Oct. 16, 1934. W. M. COSTA 1,977,173

ELECTROLYTIC PRODUCTION OF POWDERED METALS

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Fig. 1

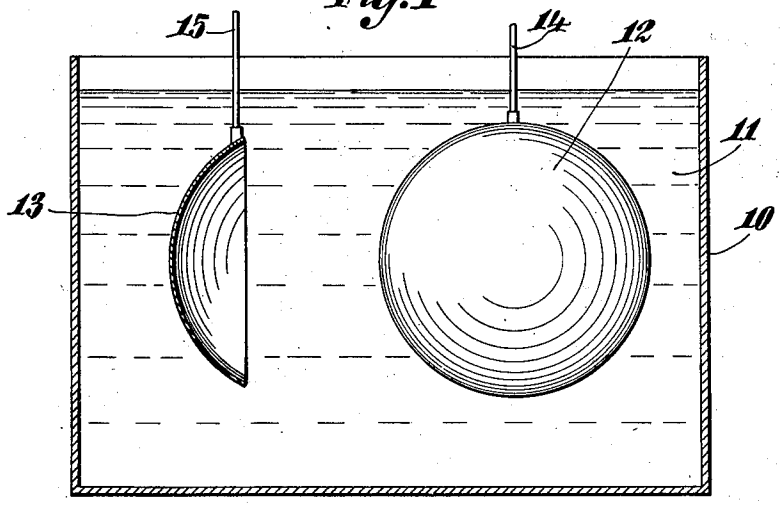
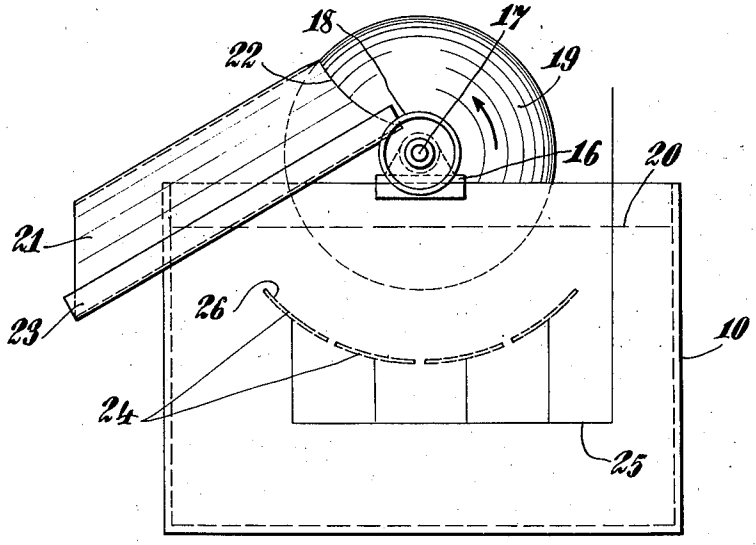


Fig. 2



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Fig. 3

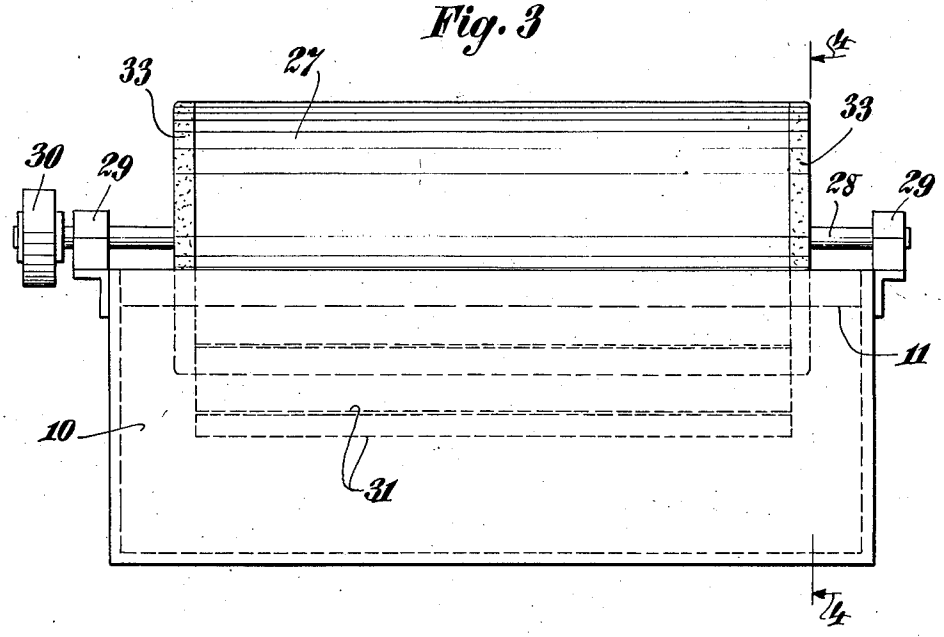
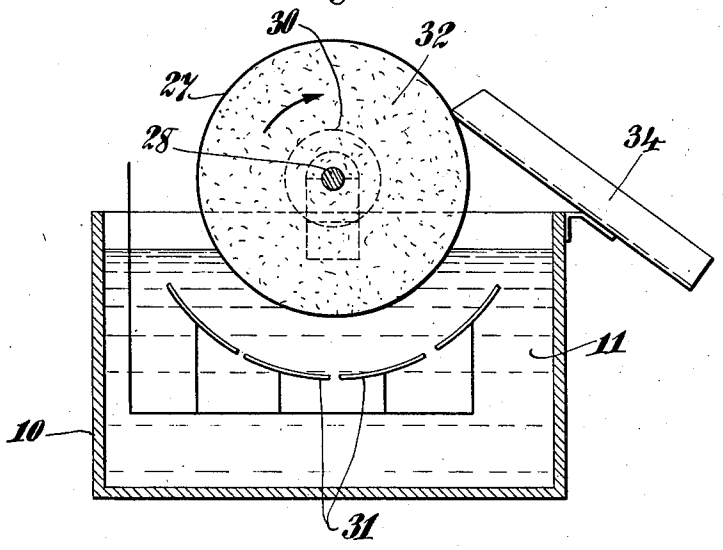


