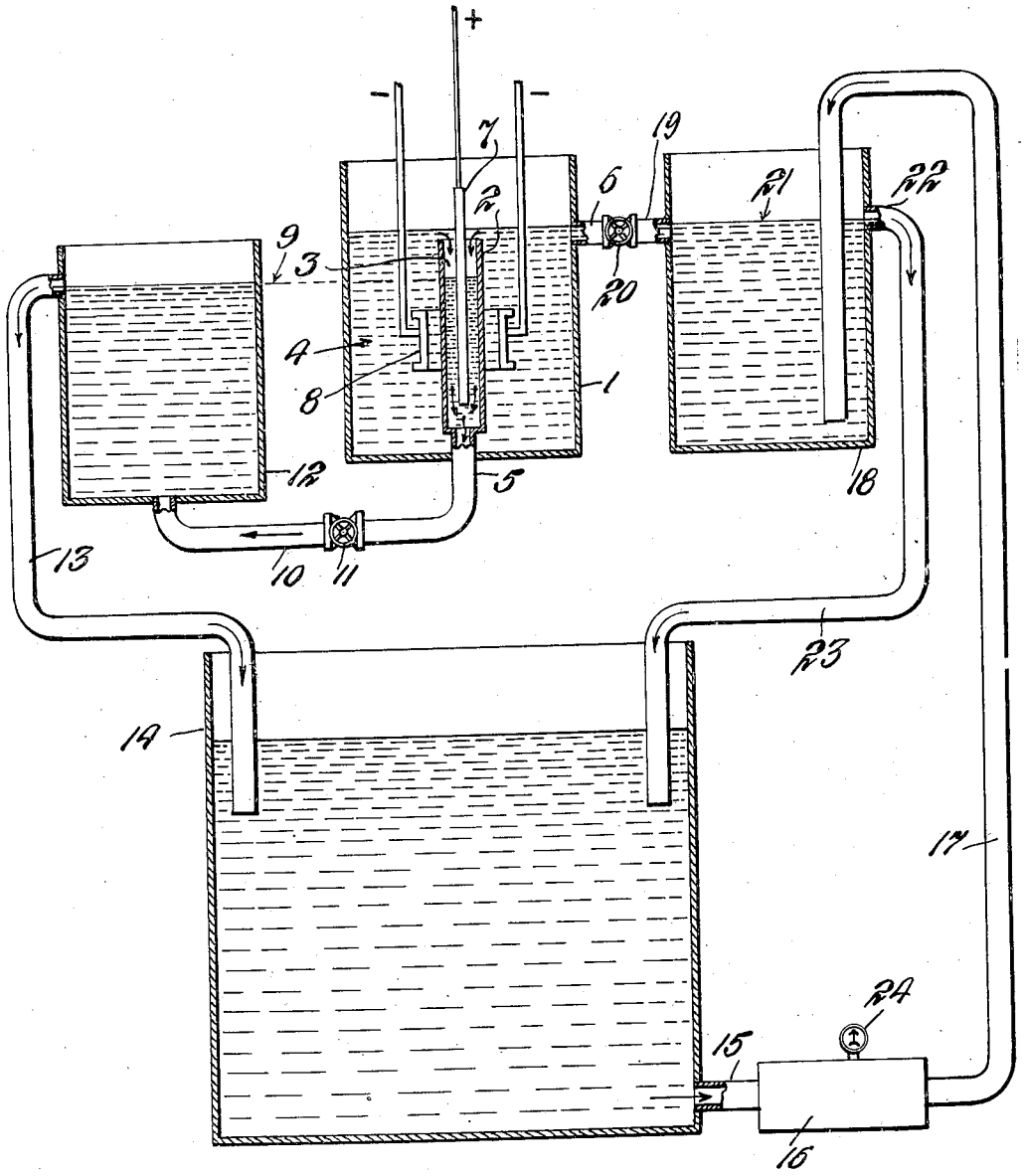
Nov. 8, 1949 A. E. THURBER 2,487,399

ELECTROPLATING APPARATUS

Filed Sept. 29, 1943



INVENTOR.
ARTHUR E. THURBER
BY
Sawyer & Kennedy
ATTORNEYS

Patented Nov. 8, 1949 2,487,399

UNITED STATES PATENT OFFICE

2,487,399

ELECTROPLATING APPARATUS

Arthur E. Thurber, Sherrill, N. Y., assignor to Oneida Ltd., Oneida, N. Y., a corporation of New York

Application September 29, 1943, Serial No. 504,220

2 Claims. (Cl. 204—264)

1

This invention relates to electroplating.

It is an object of the invention to provide an improved purifying system for electroplating apparatus.

