No. 712,153. Patented Oct. 28, 1902.

C. J. REED.

METHOD OF AND APPARATUS FOR ELECTRODEPOSITION OF METALS.

(Application filed Aug. 1, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

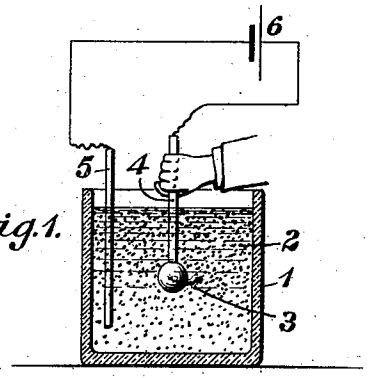



Fig. 2.

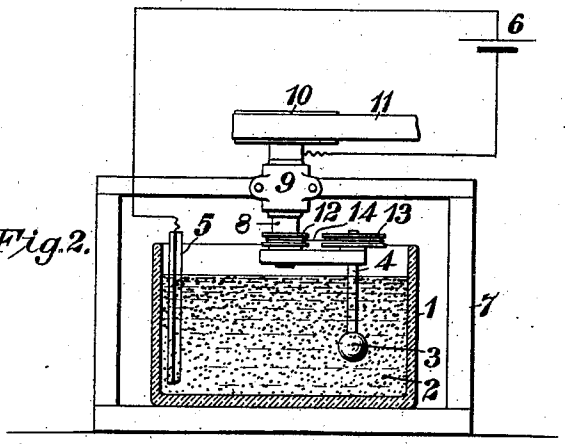



Fig. 3.

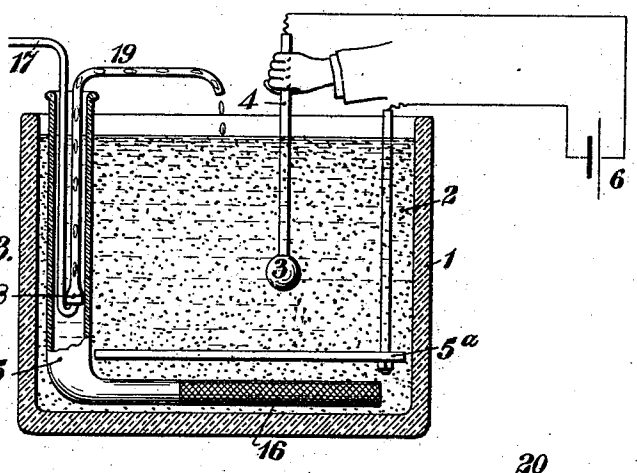
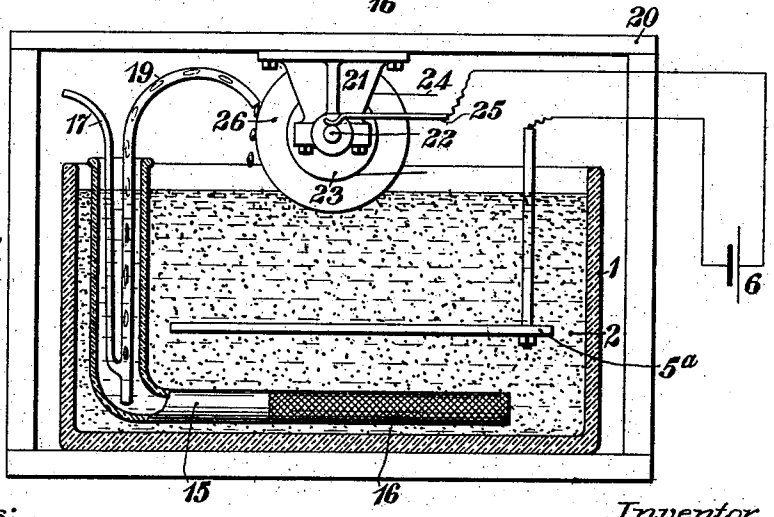



Fig. 4.




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(No Model.) 2 Sheets—Sheet 2.

Fig. 5.