Fig. 4



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UNITED STATES PATENT OFFICE

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ELECTROLYTIC PRODUCTION OF POWDERED METALS

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Application April 11, 1932, Serial No. 604,393

3 Claims. (Cl. 204—5)

The present invention relates to electrolytic apparatus for depositing metal and embodies, more specifically, an improved apparatus for producing metal in powdered form electrolytically.

The apparatus now commonly used for producing metals electrolytically includes the use of anodes and cathodes which are immersed in a suitable electrolyte. An electric current is passed through the electrolyte by connecting the anodes and cathodes to a suitable current source in order that the deposition of metal may take place. One of the electrodes (either the positive or the negative) must be soluble. The particular electrode which is soluble depends upon the property of the metal to be deposited and such deposition will take place in powdered form upon the insoluble electrode.

The current density and the time of flow are factors which bear upon the size and grade of the metal deposited in powdered form upon the electrode and, inasmuch as these factors have such an important bearing upon the characteristics of the powdered metal deposited, an object of the present invention is to provide an apparatus for depositing metal electrolytically wherein the size and grade of the metal deposited is effectively controlled.

In the present electrolytic methods for producing metallic powder, not only is the powdered metal difficult to collect but the characteristics of the particles thereof are not uniform.

In the method commonly termed the rod method, the powder is deposited upon electrodes in the form of rods which must be tapped from time to time to cause the loose powder deposited thereon to fall to the bottom of the tank. As soon as the powder begins to deposit, the dimensions of the rods are increased, thus diminishing the current density proportionately. This method is therefore faulty not only because it is difficult to remove the powder from the electrolyte but because the variations in current density result in a non-uniform texture of powder. In this method the electrolyte must be drained from the tank in order that the powder may be removed from the bottom thereof.

A second method commonly used is that termed the disc method wherein soluble fluids are placed upon either side of a revolving disc which is partially immersed in the electrolyte. The powder which is deposited upon the disc is collected by means of suitable scrapers upon either side thereof which remove the powder from the disc as the latter moves out of the electrolyte. A similar method is also commonly employed wherein a drum is substituted for the disc and rotates as described in connection with the operation of the disc method. In both the drum and disc methods, the construction is such that the current density is not uniform through the electrolyte and upon the electrode upon which deposition takes place inasmuch as both the disc and drum are formed with edges or corners. A greater amount of current will flow from the corners or edges than from a uniform surface and therefore a more rapid deposition takes place along the corners and edges than at points on the uniform or flat surfaces.

In order that the texture, that is, the size and grade, of the powder deposited may be controlled effectively, the present invention has for an object the provision of an apparatus for depositing metal in powdered form electrolytically in such fashion that a uniform current density is preserved in the electrolyte, the electrodes being of such character that the flow of electric current therebetween is not greater per unit area at one point than at others.

A further object is to provide an apparatus for depositing metal electrolytically wherein the electrodes are formed with smooth continuous surfaces having no sharp edges or corners to or from which current flow may take place.

A further object of the invention is to provide an apparatus for producing powdered metal electrolytically wherein the electrode upon which the deposition takes place is formed of a continuously curved surface, the other electrode or electrodes being so disposed that equal paths are formed between the corresponding points upon the electrodes in order that a uniform current density may exist in the electrolyte at all times.

A further object of the invention is to provide a device of the above character wherein the electrodes are formed with mating curved surfaces disposed in such manner that points in parallel planes on the respective electrodes are equidistant.

A further object of the invention is to provide a device of the above character wherein a spherical electrode is rotatably mounted and partially immersed in an electrolyte, the cooperating electrodes being so disposed as to provide a uniform current density in the electrolyte and a resulting uniform deposition and texture of metal, the rotatable electrode being provided with means to effect the removal of the powdered metal therefrom continuously.

Further objects, not specifically enumerated above, will be apparent as the invention is described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 is a view in sectional elevation showing a simple form of mechanism for practicing the present invention, this figure illustrating the electrode formation by means of which an even texture of metal is deposited.

Figure 2 is a view in side elevation, showing an apparatus constructed in accordance with the present invention wherein means is provided for removing the deposited metal continuously from the revolving electrode.

