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ELECTROPLATING APPARATUS.

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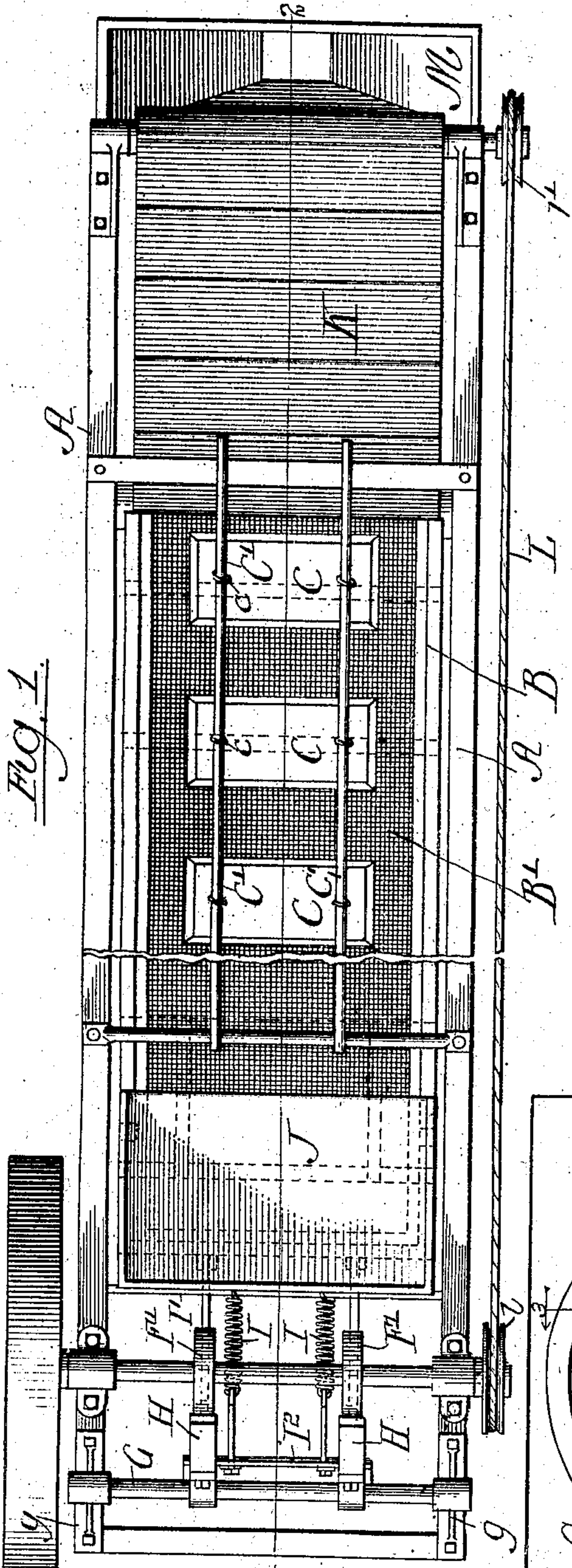


Fig. 1.