It is a further object of the invention to provide an improved circulating and filtering system by means of which the harmful effects of anodic particles on the deposit may be eliminated.

The harmful effects of suspended solids, such as anodic particles, upon electroplating have long been recognized and it has been proposed to remedy this condition by continuous or intermittent filtration or by the use of bags surrounding the anodes.

Where bags are used the electrolyte within the bag becomes very high in dissolved metal and low in the chemicals which are required for good anode corrosion, thus interfering with the proper plating action. In addition, all the various impurities whether in solution or in colloidal or solid suspension, build up concentration within the bag and then seep through and contaminate the entire electrolyte, resulting in inefficiency and poor quality deposits.

Ordinary filtering procedures likewise fall short of the intended purpose. Continuous filtration, as heretofore practiced, never completely removes the particles from the electrolyte and due to the disturbance caused by the filtering circulation, may stir up particles which would otherwise settle out and thus produce a condition which is worse than where no filtering is employed. Intermittent filtration, as where the entire electrolyte is removed and is returned after filtration, obviously causes undesirable interruptions in the plating operation and can produce a really clean electrolyte only immediately after the filtering has been done, so that after a very short time the anode particles will have formed and the bath will no longer be free of such particles.

According to the present invention, a novel form of circulation is employed, the plating tank being divided into an anodic cell and a cathodic cell separated by a porous membrane or partition and a continuous circulation between the anodic cell and a filtering system is provided, so that the electrolyte within the anodic cell is kept in the most desirable condition at all times, while no electrolyte is introduced into the cathodic cell until after it has been filtered.

The invention also contemplates the provision of a convenient and efficient circulating and filtering system in conjunction with such a plating tank, by means of which the desired flow relations are readily maintained.

The drawing illustrates schematically an apparatus embodying, in a preferred form, the invention and shows by way of example a form of apparatus which has been employed in silver plating bearings. As will be understood from the following description, however, the invention is equally applicable to plating generally, requiring only suitable modification in the shape of the tank and its component elements for dealing with articles and anodes of various shapes.

2

The plating tank, which is designated generally by the numeral 1, is divided by a porous partition or membrane 2 into an anodic cell 3, enclosed within the membrane and a cathodic cell 4 outside the membrane and surrounding the anodic cell. An outlet connection 5 leads out of the tank 1 from the bottom of the anodic cell 3 and an inlet connection 6 leads into the tank adjacent the top of the cathodic cell 4. An anode 7 is placed within the anodic cell 3 and the cathodes, or articles to be plated, 8, are placed within the cathodic cell 4.

By means of the circulating system, described more fully below, the electrolyte is pumped into the tank 1 through the inlet 6 to a level slightly above the partition wall or membrane 2 so that it continuously overflows from the top of the cathodic cell into the anodic cell. Electrolyte is continuously withdrawn through the outlet 5 from the anodic cell so as to maintain a suitable level therein, as indicated by the numeral 9, thus maintaining a continuous circulation, and further, where desired, maintaining a slightly lower hydrostatic pressure within the anodic cell so as to produce a tendency for electrolyte to flow from the cathodic cell into the anodic cell, rather than reversely.

The circulating system associated with the plating tank 1 comprises a line 10 containing a valve 11, which passes from the outlet 5 to the bottom of an overflow tank 12. The overflow of the tank 12 is arranged so as to maintain electrolyte therein at the level 9, previously mentioned, in this way controlling the electrolyte level within the anodic cell 3. Tank 12 discharges in turn through a line 13 into a storage tank or reservoir 14 from which the electrolyte is withdrawn through an outlet 15 by a pumping and filtering unit 16 from which it is delivered through the line 17 toward the bottom of a second overflow tank 18. The tank 18 communicates through an outlet 19 and valve 20 with the inlet 6 of the plating tank 1 and in this way the level 21, within the cathodic cell 4 is maintained, being substantially the same level 21 as exists in the overflow tank 18. Tank 18 has an overflow 22, preferably positioned at a slightly higher level than the outlet 19, and which communicates through the line 23 with the filtration reservoir 14, previously referred to, and serves to maintain the desired level of electrolyte within the tank 18.

As will be observed, the line 15, pumping and filtering unit 16, line 17, tank 18, overflow 22, line 23 and reservoir 14 constitute a bypass through which electrolyte may be pumped continuously

and at varying rates without affecting the amount or regularity of circulation of electrolyte through the tank 1. The circulation through this bypass system may be gauged and controlled according to a pressure gauge 24 associated with the pumping and filtering unit 16.