Figure 3 is a view in front elevation showing a modified form of mechanism constructed in accordance with the present invention.

Figure 4 is a view in section, taken on line 4—4 of Figure 3, and looking in the direction of the arrows.

With reference specifically to the construction shown in Figure 1, a suitable receptacle is illustrated at 10 and contains electrolyte 11 within which a cathode 12 and an anode 13 are immersed. The cathode may be suspended by means of a supporting and conducting terminal 14 while the anode is likewise positioned by a terminal 15. Electric current may flow between the electrodes by connecting the terminals 14 and 15 to a suitable source of electricity in a well known manner.

Cathode 12 is illustrated as being formed as a sphere while anode 13 is a spherically concaved or recessed member, the curvature thereof being upon a radius equal to that of the curvature of the sphere 12. In this fashion, each point upon one of the electrodes is equidistant from the corresponding point upon the other electrode lying in the same horizontal plane. Inasmuch as the sphere 12 is not formed with any sharp edges or corners the deposition of metal thereon in powdered form takes place with a uniform current density at all points thereof. The resulting texture or size and grade of the deposited metal is absolutely uniform and a product is obtained which is far superior to that obtainable in any of the apparatus now commonly used.

Obviously, the electrodes need not be formed with a spherical curvature as long as the curvature thereof is such that no sharp corners or angles are formed thereon. The cathode may thus be of elliptical form, egg-shaped, pear-shaped or any other curve, the anode being formed as a recessed or concaved member curved in a similar fashion to the cathode.

In the construction shown in Figure 2, the receptacle 10 is provided with a bearing 16 upon which a shaft 17 is journaled. Shaft 17 is provided with a pulley 18 whereby the shaft may be rotated and a sphere 19 secured to the shaft. The sphere is adapted to be partially immersed in the electrolyte, the level of which is indicated by the dash line 20 and a scraper is shown at 21. The scraper is formed with a scraping edge 22 which is adapted to engage the surface of the sphere 19 which is immersed within the electrolyte as the sphere is rotated in the direction of the arrow. Side rails 23 are formed on the scraper to catch the powder removed from the sphere 19 and such powder is carried away and treated in any desired manner. Within the electrolyte, and spaced about the axis of shaft 17, are one or more anodes 24 which are connected to a common lead 25. The sphere 19 is connected to a lead which forms the other terminal across which a suitable source of electricity is connected in order that the electrolysis may be effected. The anodes 24 are formed with concaved surfaces 26 which are similar in curvature to the surface of sphere 19. These surfaces are concentrically disposed with respect to the center of sphere 19 in order that the points in the same radiants on the respective surfaces may be equally spaced.

As noted in connection with the construction shown in Figure 1, the uniformly curved surface of sphere 19 without corners or projections thereon causes a deposition of metal in powdered form which is uniform in texture, size and grade.

In the construction shown in Figures 3 and 4, the receptacle 10 is provided with a drum 27 which is mounted upon a shaft 28 and journaled at 29 upon the ends of the receptacle. A pulley 30 affords a means for turning the drum and the latter is dipped into the electrolyte as shown in Figure 4. One or more electrodes 31 are provided within the electrolyte and are formed on the elongated members, having curved surfaces which are concentric to the axis of the drum 27.

Upon the ends 32 and upon a portion of the cylindrical surface of the drum 27 adjacent the ends thereof, as indicated at 33, an acid-proof non-conducting paint is applied to limit the area upon which deposition takes place to that which comprises the curved cylindrical surface of the drum. A scraper 34 is provided for removing the deposited metal and operation of this mechanism will be readily apparent. By coating the ends and corners with the acid-proof non-conducting paint, no corners or edges are provided at which a greater rate of current flow exists than at adjacent portions of the immersed surface.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited, save as defined in the appended claims.

I claim as my invention:

1. Apparatus for depositing metals electrolytically comprising a container of an electrolyte, electric terminals, an electrode connected to one of the terminals and having a spherical surface in the electrolyte, means to rotate the spherical electrode upon an axis substantially parallel to the surface of the electrode to a cooperating electrode connected to another of the terminals and having a spherically concaved surface in the electrolyte and means to remove deposited metal from the surface of the spherical electrode.

2. Apparatus for depositing metals electrolytically comprising a container of an electrolyte, electric terminals, a spherical electrode connected to one of the terminals, means to journal the electrode for rotation with a portion thereof immersed in the electrolyte, means to remove deposited metal from the surface of the spherical electrode out of the electrolyte and a spherically concaved electrode connected to the other terminal and positioned in the electrolyte with its surface equidistantly spaced from the surface of the first electrode in the direction of the current flow.

3. Apparatus for depositing metals electrolytically comprising a container of an electrolyte, electric terminals, a spherical electrode connected to one of the terminals, means to journal the electrode for rotation with a portion thereof immersed in the electrolyte, means to remove a deposition from the surface of said electrode after the same has moved out of the electrolyte, and a spherically concaved electrode connected to the other terminal and positioned in the electrolyte with its surface equidistantly spaced from the surface of the first electrode in the direction of the current flow.

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