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APPARATUS FOR ELECTROPLATING

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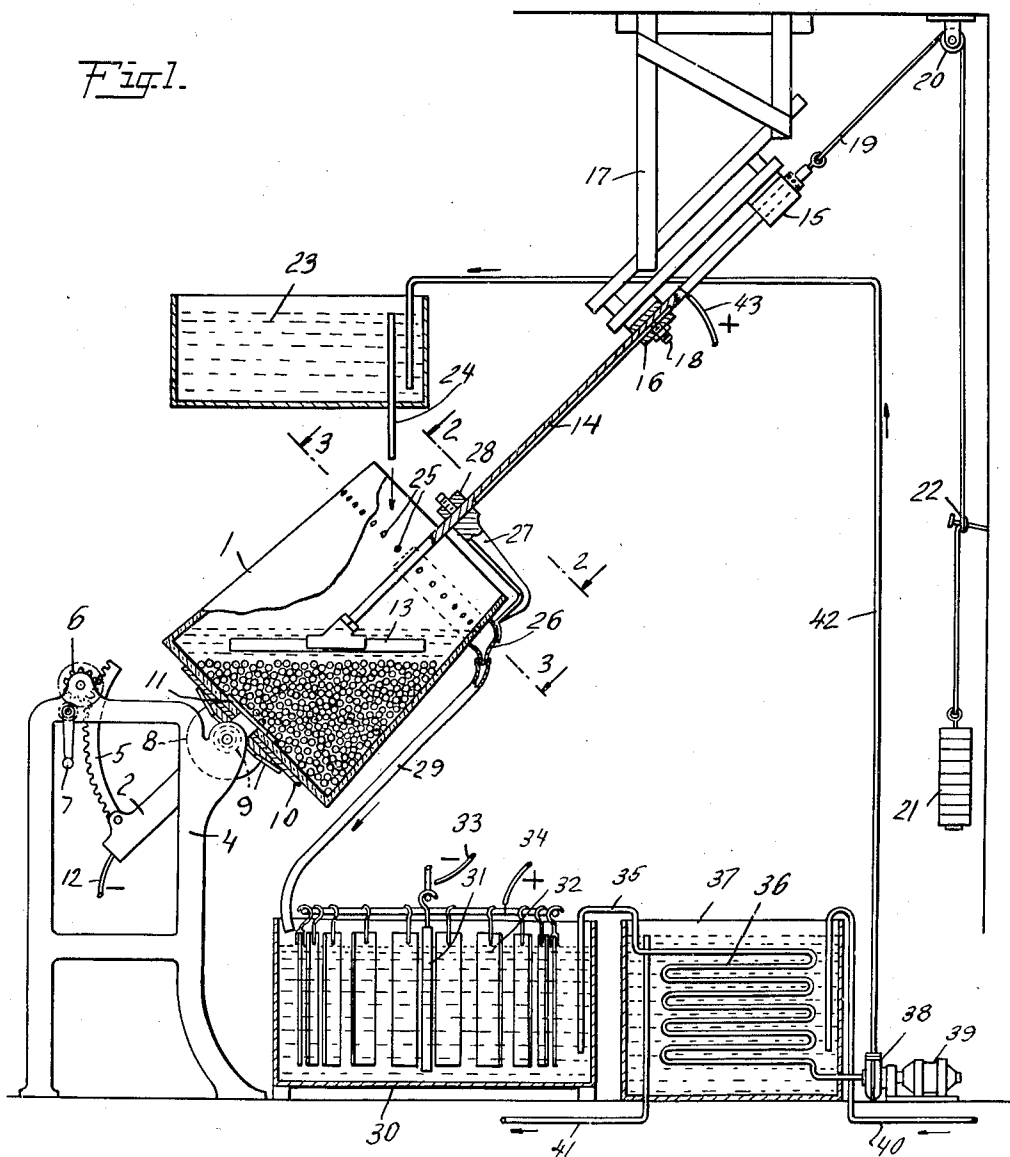


Fig. 2.

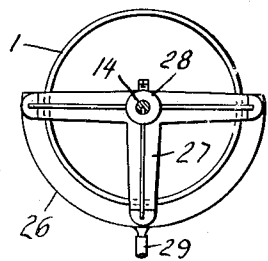
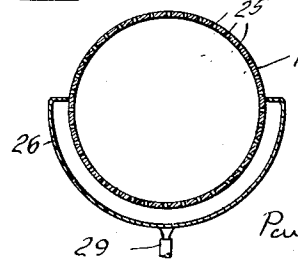


Fig. 3.



