July 9, 1935. H. LE LAURIN ET AL 2,007,204

DEVICE FOR CLEANING AND ELECTROPLATING BALLS

Filed Nov. 16, 1931 3 Sheets-Sheet 1

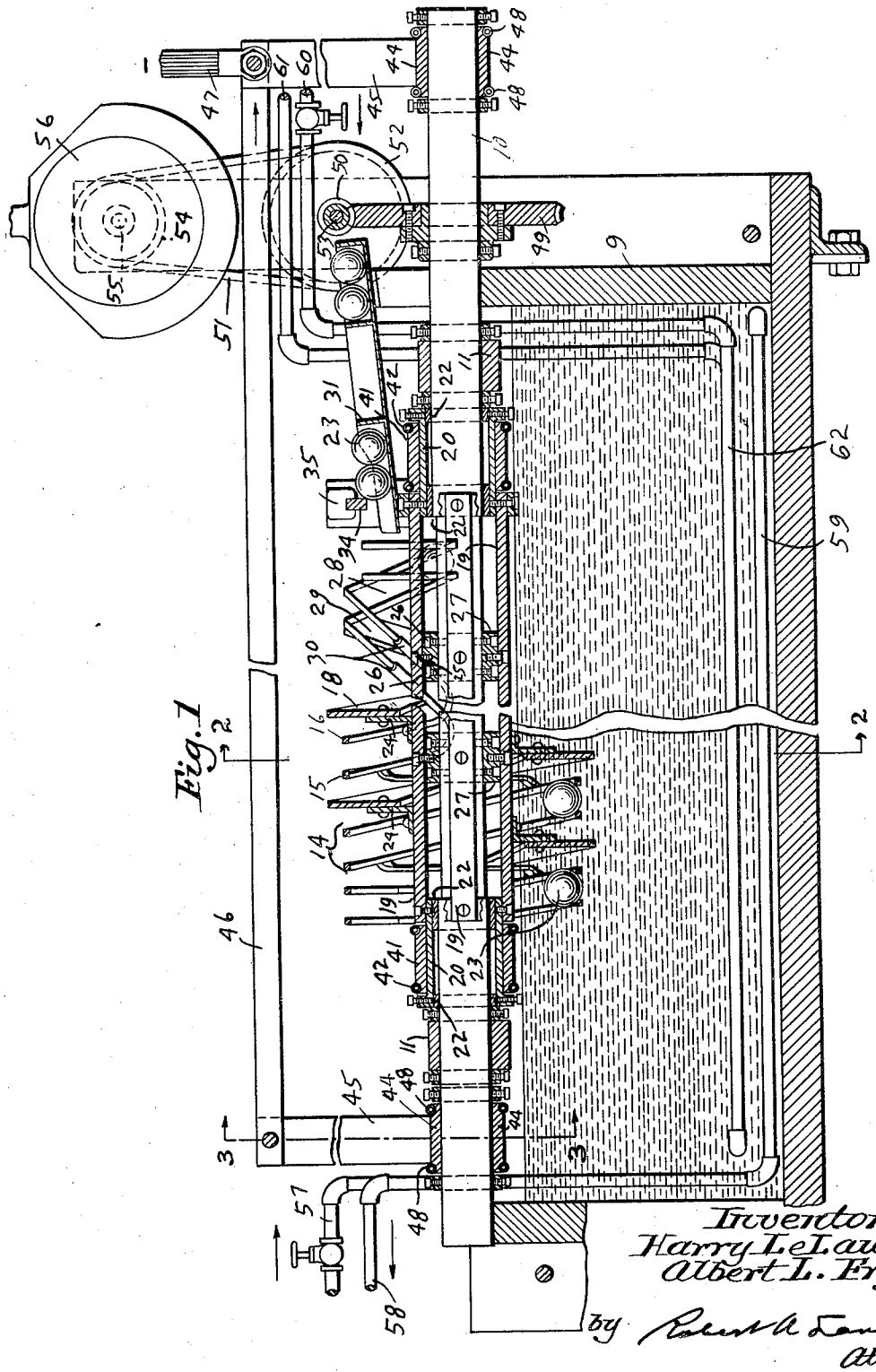


Fig. 1