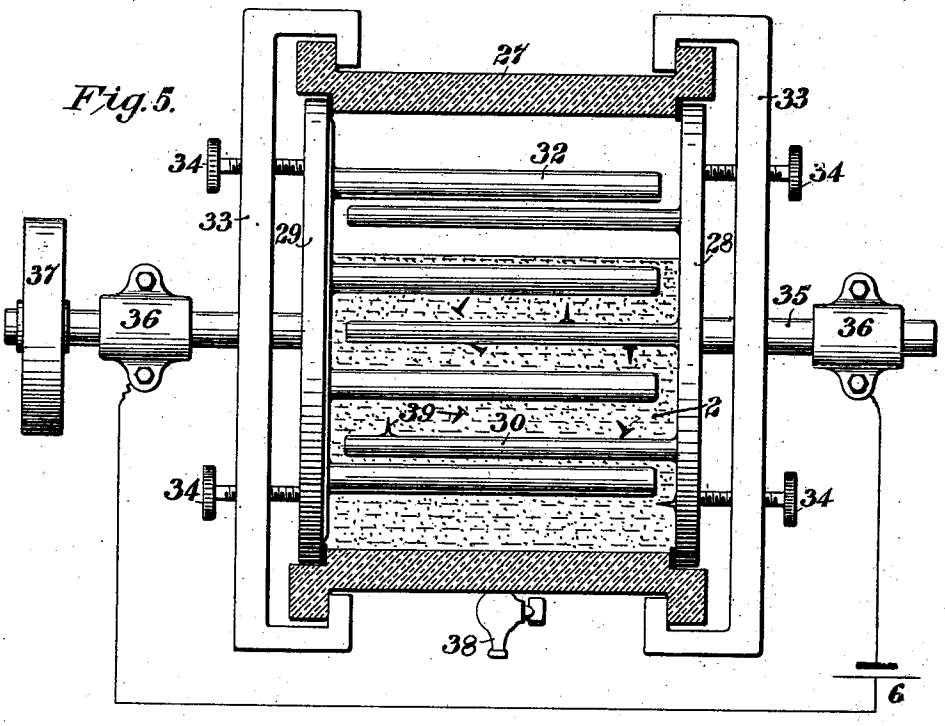
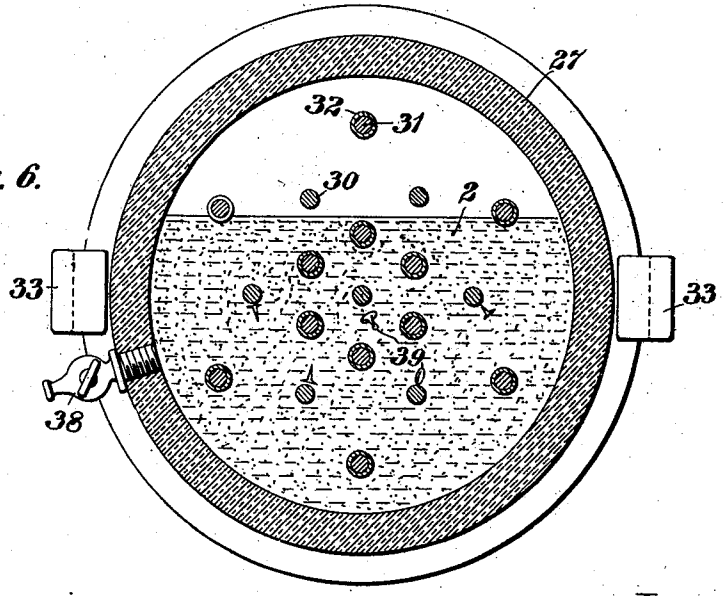



Fig. 6.




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# UNITED STATES PATENT OFFICE.

CHARLES J. REED, OF PHILADELPHIA, PENNSYLVANIA.

## METHOD OF AND APPARATUS FOR ELECTRODEPOSITION OF METALS.

SPECIFICATION forming part of Letters Patent No. 712,153, dated October 28, 1902.

Application filed August 1, 1901. Serial No. 70,534. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Electrodeposition of Metals, of which the following is a specification.

