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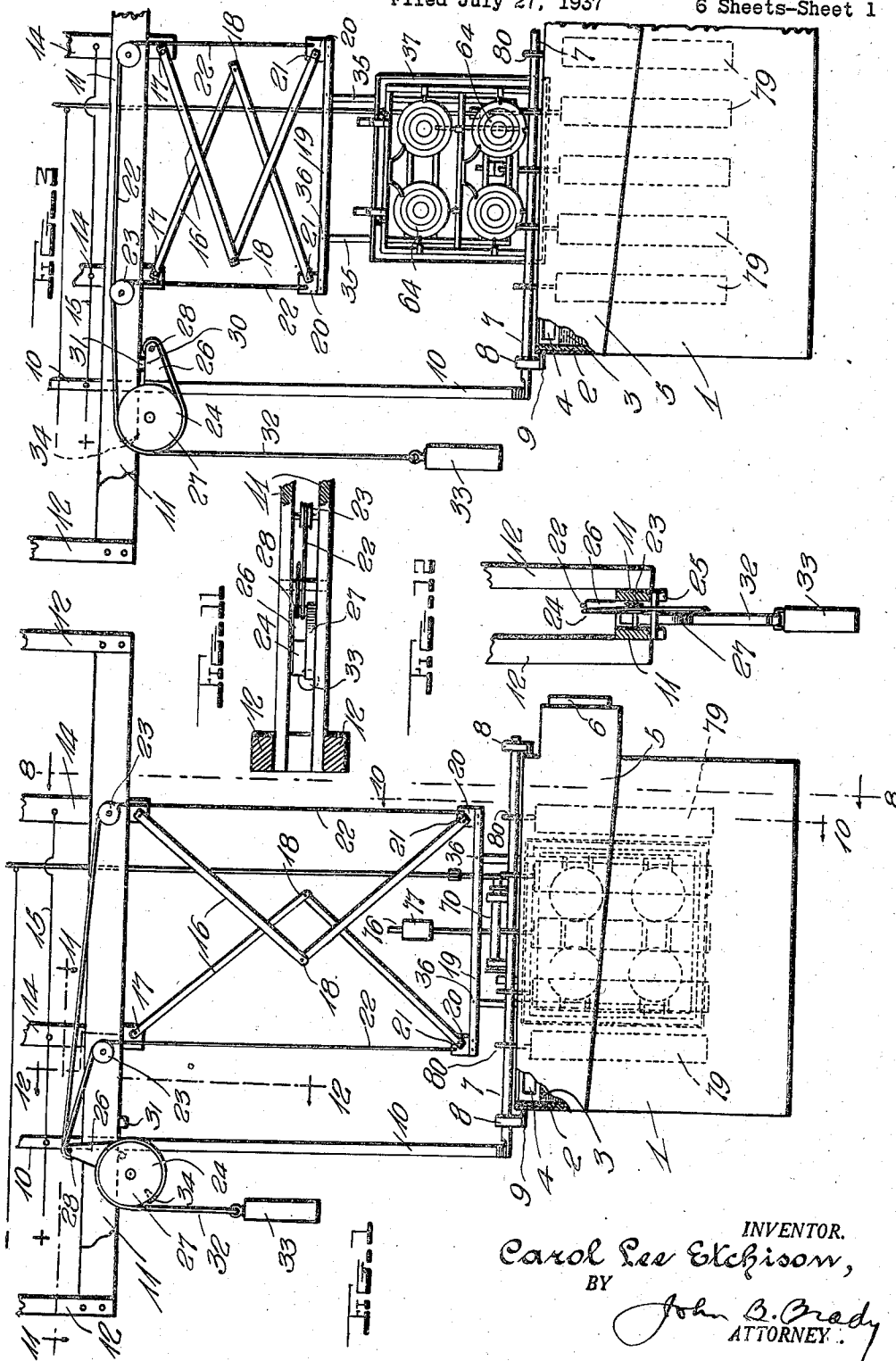
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2,199,487

APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

Filed July 27, 1937

6 Sheets-Sheet 1



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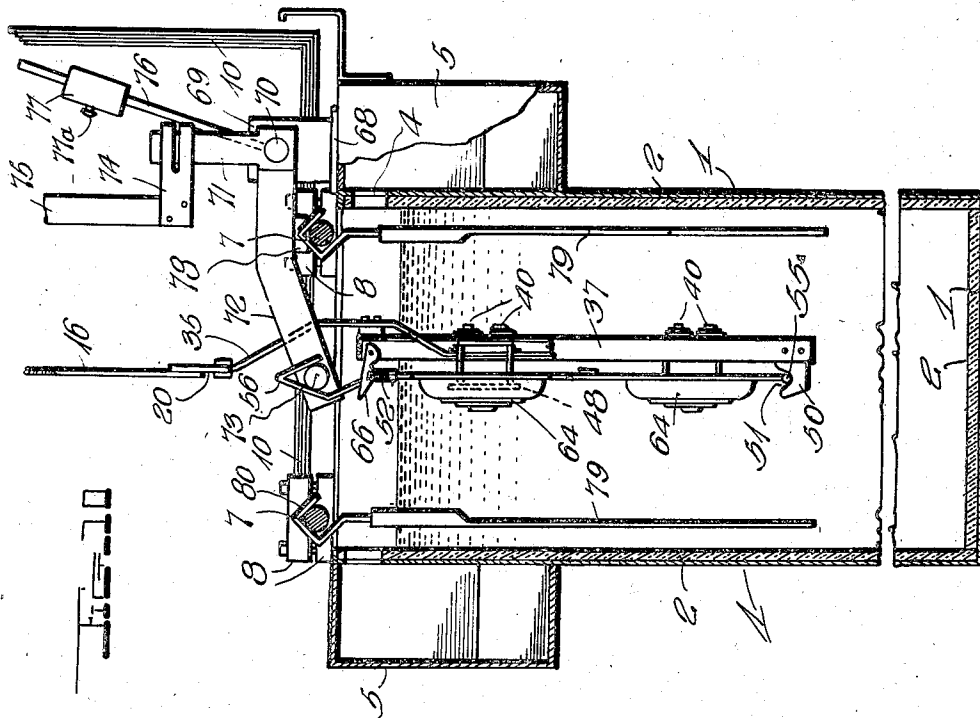
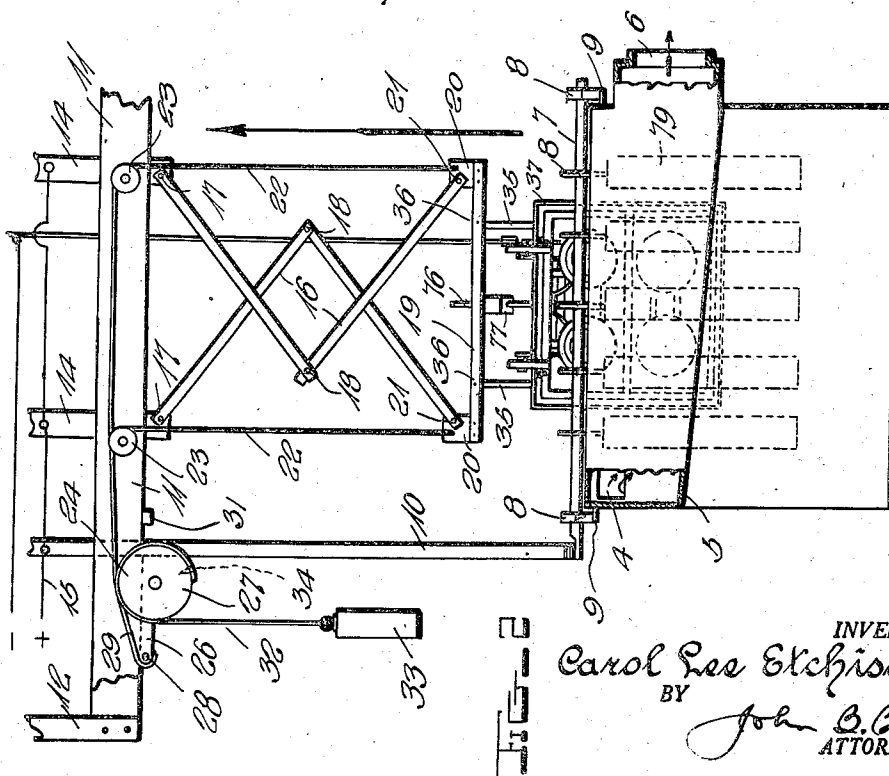
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APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