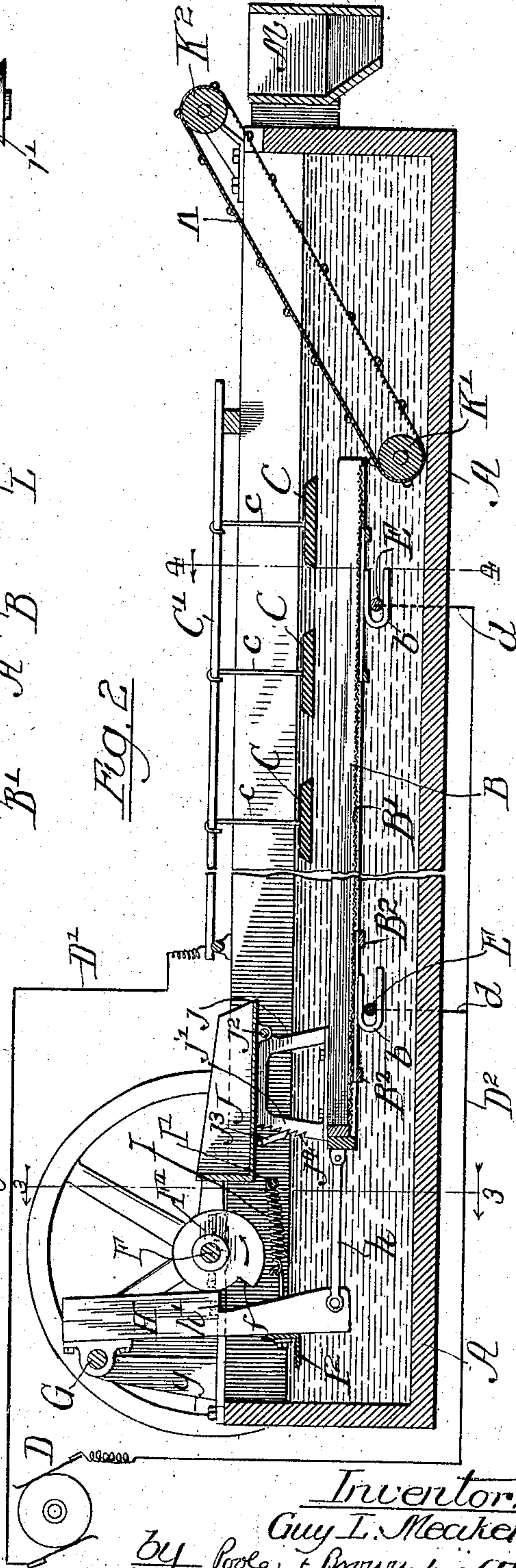


Fig. 2.

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## ELECTROPLATING APPARATUS.

No. 815,027.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, GUY L. MEAKER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electroplating Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a new machine or apparatus adapted for use in the electrodeposition of metal, and more especially designed for use in plating or coating small metal articles with metals, such as nickel or zinc.

An apparatus embodying the main features of my invention embraces a tank for the electrolyte or plating-bath, an anode or anodes connected with one terminal of the electric generator, a support for the articles to be plated made of conducting material and in electrical connection with the other terminal of said generator, means for constantly moving or advancing the articles relatively to the anode or anodes or past the area of action of the same, and means for effecting the turning over of the articles in their progressive movement, so as to present all sides thereof toward the anode or anodes, and thereby provide for the deposition of the coating on all sides or parts of such articles.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a plan view of an apparatus embodying my invention. Fig. 2 is a central vertical longitudinal section thereof, taken on line 2 2 of Fig. 1. Fig. 3 is a cross-section thereof, taken upon line 3 3 of Fig. 2. Fig. 4 is a cross-section thereof, taken upon line 4 4 of Fig. 2. Fig. 5 is a detail plan view of one end of the shaking vibrating tray of the apparatus, showing a modified form of the means for supporting said tray. Fig. 6 is a view in longitudinal section of the tray shown in Fig. 5. Fig. 7 is a plan view of one end of a tray, showing a construction in the supporting-surface thereof differing somewhat from that shown in Fig. 5. Fig. 8 is a longitudinal section taken upon line 8 8 of Fig. 7. Fig. 9 is a cross-sectional view taken upon line 9 9 of Fig. 7. Fig. 10 is a sectional view of the end of the apparatus to which the articles to be

plated are applied or fed, showing a construction in the means for actuating the feeding-receptacle of the apparatus.

As shown in said drawings, A indicates a tank or receptacle to contain the liquid-bath or electrolyte used in the plating operation, the same being herein shown as having the form of an elongated rectangular open-topped trough. Within said trough and located near the bottom thereof, so that it shall be always covered by the electrolyte, is a horizontally-disposed receptacle or tray B, which serves as a support for the articles to be electroplated. The bottom or supporting surface B' of said tray is of open, foraminous, or reticulated character and is made of metal or conducting material. Immersed within the electrolyte above said tray are a series of anodes C C C, consisting of pieces or plates of the metal of which the electrodeposited coating is formed. The anodes C C C are connected with one terminal of an electric generator, (indicated diagrammatically by D,) while the metallic supporting surface or bottom of the tray B is connected by suitable conductors with the opposite pole of said electric generator D, the construction being such that the current generated passes from the generator D through the said anodes and the electrolyte, through the metal objects resting on the supporting-surface of the tray, and from said metal supporting-surface to the other terminal of the generator. In the particular construction shown in the drawings the anodes C C C are supported by wires c from a conducting-rod C', connected by a conductor D' with the generator D, while to the metal bottom of the tray B are connected conductors b b, which are joined to a conductor D<sup>2</sup>, leading from the opposite pole of the said generator.