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Fig. 2

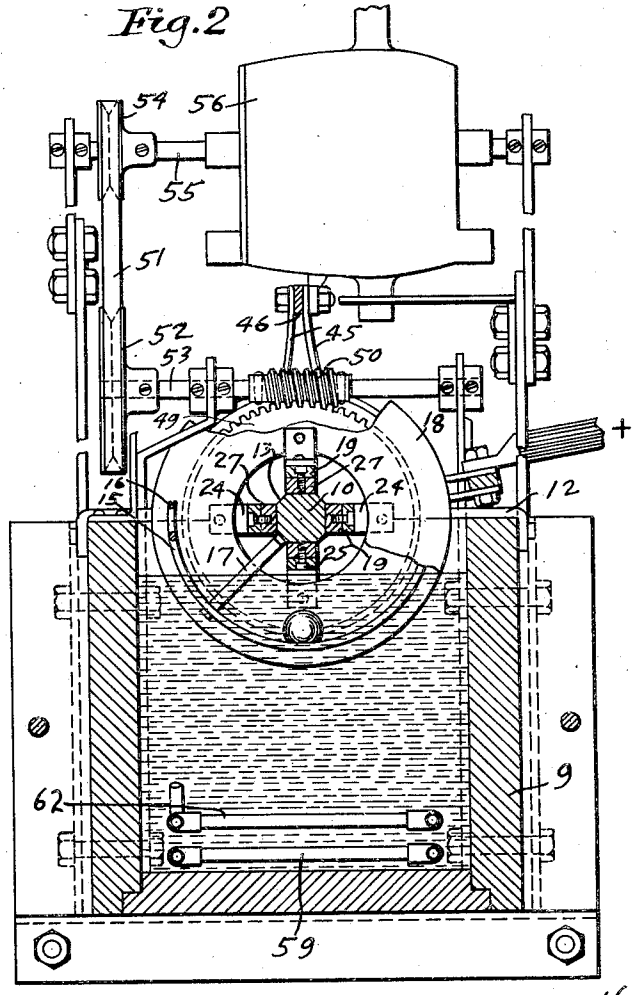


Fig. 3

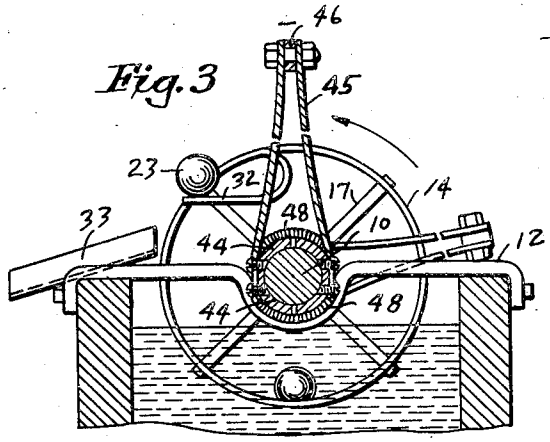
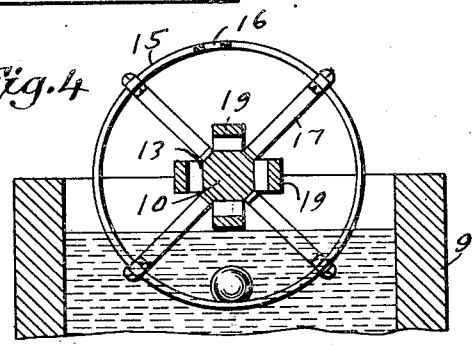