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APPARATUS FOR ELECTROPLATING

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This invention relates to processes of electro-plating and more particularly to a process of electro-plating small articles.

The usual method of plating small articles is by means of an electrolytic bath in a tumbling barrel. Two types of barrels have heretofore been employed. In one type of horizontal rotating perforated barrel of non-conducting material is employed. This barrel is completely immersed in the electrolyte and the current is conveyed to the material being plated by means of conductors embedded in the wall of the barrel and projecting into the interior thereof.

Another type of rotating barrel is one of insulating material that is arranged at an angle and is not provided with perforations. The work to be plated and the solution are both placed in the barrel. The anode does not rotate but is easily removable and the cathode connection is made by means of metal projections through the bottom of the barrel. Each of these methods of electro-plating possess certain disadvantages and in particular are subject to certain limitations which make them impractical for use in plating small articles where a heavy plate is desired. As an illustration, I will describe my invention as applied to the plating of shot although it will be apparent to one skilled in the art that the invention may be employed with equal advantage in the plating of other small articles. In plating shot, or other small articles having an average diameter of about $\frac{1}{8}$ " or less where an unusually heavy plate is desired, such as a plate of about 0.0005" or greater, the current required and time necessary to carry on such plating operation in a tumbling barrel using periodically replenished solution, renders the use of such apparatus impracticable. For instance, 1 pound of such articles will have a surface to be plated of approximately 1 square foot and would require the deposition of .025 pounds of metal or $2\frac{1}{2}$ pounds for a 100 pound batch of work. The volume of 100 pounds of such articles is small, approximately $\frac{1}{3}$ rd of a cubic foot or the equivalent of 3 gallons of liquid. To deposit $2\frac{1}{2}$ pounds of metal, such as copper from a cupric solution, would re-

quire at least 900 ampere hours of current. The maximum current that can be employed in present processes is about 100 amperes. Therefore, carrying out a plating process of this character in the apparatus heretofore used for this purpose to obtain a heavy plating of the character described above would require about 9 hours to complete the work.

In the present invention I provide a method whereby higher current densities may be maintained and the plating operation completed in a smaller period of time by continuously passing the plating solution through the plating barrel and then through an apparatus for replenishing the solution and controlling its temperature. By means of my invention rapid depletion of the solution with consequent gassing, over-heating and imperfect plating is avoided. My invention, therefore possesses all the advantages of plating according to the two processes described above and eliminates the disadvantages of each.

In the accompanying drawing, I have shown an apparatus capable of use in practicing the process and forming a part of the invention. In the drawing,

Fig. 1 is a side elevation of the apparatus, parts being shown in section;

Fig. 2 is a sectional view on line 2—2 of Fig. 1 looking in the direction of the arrows and showing the plating barrel in end elevation; and

Fig. 3 is a similar view on line 3—3 of Fig. 1.

Referring to the drawing the reference numeral 1 designates the plating barrel which is preferably formed of insulating material and which is mounted on a supporting member 2 adapted to swing about a drive shaft 3 as an axis. The drive shaft is supported in suitable bearings in a stand 4 and the sleeve 2 is provided with a segmental rack 5 meshing with an adjusting gear 6 controlled by a hand crank 7. This apparatus permits the barrel to be tilted for dumping and permits it to be arranged at any desired angle during the operation of the apparatus. The shaft 3 is driven from any suitable source of power by means of a gear or pulley 8 and drives

the barrel through suitable bevel gears 9, one of which is mounted on the shaft and one of which is carried by a plate or disc 10 connected to the bottom of the barrel to rotate the barrel with the shaft. Cathode 11 is arranged within the barrel and is connected to a suitable source of current by a lead wire 12 extending through the sleeve 2.

The upper end of the barrel is open and is adapted to receive an anode 13 mounted on a supporting arm 14 which extends through suitable guides 15 and 16 carried by a supporting frame or structure 17. The position of the anode may be adjusted by means of a set screw 18 in the lower guide 16. The end of the rod 14 is connected to a rope or cable 19 passing over a guide pulley 20 and having a counter-weight 21 on its opposite end. When the anode has been adjusted the rope may be looped or coiled about a nail 22 or other fastening element as shown.