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6 Sheets-Sheet 2



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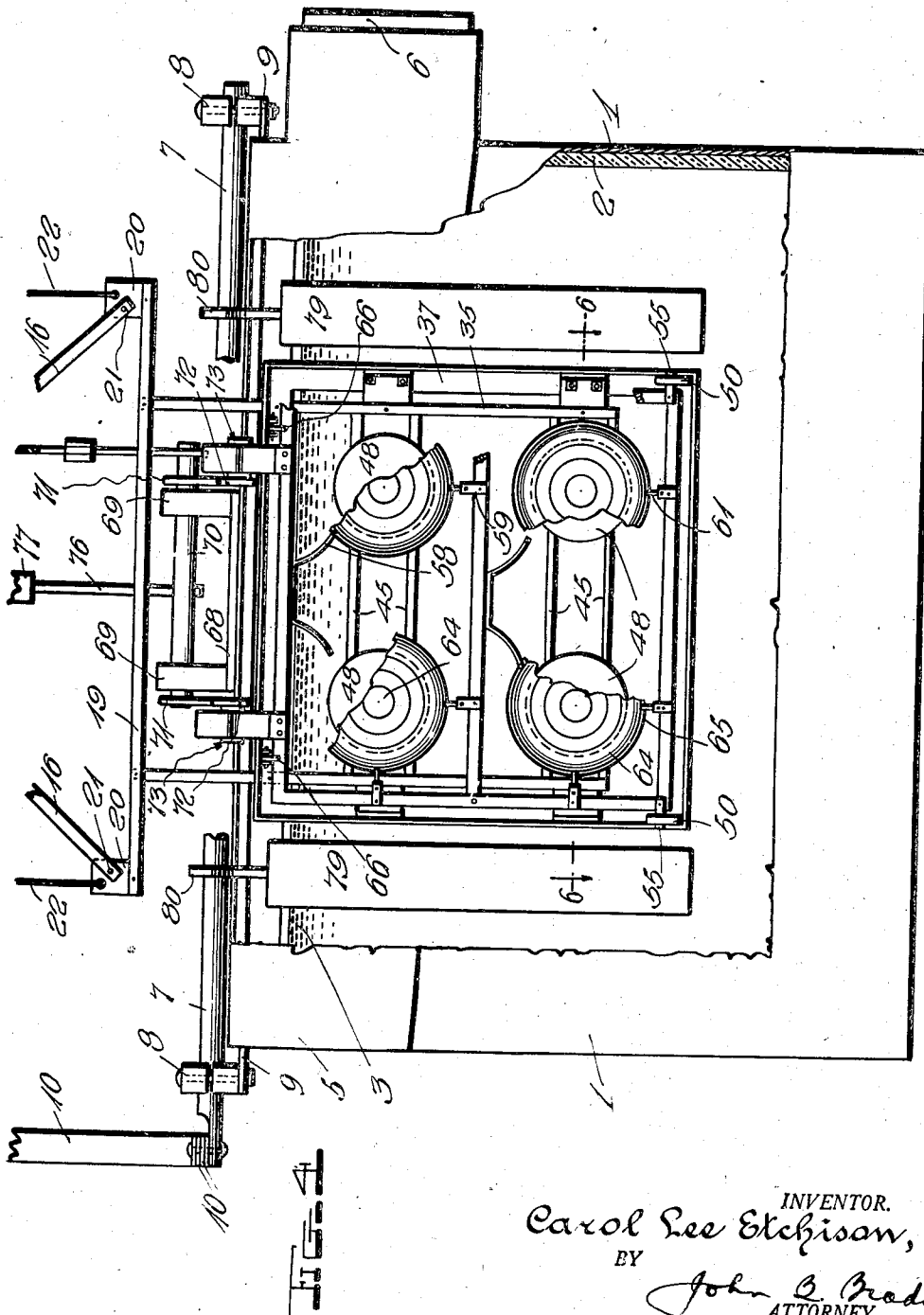
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APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