Fig. 4



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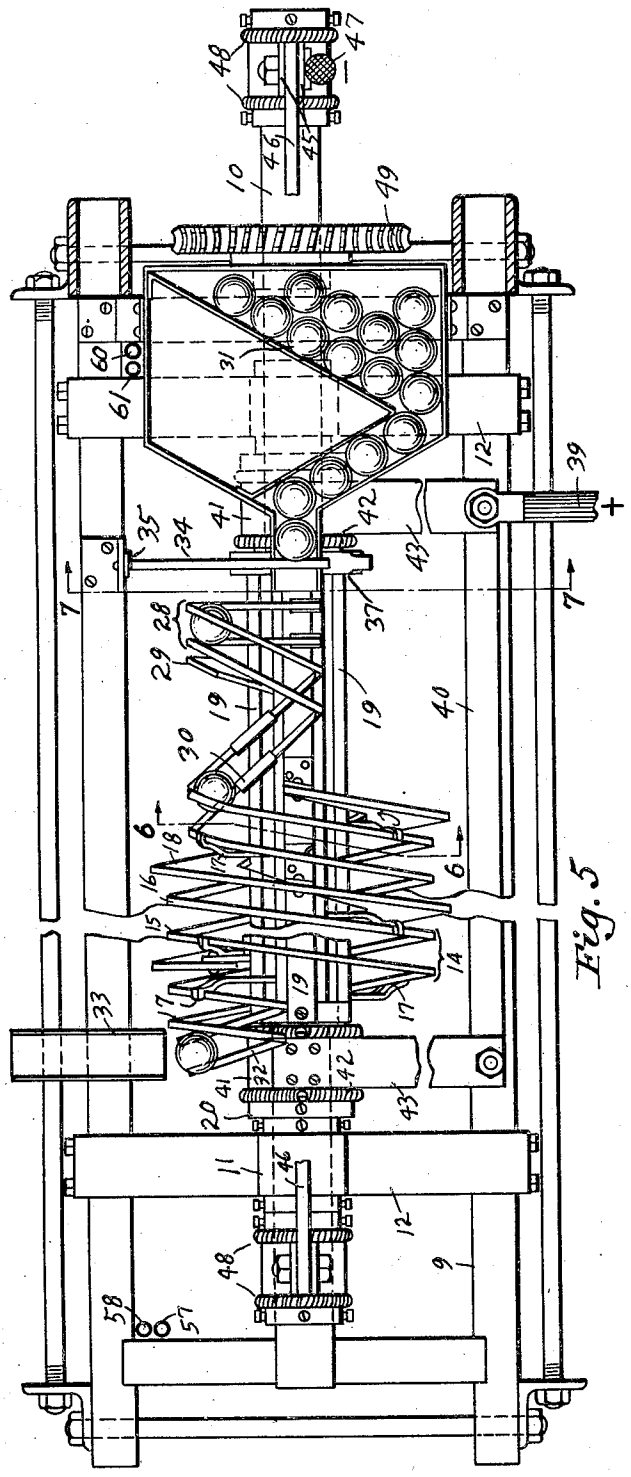


Fig. 5

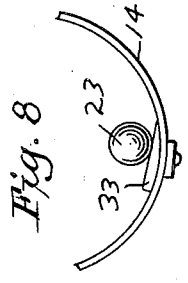


Fig. 8

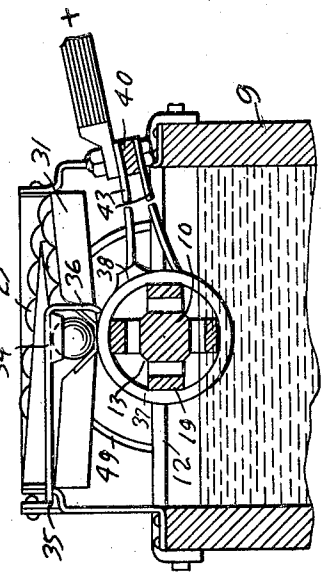


Fig. 7

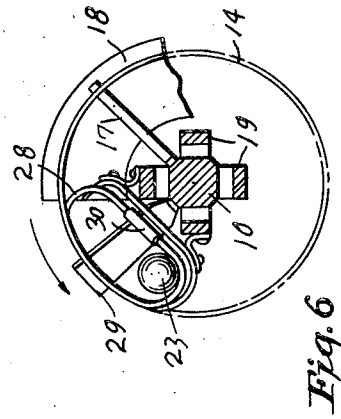


Fig. 6

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UNITED STATES PATENT OFFICE

2,007,204

DEVICE FOR CLEANING AND ELECTRO-PLATING BALLS

Harry Le Laurin and Albert L. Fry,
Washington, D. C.

Application November 16, 1931, Serial No. 575,430

13 Claims. (Cl. 204—11)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

Our invention relates to a device for cleaning metal balls by anodic action and subsequently electroplating them in one operation.

The object of our invention is to provide a machine that will keep the balls being plated in rotation at all times to present a continuously varying point of contact with the current supply and continuously to change the surface presented to the anode, whereby a uniform deposition over the entire surface is secured.

A further object is to subject the balls to a reversed action of the current during a portion of the process to clean them by anodic action.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts as will be described more fully hereinafter.