In connection with the tray or support having a metallic bottom B' arranged as described devices are provided for agitating, jarring, or vibrating said tray in such manner that the articles supported thereon will be shifted or moved constantly or intermittently in one direction, so that if said articles be constantly supplied or fed to one end of the tray they will through the vibratory movement thereof be caused to move or travel endwise of the tray until discharged from the opposite end thereof. Various forms of construction in the tray and in actuating devices to give movement thereto may be employed for the purpose of effecting a constant or con-



tinuous movement or travel of the articles or objects to be plated along or upon the tray. In the particular construction shown means for this purpose are provided as follows: The

5 said tray is shown as consisting of a rectangular open wooden frame to which the bottom B', which may be made of woven wire, is secured at its margins. Cross-bars B<sup>2</sup> are shown

10 as extending across the frame of the tray below the bottom B' to prevent the latter from sagging or to keep it level. The tray is supported in the receptacle A in such manner that it may have a horizontal endwise-reciprocatory movement. The supporting de-

15 vices illustrated consist of two metal rods E E, extending horizontally across the tank a short distance above the bottom thereof and which are supported at their ends on the side walls of the tank. The tray rests and slides

20 upon said rods, its side frame-pieces being provided with metal guides b b, preferably made of U form, with their upper and lower horizontal parts above and below the rods in

25 contact with the top and bottom surfaces thereof, so that the tray will be held by said guides in engagement with the rods while free to move horizontally in an endwise direction. Devices for giving endwise reciprocatory

30 motion to the said tray are provided as follows: Mounted upon the receptacle A at the receiving or feeding end thereof is a horizontal transverse shaft F. Said shaft is provided with two cams F' F', each having a

35 volute cam-surface and an abrupt or radial shoulder f at one point in its circumference. A horizontal transverse rock-shaft G is arranged at the rear and above the shaft F, the same being, as herein shown, supported in

40 standards g g, which rise from the side walls of the receptacle A. Mounted on said rock-shaft G are two vertically-disposed levers H H, which are pivotally connected at their upper ends with the rock-shaft and which are

45 arranged in the same vertical planes with the cams F' F'. Said levers H H extend at their lower ends below the level of the shaft F and are connected at said lower ends with the adjacent end of the tray B by means of connecting-rods h h. The levers H H are provided

50 with shoulders h' h' and are adapted to bear at their parts above said shoulders against the rear margins of the cams F' F'. The said levers H H are herein shown as held in contact with said cams by means of suitably-applied springs, herein shown as having the form

55 of spirally-formed contractile springs I I, which are attached to a rod I', extending across the receptacle and connected with a cross-bar I<sup>2</sup>, which is attached to and extends

60 between the two levers H H near the lower ends thereof. The shoulders h' h' of the levers H are so arranged with respect to the shoulders f f of the cams that as the cams are rotated the levers H will be thrown back-

65 wardly through the action of the volute sur-

faces of the cams, and when the shoulders f f reach the said shoulders h' h' the levers will be drawn suddenly or quickly forward by the action of the springs I I. This arrangement of the parts produces an endwise movement

70 or travel on the tray of articles resting thereon, the tray being moved slowly in a backward or rearward direction by the action of the volute portions of the cam and tray being

75 thrown suddenly or quickly forward when the shoulders of the cams pass the shoulders on the levers, so as to give a quick or rapid forward movement to the tray with the articles thereon. The sudden advance move-

80 ment and stoppage of the tray when the shoulder on the lever drops over the shoulder on the cam imparts rapid forward movement to the articles on the tray, which continues

85 when the movement of the tray is arrested, and thereby produces intermittent forward movement of the articles on the tray so long as the same continues to vibrate.