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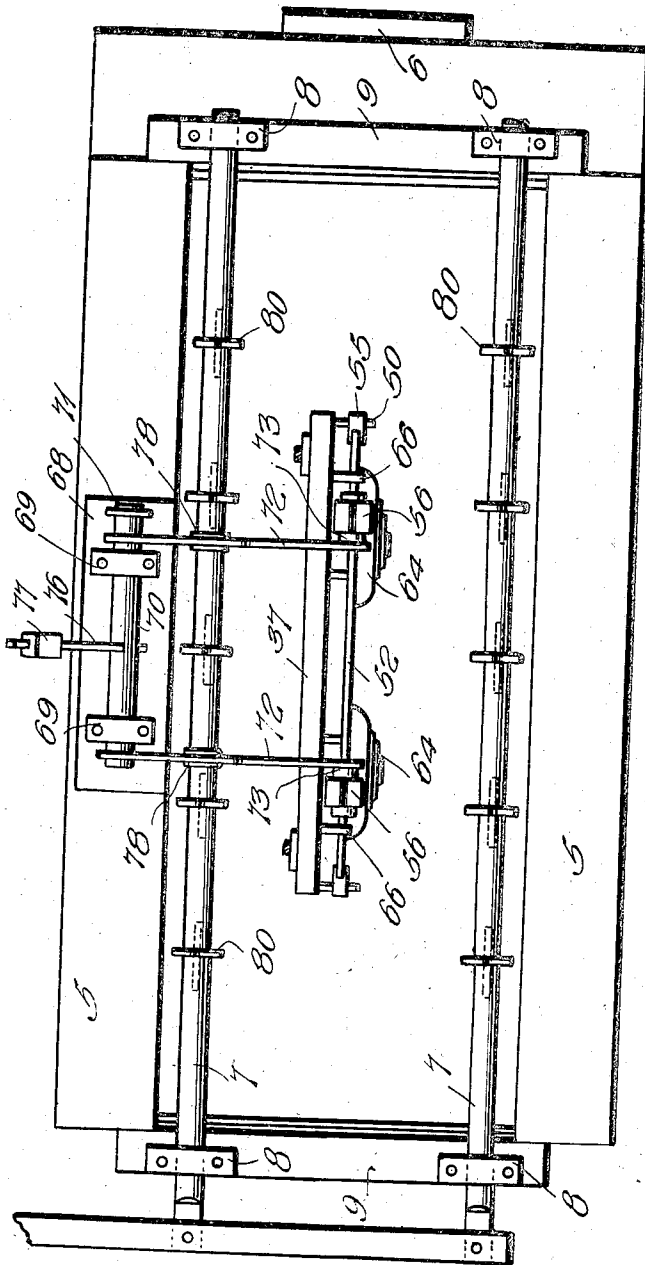
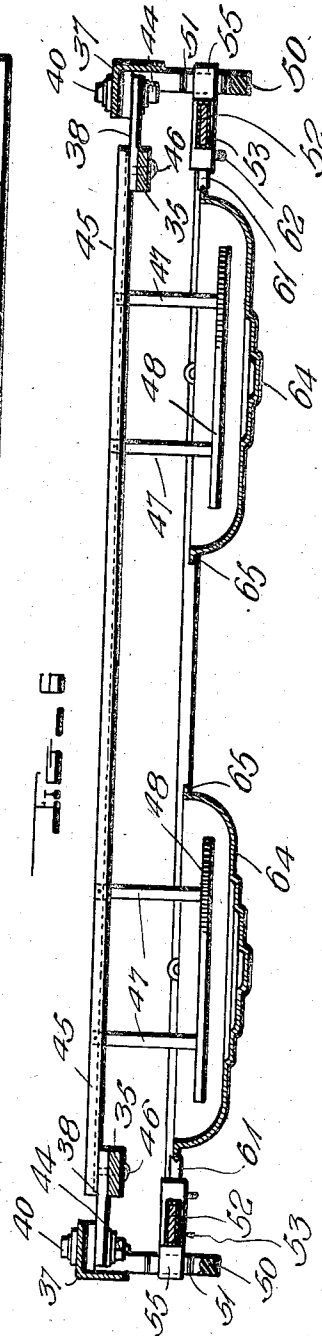
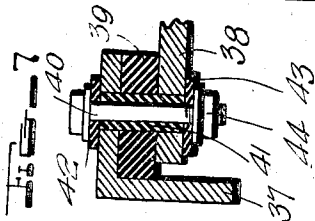
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APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