Reference is to be had to the accompanying drawings forming a part of this specification, in which like reference characters indicate corresponding parts throughout the several views, and in which:

Figure 1 is a section taken along the shaft that supports the rotating electrodes;

Figure 2 is a transverse section taken on the line 2—2, Figure 1;

Figure 3 is partial transverse section, taken on the line 3—3, Figure 1;

Figure 4 is a sectional detail showing the connection of the cathode track to the shaft;

Figure 5 is a top plan view of the machine;

Figure 6 is a partial section on the line 6—6 Figure 5;

Figure 7 is a transverse section on the line 7—7, Figure 5;

Figure 8 is a detail view showing one of the ramps on the cathode track for changing the point of contact of the balls with the track.

While the subject apparatus is herein described, for purpose of illustration, as adapted to plating with chromium, it is to be understood that any of the metals used for electroplating may be applied thereby.

The tank 9 to contain the electroplating solution may be of any construction suited to the purpose. Shaft 10 is mounted in bearings 11 that are supported by members 12 resting on the sides of tank 9. The intermediate portion of shaft 10 is made polygonal as indicated at 13 to facilitate the securing of certain members thereto, as explained hereafter.

The cathode track 14, along which roll the balls 23 that are being plated, is made up of the two equidistantly spaced bars 15 and 16 formed into helices. Each of bars 15 and 16 is connected to shaft 10 twice in each turn by electrically conducting straps 17, or more frequently if found desirable.

Between the turns of track 14 is a helix 18 of sheet lead, which acts as the anode. Helix 18 is, by means of metal brackets 24, supported from and electrically connected to anode bars 19 that are connected to metal sleeves 20 which are insulated from shaft 21 by insulating elements 22. Anode bars 19 are supported intermediate their ends by blocks 27 of insulating material secured to both the anode bars and shaft 10 by screws 25 and 26, respectively, the screws 25 stopping short of contact with the shaft. When plating with chromium, anode bars 19 and brackets 24 are preferably either of lead or are coated with lead to prevent contamination of the solution by metal that would be acted upon by that solution.

The first portion 28 of the track 14 traversed by a ball is connected to anode bars 19 and a piece of sheet lead 29 connected to shaft 10 is disposed adjacent thereto, so that the balls are for a short time subjected to anodic action, whereby they are cleaned and made readily receptive of the plating metal. The portion 28 of the track is isolated from the remainder of the track by insulating members 30.

When a ball 23 is delivered to track portion 28 from hopper 31 it rolls to the position 23—1, Figure 5, where it remains until carried down into the electrolyte by rotation of shaft 10, where it remains while the shaft rotates sufficiently to move it across insulating members 30 to the cathode track, when the ball is carried down into solution again and there remains at the lowest portion of the track until it has moved the length of the track to the reversed portion 32, which picks it up and discharges it to chute 33. While the ball is in the solution current is passing through it to the track from anode helix 18, and metal is deposited on it. At intervals ramp elements 33 are affixed to cathode track 14 to cause the balls to turn and prevent the same zone of the ball from remaining in contact with the track throughout, which would result in uneven plating; by presenting changing surface elements to contact with the track a uniform coat of metal on the ball is secured.

Balls 23 are kept separated on the track 14 by delivering to the track one ball each rotation of the track. This is done by gate 34 carried on resilient mounting 35 at one end of the gate that normally hangs low enough to prevent passage of balls from hopper 31. The free end of gate 34 has a down-turned end 36 that rides upon

ring 37 fixed on anode bars 19 to rotate therewith. A cam boss 38 on the ring contacts end 36, lifts gate 34, and permits a ball to pass out of the hopper, the length of boss 38 being just sufficient to allow the delivery of one ball to the track, after which the gate moves down until it is again raised by passage of the boss under end 36.

Current is supplied to anode bars 19 through positive cable 39 and bus bar 40. Split bearing contact members 41 are held in contact with sleeves 20 (to which the anode bars 19 are connected) by springs 42, and conducting straps 43 connect bus bar 40 to contact members 41. The current is conducted away from shaft 10 through split bearing contacts 44 that bear on the shaft, and straps 45 connect the contacts 44 to negative bus bar 46 and cable 47. Springs 48 insure a proper degree of pressure of contacts 44 upon shaft 10.

The mechanism for rotating shaft 10 consists of a gear wheel 49 mounted on shaft 10 and engaged with a worm 50 driven by belt 51 that runs over pulley 52 on the shaft 53 of worm 50 and pulley 54 on shaft 55 of motor 56, which for purpose of illustration is here shown as an air motor, though any suitable prime mover may obviously be substituted.

Pipes 57 and 58 are respectively the inlet and exhaust for steam circulated in coil 59 to heat the solution. Pipes 60 and 61 convey water to and from coil 62 to cool the solution when necessary. The two coils 59 and 62 serve to control the temperature of the solution in tank 9 within the limits necessary for successful electroplating.