In this way the filtering action may be controlled largely independently of the quantity of electrolyte which is circulated through the plating tank and is adjusted so as to keep the electrolyte free from suspended anodic particles, the circulation through the plating tank being controlled by the levels in the overflow tanks 18 and 12 rather than by the rate of circulation through the unit 16. The valves 11 and 20 do not require adjustment in the normal operation of the bath but are provided for purposes of isolating the plating tank when desired for any reason.

While but a single plating tank 1 has been shown in association with the circulating system, a plurality of tanks may be connected through suitable manifolds with the overflow tanks 18 and 12, the action in all tanks being similar and in this case it is necessary only to provide piping in the circulating system which is of adequate diameter to take care of the increased amount of circulation required for a larger number of plating tanks.

The circulation within the plating tank itself is uniformly from the cathodic cell to the anodic cell so that no anode particles can pass into the cathodic cell. The cathodic cell is supplied at all times with filtered electrolyte from the tank 18, and so also is the anodic cell so that no opportunity is given for the building up of suspended particles within the anodic cell. Where desired, the anode 7 may be rotated so as to provide for agitation to obtain greater anode corrosion. By placing a screen at the bottom of the porous membrane 2, shot anodes may be used. Agitation may be applied to the cathode 8 also, where desired.

The separating wall or membrane 2 dividing the cathodic and anodic cells may be made of any suitable material which possesses the desired characteristics of non-conductivity, a sufficiently fine structure to prevent passage of anodic particles and sufficient porosity to allow sufficient flow of electric current. Such materials as cloth, paper, ceramics or plastics are suitable and the specific material employed will of course depend upon the specific plating being done. In silver plating on bearings, with the usual cyanide electrolyte solution, either a membrane of cloth supported by a non-electrical framework or ceramic materials have been found suitable. A composite membrane formed by placing finely divided material, such as diatomaceous earth between two layers of cloth or the like may also be employed.

The circulating system in addition to providing for filtration permits also convenient analysis and maintenance of the bath, as the bath may be tested and adjusted within the storage tank 14. Likewise, where temperature control is of importance and where, as is usual, the room temperature is fairly stable, the temperature of the entire electrolyte may readily be maintained at the desired value by placing a heat exchanger at any point in the circulating line. Inasmuch as the circulation through the inlet 6 will be constant and with a given number of plating tanks

in operation, the circulation through the line 19 will also be constant, the heat exchanger may conveniently be located at either of these points so as to deliver the electrolyte at the desired temperature directly to the plating tanks. While the invention has been shown as applied merely to filtration, it will be understood that any desired purifying process may be carried out in the course of the circulation.

What is claimed is:

1. Electroplating apparatus comprising a cathodic cell, an anodic cell, a porous membrane separating the said cells, means for circulating electrolyte to and from said anodic cell and purifying the same during such circulation, comprising an outlet connection from the bottom of the said anodic cell and a first tank for receiving electrolyte from said anodic cell and having an overflow to maintain the level in said tank and said anodic cell below the top of said membrane, a second tank for discharging electrolyte into said cathodic cell and having an overflow to maintain the level in said second tank and cathodic cell above the top of said membrane for causing overflow from said cathodic cell into said anodic cell, and means for maintaining a flow of electrolyte from said first tank to said second tank.

2. Electroplating apparatus comprising a cathodic cell, an anodic cell, a porous membrane separating the said cells, means for circulating electrolyte to and from said anodic cell and purifying the same during such circulation, comprising an outlet connection from the bottom of the said anodic cell and a first tank for receiving electrolyte from said anodic cell and having an overflow to maintain the level in said tank and said anodic cell below the top of said membrane, a second tank for discharging electrolyte into said cathodic cell and having an overflow to maintain the level in said second tank and cathodic cell above the top of said membrane, a storage tank for receiving electrolyte from said overflows and means for withdrawing electrolyte from said storage tank, filtering the same and discharging the filtered electrolyte into the said second tank.

ARTHUR E. THURBER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
512,266	Andreoli	Jan. 9, 1894
686,395	Dessolle	Nov. 12, 1901
814,864	McDonald	Mar. 13, 1906
871,161	Chaplin	Nov. 19, 1907
874,064	Gibbs	Dec. 17, 1907
961,945	Finlay	June 21, 1910
1,371,699	Linder	Mar. 15, 1921
1,395,827	Hybinette	Nov. 1, 1921
1,587,438	Tainton	June 1, 1926
1,945,107	Cain	Jan. 30, 1934
1,980,381	Cain	Nov. 13, 1934
2,014,148	Sievert	Sept. 10, 1935
2,288,503	Weaver	June 30, 1942

FOREIGN PATENTS

Number	Country	Date
18,390/29	Australia	Aug. 30, 1929