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6 Sheets-Sheet 4



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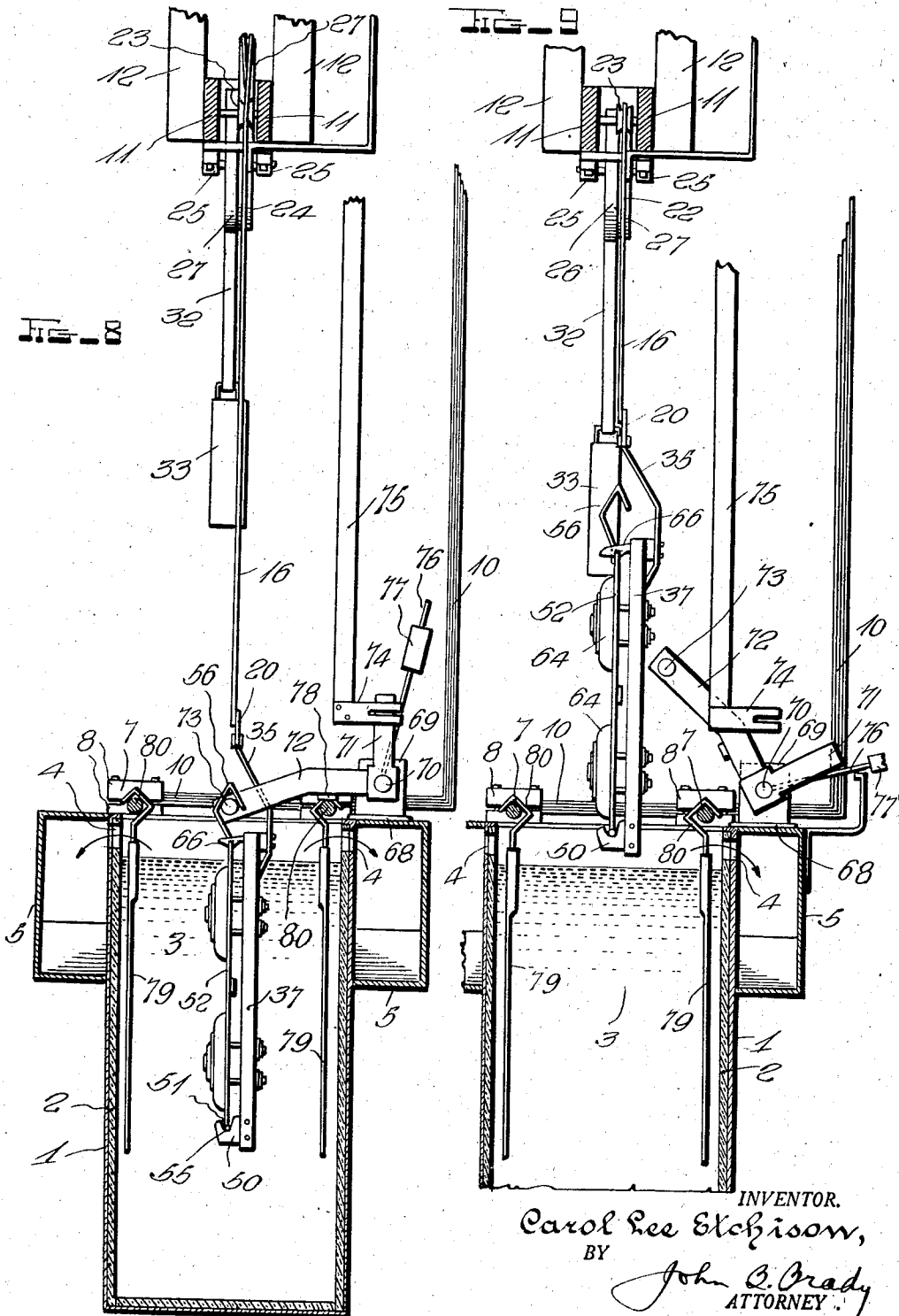
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APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