The operation of this device is as follows:

Hopper 31 is loaded with balls 23, and motor 56 is started and the shaft is set in rotation. Boss 38 lifts gate 34 and permits a ball to roll down upon the portion 28 of the track, where it is subjected to anodic cleaning while in the solution. The next revolution of the shaft causes the ball to roll over to the cathode track 14, and the ball is carried down into the solution in tank 9, where it remains at the lowest part of the track as it is moved along the helical track. When the ball reaches the reflexed portion 32 it can roll no farther, and so is picked up and carried around until the reflexed portion starts down on the other side of shaft 10, at which time the ball is discharged into chute 33. Throughout the time ball 23 is immersed in the solution, while on track 14, the metal in the solution is being deposited upon the ball, and as the part thereof in contact with the track is continually changing, a coating of uniform thickness over the whole surface of the ball results. As the operation of the device is continuous, it has a high output.

The length of time the balls are kept in the solution may be controlled by the speed of rotation of the shaft 10 and also by the length of the track 14.

If the electrolyte used has high "throwing" capacity the spiral anode 18 may be omitted and anodes suspended at the sides of the tank be substituted therefor.

When the electrolyte is such that it is not practical to clean the balls therein, a separate cleaning device may be used and the balls fed automatically from the cleaning into the plating device.

The transfer of the ball from the anodic track to the cathodic track may be effected in the solution where the amperage is not so high as is used in chromium plating, but in the instance shown it is preferable to make the change out of the solution, as shown in Figure 5, to prevent danger of pitting the ball by arcing of the current as the ball breaks contact in the solution.

It will be understood that the above description comprehends only the general and preferred embodiment of our invention, and that various changes therein may be made within the scope of the appended claims without sacrificing any of the advantages of our invention.

The herein described invention may be manufactured and used by or for the Government of the United States for governmental purposes without the payment of any royalty thereon.

We claim:

1. An apparatus for electroplating balls, comprising a tank for electrolyte, a shaft rotatably mounted above the level of electrolyte therein having a portion of its length of polygonal cross section, insulating members on said shaft at the ends of said portion, conducting sleeves secured on said insulating members, anode bars connected to said sleeves, split-bearing contact members on said sleeves, springs disposed to retain said contact members against said sleeves, current supply means connected to said contact members, other split-bearing members on said shaft, springs to retain said other contact members in position, conducting elements connected to said other contact members, a cathodic track formed of helically wound equidistantly spaced conducting bars connected to the polygonal portion of said shaft, a spiral anode of sheet lead connected to said anode bars, and disposed between the turns of said track the said shaft lying along the axis of said track and said spiral anode, an anodic track at the intake end of said cathodic track mechanically connected to said cathodic track by insulating members, a portion of said anodic track being reflexed to lift a ball out of the electrolyte while it is being transferred from one track to the other, a reflexed portion at the discharge end of said cathodic track to lift a ball out of the electrolyte and discharge same from the track, a cathode element disposed adjacent said anodic track and connected to said shaft, a hopper adapted to contain balls to be plated and disposed to feed said balls on to said anodic track, a gate disposed to control movement of balls from said hopper having one end secured to a resilient mounting and the other end down-turned, and a ring on said cathode bars on which said down-turned end rides, said ring having a cam on its periphery disposed to contact said down-turned end to lift said gate to feed a ball into said anodic track.

2. An apparatus for electroplating balls, comprising a tank for electrolyte, a shaft rotatably mounted above the level of electrolyte therein, spaced insulating members on said shaft, conducting sleeves secured on said members, anode bars connected to said sleeves, split contact members around said sleeves, contractile means to hold said contact members in position, current supply means connected to said contact members, other split contact members on said shaft, current conducting means connected to said other contact members, a helical cathode track whereof the lower side is below the electrolyte level adapted to convey balls connected to said shaft at a plurality of points, a helical anode disposed between the turns of said cathodic track and connected to said anode bars, an anodic track at the intake end of said cathodic track mechanically connected to said cathodic track by insulating

members, a portion of said anodic track being reflexed to lift a ball out of the electrolyte while it is being transferred from the anodic track to the cathodic track, a reflexed portion at the discharge end of said cathodic track to lift a ball out of the electrolyte and discharge same from said track, a cathode element disposed adjacent said anodic track and connected to said shaft, a container for balls to be plated disposed to feed balls to said anodic track, means to control the passage of balls from said container, and means actuatable by the rotation of said shaft to move said control means to permit one ball at a time to pass from said container to said anodic track.