My invention relates to the electrodeposition of metals; and it has for its object to provide a means whereby electric conducting-bodies of any suitable form and material may be provided with uniform, hard, and non-porous coatings of any desired metal by means of electrolytic action and whereby such coatings are not only uniformly distributed, but also burnished or polished without the use of any other implement or burnishing or polishing material except that embodied in the electrolytic apparatus.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a view, partially diagrammatic and partially in section, of a simple form of apparatus adapted for practicing the invention. Figs. 2 and 3 are similar views of modified forms of apparatus. Fig. 4 is a view similar to Figs. 1, 2, and 3, but illustrating means for electroplating a cylinder. Fig. 5 is a view, partially in elevation and partially in section, of an apparatus suitable for electroplating a considerable number of small articles at the same time. Fig. 6 is a transverse sectional view of the apparatus shown in Fig. 5.

My invention consists, primarily, in the employment of a granular polishing or abrading material, in conjunction with the liquid electrolyte, and in moving the article to receive the electrolytic deposit through the mixture of electrolyte and abrading material during the depositing operation, so that the coating will be hard and compact in structure and uniformly distributed, and the surface of which will be polished and in condition for service.

In Fig. 1, 1 is a suitable tank or receptacle which contains a mixture 2 of a suitable electrolyte and granular polishing or abrading material—such, for example, as sand. The article upon which the deposit is to be made is here indicated as a ball 3, which is attached to a rod 4, the latter being grasped by the hand and moved about sufficiently to effect abrasive engagement between the object 3 and the grains of sand in the electrolyte. The anode 5 may be of any suitable form and of such metal as it is desired to deposit upon the surface of the object 3. The source of current 6, the poles of which are respectively connected to the cathode-rod 4 and the anode 5, which is here indicated as a battery, may obviously be a dynamo-electric generator.

In Fig. 2 the receptacle 1 is supported by a frame 7, which also supports a shaft 8, mounted in suitable bearings 9. This shaft is rotated by means of a pulley 10 and a belt 11 from any suitable source of power (not shown) and transmits motion through pulleys 12 and 13 and a belt 14 to the rod 4 for the purpose of moving the object 3 in contact with the sand or other polishing material to secure the polishing action desired.

In Fig. 3 the receptacle 1 contains, in addition to the mixture of electrolyte and polishing material, an object 3 to be plated and an anode $5^a$, a bent tube 15, one arm of which is arranged horizontally and has an open-work or sieve construction, as indicated at 16, and the other arm of which projects upward to a point above the mixture 2. Projecting into the vertical portion of the pipe 15 is a smaller pipe 17, to which air or other gas may be supplied under pressure from any suitable source. The lower end of the pipe 17 projects into the bell-mouth 18 of another pipe 19, that also projects above the end of pipe 15 and is bent or curved so that the liquid electrolyte, which passes through the perforations 16 of the pipe 15, may be forced, by means of the air introduced through pipe 17, back into the receptacle 1 at the top.

In Fig. 4 the receptacle 1 contains a mixture 2, an anode $5^a$, a pipe 15, having the open-work or sieve construction 16 and provided with the air-pipe 17 and liquid-circulating pipe 19, all substantially as indicated in Fig. 3 and employed for the same purpose. In this case, however, the receptacle 1 and the other parts just enumerated are supported by a frame 20, having suitable brackets

21, in which is journaled a shaft 22, which is driven by a pulley 23 and a belt 24, connected to any suitable source of power. Electrical connection between the shaft 22 and the source of energy 6 is made by means of a brush 25. The body which receives the electrolytic deposit is here shown as a cylinder 26, that is mounted upon and is in electrical connection with the shaft 22 and is of such diameter that it projects into the mixture 2, and thus serves as the cathode to receive the deposit. As it is continuously rotated in contact with the mixture, the granular material polishes the surface in the same manner as has already been described in connection with the body 3 shown in connection with the preceding figures.