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6 Sheets-Sheet 5



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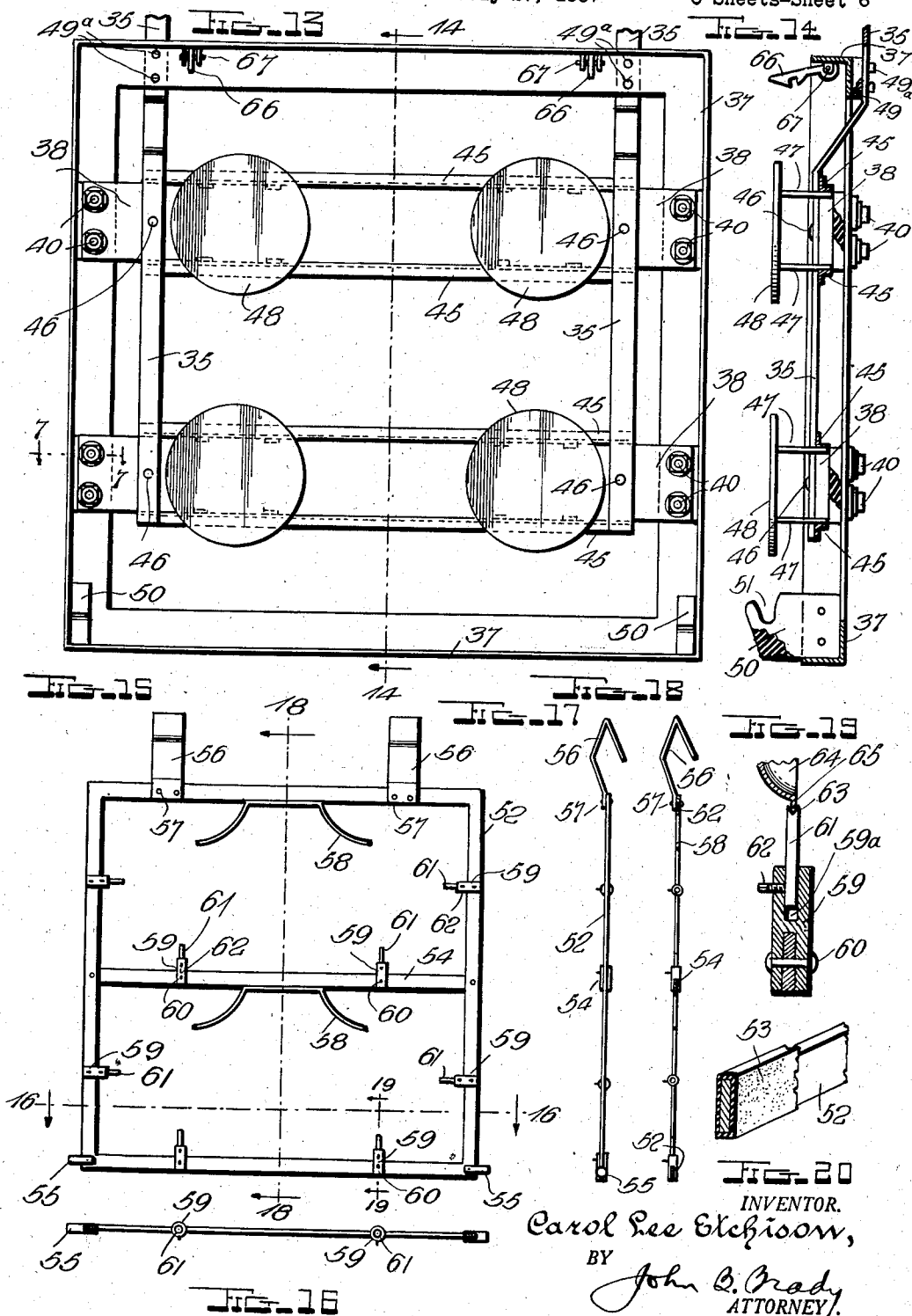
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APPARATUS FOR ELECTROPLATING METALLIC ARTICLES

Filed July 27, 1937

6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE

2,199,487

APPARATUS FOR ELECTROPLATING
METALLIC ARTICLES

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Application July 27, 1937, Serial No. 156,035

5 Claims. (Cl. 204—5)

My invention relates broadly to an improved apparatus for electroplating metallic articles and more particularly to a system and apparatus for increasing the quality and speed of electroplating of metallic articles.

One of the objects of my invention is to provide apparatus for immersing and removing metallic articles with respect to an electroplating bath in which the activation of the electroplating bath is controlled automatically according to the immersion or removal of the articles with respect to the plating bath.

Another object of my invention is to provide means for facilitating the electroplating of metallic articles wherein the metallic articles may be mounted upon a relatively lightweight frame which is readily attachable or removable with respect to an anode supporting frame with automatic means for electrically connecting the articles to be plated, as cathodes, in the electroplating bath upon immersion of the articles in the electroplating bath.

Still another object of my invention is to provide apparatus for removably mounting articles to be plated in an electroplating bath and automatically connecting such articles as cathodes in the electroplating bath immediately upon immersion of the articles in the bath and disconnecting the articles as cathodes immediately upon the withdrawal of the articles from the plating bath.