Devices for feeding the articles to be electroplated to the vibrating tray and for removing the articles from the delivery or tail

90 end of the tray are provided as follows: As shown in Figs. 1 and 2, a feed-receptacle J is supported on the tray B above the receiving end of the same, said receptacle being supported a sufficient distance above the tray to

95 be above the surface of the liquid in the tank A and in position convenient for the delivery thereto of the articles to be operated upon. The receptacle J is open at its side which

100 overhangs the feed end of the tray and is slightly inclined downward toward its open side, so that articles resting on its bottom may fall freely from its forward edge, which

105 latter extends across the full width of the tray. It follows that the articles delivered to the feed-receptacle and spread thereon by

110 a jarring movement imparted to the same will be distributed over the full width of the receptacle, or substantially so, and will thus be delivered to the tray throughout the full

115 width thereof. The said receptacle J being in this instance attached to or supported upon the tray partakes of its jarring or vibratory movement, so that articles delivered

120 to or thrown upon the bottom of the receptacle will be continuously moved or shifted toward the forward end of the receptacle and will be thereby caused to fall from the same

125 upon the perforated or reticulated bottom of the tray. In the particular construction shown in said Figs. 1 and 2 the tray is made

130 adjustable in its inclination with respect to the tray, so that the bottom of said receptacle may be inclined to a greater or less extent toward its forward or discharged edge, the

135 intent being that the receptacle should be adjusted to a greater or less angle for the purpose of increasing or decreasing the rate of feed of the articles to the tray, such adjustment of the angular position of the bottom of



the tray being required by reason of different character of the articles or their capability of easily moving or rolling when resting on a flat surface. According to the details of construction illustrated in the drawing the said receptacle J is supported from the side frame-pieces of the tray B by means of standards  $j'$ , and the tray is connected with the forward standard by means of hinged connections  $j^2$ , while the rear end of the tray is provided with hinged braces  $j^3$ , which may be placed in either one of the series of teeth or notches  $j^4$ , formed in the rear standards  $j'$  for the purpose of elevating the rear of the receptacle to a greater or less extent, as desired.

For conveying away or out of the tank the articles discharged from the rear or tail end of the tray B, I have shown an endless traveling conveyer-belt K, which is trained over rollers  $K'$   $K^2$ , the roller  $K'$  being located near the bottom of the tank beneath the discharge end of the tray B, while the roller  $K^2$  is located above and outside of the rear end wall of said tank. Devices for driving the belt K (illustrated) consist of a driving-belt L, trained over a pulley  $l$  on the shaft F, and a like belt-pulley  $l'$  on the shaft of the pulley  $K^2$ . Said belt K is shown as provided with cross slats or ridges by which the articles deposited on the lower end thereof are held from slipping backward on and are carried upwardly with the conveyer-belt. A hopper M, secured to the discharge end of the tank A below the roller  $K^2$ , is adapted to receive the articles as they fall from said belt and discharge them into a suitable receptacle.

While the feed-receptacle J is shown in Figs. 1 and 2 as mounted on the tray B and moving therewith, yet this construction is not essential, and said receptacle may be otherwise supported and given a vibratory movement as required for producing constant feed or delivery of the articles therefrom to the tray by any suitable device adapted for the purpose; as, for instance, in Fig. 10 is shown a receptacle  $J'$ , which receptacle is pivotally mounted near its forward or discharge end upon a horizontal transverse pivot-rod  $J^2$ , which is attached at its ends to the side walls of the tank A and extends across the same. The rear end of said receptacle  $J'$  in this instance rests upon the two cams  $F'$   $F'$  and its rear end is so located with respect to the abrupt surfaces or shoulders of said cams that said rear end of the tray will be lifted by the volute surfaces of the cams as the latter revolve and will when the abrupt surfaces of the cams pass the rear edge of the tray drop past said abrupt surfaces, and thus produce a jarring movement to effect the feed of the articles from the receptacle.

In connection with the means described for effecting a continuous travel or movement of the articles undergoing the electroplating

operation along or over the supporting-surface on which they rest I have provided means by which the articles may be continually turned or shifted in position with respect to the sides thereof which are uppermost, so that all portions of the articles will be equally presented toward the anodes and will equally receive the deposits of plating metal. In the case of articles which are more or less of symmetrical form and will tend by reason of their shape to roll over or rotate upon the bottom of the tray as they advance no special provision will be required to effect the continuous turning of the articles; but in the case of articles more irregular in shape or which are flat-sided and which by their shape will in their forward movement naturally tend to maintain one position upon and to slide over or along the bottom of the tray without turning over it will be necessary to provide special means for turning the articles as they move or advance on the tray. In one form of the tray B (shown in Figs. 5 and 6) its bottom is transversely corrugated or ridged, and so shaped as to form a series of inclines  $b'$   $b'$   $b'$  and connecting upright portions or abrupt shoulders  $b^2$   $b^2$ , which extend from side to side thereof, the said shoulders facing toward the rear or discharge end of the tray. When in the use of the tray thus made articles are being plated, such as nuts, which have flat sides and which are liable to slide on the supporting-surfaces of the tray-bottom without turning over the article will rise on the inclines of the corrugations and as they fall over the vertical shoulders thereof will be turned over or reversed in position, thereby insuring the constant turning of the articles as they successively pass over the several transverse ridges on the tray-bottom.