3. An apparatus for electroplating balls, comprising a tank, a helical cathodic track mounted to have its lower side immersed in electrolyte in said tank, said track comprising two electrically conducting helically wound bars equidistantly spaced from each other, a helical sheet lead anode disposed between the turns of said track, a like anodic track mechanically connected to the intake end of said cathodic track by insulating members, a cathodic element adjacent to said anodic track, rotatable mounting means for said tracks, said anode and said cathodic element, a container for balls disposed to feed balls to said anodic track, means actuatable by the rotation of said mounting means to control movement of balls from said container, means to supply current to said anode bars, and other means to conduct current away from the cathodic track and cathodic element.

4. An apparatus for electroplating balls, comprising a rotatably mounted shaft, a helical cathodic track adapted to convey balls mounted on and electrically connected to said shaft, a helical anode mounted on but insulated from said shaft and disposed between the turns of said cathodic track, means to feed balls on to said track, means to supply current to said anode, and other means to conduct current away from said track.

5. An apparatus for electroplating balls, comprising a rotatably mounted shaft, a helical cathodic track adapted to convey balls mounted on and electrically connected to said shaft, a helical anode mounted on but insulated from said shaft and disposed between the turns of said cathodic track, means on said track to impart rotation in addition to that due to the movement of said balls along said track, means to feed balls on to said track, means to supply current to said anode, and other means to conduct current away from said track.

6. In an apparatus for electroplating balls, a helical cathodic track, a helical anode disposed between the turns thereof, an anodic track, a cathode element disposed adjacent to said anodic track, insulating means mechanically connecting said tracks together, a rotatable mounting for all the aforesaid elements, means to contain electrolyte into which all the said elements dip, means to supply current to said anode and said anodic track, and means to conduct current away from said cathodic track and said cathodic element.

7. In an apparatus for electroplating balls, a mechanically continuous track to convey balls in electrolyte, said track comprising a continuously anodic portion and a continuously cathodic portion insulated therefrom, an anode adjacent said cathodic portion, and a cathode adjacent said anodic portion, both the anodic portion and the cathodic portion operating at all times in the same body of electrolyte.

8. In an apparatus for electroplating balls, a helical cathodic track adapted to convey balls through electrolyte, said track having each turn thereof directly connected to the source of electrical supply, a rotatable mounting therefor, and anode means disposed to dip into said electrolyte to pass current to balls carried by said track.

9. In an apparatus for electroplating balls, a helical cathodic track adapted to convey balls through electrolyte, a rotatable mounting therefor, a container for balls disposed to pass balls to said track, a member disposed to retain balls in said container, means rotatable with said mounting to move said member to release balls from said container one at each revolution of the mounting, and anode means disposed to dip into said electrolyte to pass current to balls carried by said track.

10. In an apparatus for electroplating balls, a cathodic track comprising two equidistantly spaced helically wound electrically conducting bars to contact and form the sole support for the balls having a reflexed portion at one end to discharge balls therefrom into a receiving member placed laterally thereof, a rotatable mounting therefor, and anode means disposed to pass current to balls carried by said track.

11. In an apparatus for electroplating balls, a cathodic track comprising two equidistantly spaced helically wound electrically conducting bars to contact and form the sole support for the balls having a reflexed portion at one end to discharge balls therefrom into a receiving member placed laterally thereof, means fixed to said track to impart to balls carried thereby rotational movement in addition to that due to movement along said track, a rotatable mounting for said track, and anode means disposed to pass current to balls carried by said track.

12. In an apparatus for chromium plating balls, a mechanically continuous track to convey a number of balls in electrolyte, each ball separately and out of contact with any other ball but always in contact with the track, said track comprising a continuously anodic portion and a continuously cathodic portion insulated therefrom, an anode adjacent said cathodic portion, and a cathode adjacent said anodic portion.

13. In an apparatus for electroplating balls, a helical cathodic track adapted to convey balls through electrolyte, a rotatable mounting therefor, a container for balls disposed to pass balls to said track, a member disposed to retain balls in said container, means rotatable with said mounting to move said member to release balls from said container at spaced intervals to keep said balls out of contact with each other, and anode means disposed to dip into said electrolyte to pass current to balls carried by said track.

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