A further object of my invention is to provide a construction of carrier for articles in an electroplating bath in which the weight of the articles is substantially counterbalanced through all positions of movement of the articles into and out of the electroplating bath.

A still further object of my invention is to provide an arrangement of carrier for articles to be immersed into or withdrawn from an electroplating bath in which different degrees of counterbalance is rendered effective for different positions of the articles with respect to the electroplating bath.

Another object of my invention is to provide a compact arrangement of carrier for articles immersed in an electroplating bath wherein the exposed metallic parts of the carrier are substantially insulated from the plating circuit so that electrodeposition is substantially limited to the articles which are connected as cathodes in the electroplating circuit.

Other and further objects of my invention reside in the apparatus for moving the article carrier and the construction of the article carrier in

an electroplating system as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a side elevation showing the article to be plated completely immersed in the electroplating bath and the switch to the energization circuit closed; Fig. 2 is a similar view showing the article carrying frame partially raised and the switch to the energization circuit open; Fig. 3 is a similar view showing the article carrying frame completely raised out of the electroplating bath; Fig. 4 is a side elevation showing the articles in electroplating position partially in section on an enlarged scale, with parts broken away to disclose the interior; Fig. 5 is a plan view of the tank for the electroplating bath and adjacent parts; Fig. 6 is a horizontal section view on line 6—6 of Fig. 4; Fig. 7 is a detail horizontal view taken on line 7—7 of Fig. 13 showing the manner of insulating the structural parts of the main supporting frame from the anodes carried by the main frame; Fig. 8 is a transverse vertical section taken on line 8—8 of Fig. 1, showing the article carrying frame immersed in the electroplating bath; Fig. 9 is a similar view showing the article carrying frame raised out of the electroplating bath; Fig. 10 is a transverse vertical section on an enlarged scale taken on line 10—10 of Fig. 1; Fig. 11 is a horizontal sectional view taken on line 11—11 of Fig. 1; Fig. 12 is a transverse vertical section taken on line 12—12 of Fig. 1; Fig. 13 is a front view of the angle iron anode supporting frame upon which the article carrying frame is superimposed when in electroplating position; Fig. 14 is a transverse vertical section taken on line 14—14 of Fig. 13; Fig. 15 is a front view of the article carrying frame; Fig. 16 is a horizontal section taken on line 16—16 of Fig. 15; Fig. 17 is an edge view of the article carrying frame; Fig. 18 is a transverse vertical section taken on line 18—18 of Fig. 15; Fig. 19 is a detail fragmentary sectional view showing more particularly how the articles to be plated are suspended and electrically connected as cathodes, taken on line 19—19 of Fig. 15; and Fig. 20 is a detail fragmentary perspective view of a portion of the insulated article carrying frame.

My invention is directed particularly to apparatus for economical operation of a chromium plating bath on a quantity production basis with minimum consumption of time for each plating operation. While I have developed the apparatus herein described particularly for chromium plating, my invention is broader than the par-

tical application to chromium plating, and throughout the description and claims, I shall refer generally to electrodeposition upon metallic articles independently of the character of the plating bath.

Referring to the drawings in detail, reference character 1 designates the tank for the electroplating bath having a suitable lining of insulation material represented generally at 2. The solution constituting the plating bath is designated by reference character 3 which fills the tank 1 to a level just below the ventilating apertures in the walls of the tank 1, designated at 4. I provide a system of air ducts 5 extending along the side walls of the tank 1 and across one end thereof and interconnected by a common suction discharge connection 6 as illustrated more particularly in Fig. 5.

I provide a pair of positive bus bars 7 extending longitudinally of tank 1 in spaced relation to each other and in positions spaced from but adjacent the side walls of the tank. I mount insulated supports 8 for the positive bus bars 7 on brackets 9 mounted adjacent opposite ends of tank 1. The positive bus bars 7 are interconnected at one end by means of the positive connecting bus indicated at 10.

The tank 1 is mounted adjacent the floor of the plating room and beneath an overhead frame 11 supported from the ceiling structure by suitable suspension means indicated generally at 12.

I mount positive connecting buses from the overhead frame 11 in a position depending therefrom. The buses 14 are interconnected with the bus 10 to the positive side of the potential source through a conductor indicated generally at 15.