The important feature of the present invention resides in the provision of means whereby an electrolyte of large volume as compared to the work is employed and this electrolyte is continuously circulated through the plating barrel and replenished. As shown a reservoir 23 is arranged above the barrel and is provided with an over-flow pipe 24 communicating with the barrel. The barrel is provided with a series of perforations 25 which are circumferentially arranged at a desired point near the top of the barrel to maintain a constant level of electrolyte therein. A trough 26 partially surrounds the barrel in alignment with these perforations and this trough is supported by an arm 27 having a sleeve or bearing 28 on its opposite end which is adapted to surround the rod 14. A hose or other suitable conduit 29 is arranged to the outlet of the trough and communicates with a replenishing tank 30. The replenishing tank is provided with a cathode 31 and a number of anodes 32 of the same metal as the metal being deposited on the work in the plating barrel. The electrodes of the replenishing tank are connected to a suitable source of current by lead wires 33 and 34. As shown in the drawing, the ratio of anode surface to cathode surface in the replenishing tank is large so that the metal content of the electrolyte will be maintained as high as possible.

A pipe 35 communicates with the interior of the replenishing tank and also with a coil 36 arranged in a cooling tank 37. Beyond the cooling tank the coil is connected to a pump 38 driven by an electric motor 39 or other source of power. Cooling liquid may be delivered to the cooling tank through the pipe 40 and the over-flow drained therefrom through a pipe 41. The outlet side of the pump is connected to a pipe 42 which communicates with the reservoir 23.

It will be apparent from the foregoing description of the apparatus that I have provided means whereby the volume of electrolyte employed is very large as compared to the amount contained in the plating barrel. In actual practice I maintain a ratio of at least 50:1 between the entire volume of the electrolyte and the amount contained in the plating barrel, but the invention is, of course, not limited to these specific figures but includes any modification thereof wherein the electrolyte solution is circulated through the plating barrel, replenished and then returned thereto. In practicing the process the plating barrel is rotated at such a speed as will keep the work being plated constantly mixing with itself. The anode 13 is fixed in a position just above the work and parallel to it. The electrolyte is maintained at a constant level above the lower surface of the anode by means of the perforations 25 in the side wall of the barrel through which it over-flows. The over-flow is then conveyed to the replenishing tank where the electrolytic action replaces the metal in the solution and it is then sent through the coil 36 and returned by the pump 38 to the reservoir 23. Cooling coil 36 is provided so that the temperature of the electrolyte may be controlled, if necessary or desirable. Fresh electrolyte is therefore constantly flowing into the plating barrel to replace the over-flow of the spent electrolyte through pipe 24 and the electrolyte is thus maintained in such condition that high current density may be used without gassing, over heating or imperfect plating as would occur if similar current density were employed in the ordinary type of tumbling barrel wherein the electrolyte is replaced or replenished periodically. The time necessary in obtaining a heavy plate on small articles can thus be materially reduced and more uniform and better plating obtained.

While the particular manner of mounting the anode may be varied without departing from the invention, attention is called to the fact that the anode can be quickly removed to permit dumping the contents of the barrel when the plating operation is completed by loosening the set screw 18 and moving the rod 14 upwardly. When the anode is removed from the barrel the counter-weight 21 will retain it in raised position until it is again manually adjusted to its proper position within the barrel when another plating operation is to be carried out. With the anode removed from the barrel the barrel can be tilted on its pivot by means of its gear 6 and segmental rack 5 by operating the crank 7.

I claim:

1. Apparatus for electro-plating comprising a rotating barrel, an anode and a cathode arranged in said barrel, the wall of said bar-

rel being provided with perforations, means
for delivering electrolyte to said barrel,
means for catching the over-flow of electro-
lyte passing through said perforations, and
means for returning the electrolyte to said
5 barrel.

2. Apparatus for electro-plating compris-
ing a rotating barrel, an anode and a cathode
arranged in said barrel, means for delivering
electrolyte to said barrel, the wall of said
10 barrel being provided with perforations to
permit the over-flow of electrolyte, a trough
surrounding said barrel to receive the over-
flow of electrolyte, and means for returning
the over-flow of electrolyte to said barrel.

15 In testimony whereof I affix my signature.
PHILIP A. SMITH.

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