In Figs. 7, 8, and 9 I have shown another construction in the tray-bottom wherein the same is divided into rectangular sections  $b^3$   $b^4$ , of which the sections  $b^4$  are longitudinally corrugated, while the intervening sections  $b^3$  are flat. All of the sections are, however, inclined with their highest portions or edges nearest the discharge end of the tray and separated from each other by vertical transverse shoulders  $b^5$ . The advantage gained by making the supporting surface or part of the same of corrugated form is that flat-sided articles, such as nuts, will be supported by the corrugated surface on angular or oblique positions and will by reason of the vibratory motion given to the tray constantly change their positions as they move along the supporting-surface of the tray. Moreover, by making the alternate sections of corrugated and flat form articles, such as nuts or the like, having flat sides parallel with and at right angles to each other will during a part of their journey along the tray be supported with their flat sides horizontal and at other times with their flat sides in angular position to a



horizontal plane, thereby insuring greater uniformity in the deposition of the metal, which is deposited most thickly on those surfaces of the objects which are directed toward the anodes above them. It will of course be understood that a tray-bottom made as shown in Figs. 7 and 8 may be composed of woven wire or of finely-perforated sheet metal, or it may be made of sheet metal not perforated.

While the use of a perforated, foraminated, or reticulated supporting-surface for the articles to be electroplated is preferred because a supporting-surface of this kind will afford the necessary metallic connection between the said articles resting on the surface and the conductors which lead to the generator or dynamo and will at the same time insure the maintenance of constant contact of the liquid of the bath with parts of the surface of said articles; yet this construction is not essential, and a supporting-surface of sheet metal may be used, especially if the same be of corrugated form, as shown in Figs. 7, 8, and 9, or otherwise shaped to facilitate the turning of the articles and the presentation of all sides thereof upwardly or toward anodes as said articles are moved or shifted along the tray.

One important feature of my invention is embraced in means for supporting the objects or articles to be electroplated within the electroplating-bath in connection with means for moving or shifting the said articles along or through the bath during the plating process, and so far as said broad feature of construction is concerned I do not wish to be limited to the particular details or arrangement of parts herein illustrated and above described.

Another important feature of my invention is embodied in an apparatus embracing in connection with such means for bodily moving or shifting the articles of means for turning over the same during their forward or bodily progressive movement.

Other features of construction illustrated and described also constitute important features of my invention and are pointed out as such in the appended claims.

I claim as my invention—

1. An electroplating apparatus comprising

a tank for containing an electrolyte, a tray for supporting the articles to be plated, the bottom of which is made of conducting material, and means for giving endwise vibratory motion to said tray constructed to advance articles resting on the tray-bottom from one end of the tray to the other.

2. An electroplating apparatus embracing a tank containing an electrolyte, a generator, an anode, a tray for supporting the articles to be treated, the bottom of which constituting the cathode-terminal and means for giving endwise vibratory motion to said tray; the supporting-surface of the tray having transverse shoulders to effect the turning of the said articles during their progressive movement.

3. An electroplating apparatus comprising a tank containing an electrolyte, a generator, an anode, a tray for supporting the articles to be plated, the bottom of which constitutes the cathode-terminal, and means for giving endwise vibratory movement to said tray adapted to afford a slow rearward and rapid forward movement of the same.

4. An electroplating apparatus comprising a tank containing an electrolyte, a generator, an anode, a tray for supporting the articles to be plated, said tray having a bottom which constitutes the cathode-terminal, and means for giving vibratory movement to said tray, the said bottom of the tray being of ridged or corrugated form.

5. An electroplating apparatus comprising a tank containing an electrolyte, a horizontally-moving tray located in said tank, and means for giving endwise vibratory movement to said tray, embracing a rotating cam having an abrupt shoulder and a lever which is acted upon by said cam and which is connected with said tray.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 19th day of December, A. D. 1904.

GUY L. MEAKER.

Witnesses:

C. CLARENCE POOLE,  
G. R. WILKINS.