In Figs. 5 and 6 I have shown an apparatus that is adapted for simultaneously electroplating large numbers of small articles—such as tacks, buttons, articles of jewelry, &c.—at the same time, and it comprises a cylinder 27, two heads or ends 28 and 29, of conducting material, which are suitably insulated from each other and are respectively provided with rods 30 and 31, that project nearly the entire length of the cylinder and approximately parallel to its axis. The rods 31 are provided with insulating-sheaths 32, of porous material—such, for example, as textile fabric—and the two heads 28 and 29 are clamped to the cylinder 27 by means of bracket-arms 33 and set-screws 34. The apparatus thus far described is mounted upon a shaft 35, which is journaled in suitable bearings 36 and is provided with a pulley 37, to be driven by means of a belt from any suitable source of power, or the shaft may be rotated by hand, if desired, provided a suitable crank is supplied for that purpose. In order to withdraw any gas that may be generated in the cylinder, I provide a cock 38 of ordinary construction. The rods 30, which constitute the cathodes of the apparatus, may be of any suitable conducting material, and the rods 31, which constitute the anodes, should obviously be of such material as it is desired to deposit upon the surfaces of the articles to be treated by the apparatus. The mixture 2, of polishing or abrading material in granular form, and liquid electrolyte are contained in the cylinder, as is the case in the forms of apparatus previously described. The small articles 39 to be coated with an electrolytic deposit are placed in the cylinder, together with the mixture 2, of inert granular material and liquid electrolyte, and as the cylinder is rotated these articles will come into contact with the rods 30, and will thus become cathodes and receive the deposit dissolved from the rods 31, and at the same time the granular material mixed with the electrolyte serves to polish its surface.

I am aware that it has been proposed to employ metal in granular form as a polishing material in connection with electrodeposition of metals, as is set forth, for example, in British Patent No. 16,399, of August 15, 1891, granted to A. J. Boult, and I make no claim herein for apparatus embodying such material or involving the use of such material. A granular metal as set forth in the British patent above referred to upon coming into engagement with the cathode of the apparatus becomes itself a cathode, and thus receives the deposit which should be received by the article or articles treated. Furthermore, the only polishing effect which is possible under such conditions is that which is produced by the rubbing together of two pieces of the same metal, and this action, as is well known, results in little, if any, polishing action. On the other hand, by employing an inert or non-conducting granular material I am able to effect the desired result in a satisfactory manner.

Other forms of apparatus may obviously be employed to practice the invention, and I therefore desire it to be understood that my invention is not limited to specific apparatus except in so far as limitations may be imposed by the state of the art and specifically set forth in the claims.

I claim as my invention—

1. An electrolytic apparatus comprising a mixture of a liquid electrolyte and an inert or non-conducting granular substance in combination with two electrodes or sets of electrodes one of which receives the metallic deposit and is movable in the mixture.

2. An electrolytic apparatus comprising a mixture of liquid electrolyte and an inert or non-conducting granular substance, in combination with two electrodes or sets of electrodes located in said mixture and one of which receives the metallic deposit and means for producing relative movement between the last-named electrode or electrodes and the mixture.

3. An electrolytic apparatus comprising a mixture of liquid electrolyte and an inert or non-conducting granular substance in combination with two electrodes or sets of electrodes, a generator for supplying electrical energy to said electrodes, and means for producing relative movement between the cathode or cathodes and the mixture.

4. An electrolytic apparatus comprising a rotatable receptacle, and a mixture of liquid electrolyte, an inert or non-conducting granular substance and electrodes contained therein, and a source of electrical energy for supplying current to the electrodes.

5. An electrolytic apparatus comprising a rotatable receptacle containing a mixture of liquid electrolyte, an inert or non-conducting granular substance and electrodes which move with the receptacle and are supplied with current from a source of electrical energy.

6. An electrolytic apparatus comprising a rotatable receptacle having anodes project-

ing from one end and cathodes projecting from the other end, porous coverings for the anodes and a mixture of liquid electrolyte and an inert or non-conducting granular substance.

7. An electrolytic apparatus comprising a receptacle, a mixture of liquid electrolyte and an inert or non-conducting granular substance contained therein and means for producing a circulation of the electrolyte through the granular substance.

In testimony whereof I have hereunto subscribed my name this 24th day of July, 1901.

CHARLES J. REED.

Witnesses:
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