To facilitate the handling of the articles to be plated, as will be hereinafter described in more detail, I provide a foldable, extensible and retractable frame 16 containing links pivotally connected at 17 with the positive depending buses 14 and provided with pivoted interconnections at 18. The lower ends of the links are pivotally connected with respect to a horizontal bar 19 through pivotal connections on brackets 20 carried by bar 19 as indicated by the pivotal connections 21.

I provide cables 22 connected to brackets 20 on bar 19 and extending through guide pulleys 23 which are journaled on overhead frame 11. For purposes of controlling the cables 22, I provide a rotary member 24 which is journaled as indicated at 25 with respect to the overhead frame 11.

The rotary member 24 comprises two interconnected portions, that is, an eccentric cam portion 26 and a cylindrical drum portion 27. There is a connection 28 between cables 22 and the extreme end of eccentric cam 26. The eccentric cam 26 has a contacting face portion 29 whose function is shown more clearly in Fig. 2. In the position shown in Fig. 1 wherein the articles to be plated are entirely immersed in the plating bath, the rotary member 24 has the eccentric cam portion 26 thereof extending substantially in a vertical position. When however, the article carrying frame is partially raised from the plating bath in the position shown in Fig. 2, the cables 22 extend taut directly against the contacting face 29 of the eccentric cam as shown in Fig. 2. The opposite side of the eccentric cam 26 terminates in an abutting face 30 which functions when the article carrier is wholly raised from the plating bath as illustrated in Fig. 3 to coact with a limiting abutting

stop 31 on the overhead frame 1 as shown in Fig. 3.

The cylindrical drum portion 27 of the rotary member 24 has a strap or belt 32 secured to a peripheral portion of drum 27 as indicated at 34 in a position substantially on an obtuse angle with respect to the axis of the extended portion 26 constituting the eccentric cam as indicated in Fig. 3. The strap or belt has a weight 33 attached to the end thereof. As illustrated in Figs. 1, 2 and 3, weight 33 acts on a radius equal to the diameter of the cylindrical drum 27 urging the work carrying frame to elevated position and counterbalancing the entire assembly for permitting the work carrying frame to be readily elevated from immersed position. The mass of the work carrying frame acts differentially through radii which effectively change according to the radius of the cylindrical drum portion 27 or the distance between the axis of rotary member 24 and the extremity of the eccentric cam 26. By reason of this differential leverage condition the effective weight of the work or article carrying frame may be employed to advantage when the work or article carrying frame is immersed in the electroplating bath for establishing substantial electrical contact between the engaging hook members of the work or article carrying frame and the negative terminal connecting means as will be described hereinafter in more detail, which I have illustrated in the conditions set forth in Fig. 1. However, when the work or article carrying frame and anode assembly is raised only slightly out of the electroplating bath, a complete counterbalance is obtained as illustrated under the conditions shown in Figs. 2 and 3 because of the fact that the same effective radius is exerted about the journal of the rotary member 24 by both the mass of the work and article carrying frame and movable anode assembly on the one hand and the counterbalance weight 33 on the other hand.

Referring more particularly to Figs. 13-20, I provide suspension members and positive bus bar connections 35 leading from the anodes 48 on the frame 37 and connected at 36 as illustrated in Figs. 1, 2 and 3 to horizontal bar 19. The frame 37 has horizontally extending members 38 insulatingly mounted through insulation blocks 39. Bolts 40 interconnect the horizontally extending members 38 and frame 37. Each bolt 40 passes through an insulated sleeve 41 surrounding the bolt 40. Insulated washers 42 and 43 are provided adjacent the headed end of the bolt and the nut engaging end of the bolt so that a secure mechanical mounting is provided for horizontally extending members 38 while electrically insulating members 38 from the frame 37. Nuts 44 engage the bolts 40 for securing members 38 in position with respect to frame 37. The bus bars 35 are secured to the members 38 by suitable means such as rivets 46. The bus bars 35 and horizontally extending angle members 45 secured thereto are spaced to embrace opposite sides of horizontally extending members 38. The angle members 45 provide mechanical supporting means and electrical connecting means for the anodes 48 through members 47 which project from angle member 45. Anodes 48 formed from lead and may be conveniently spaced to correspond to the contour of the article to be plated. The bus bar connections 35 are electrically insulated from frame 37 through insulated spacer blocks 49. A mechanical connection is established between bus bars 35 and frame 37 through bolt members 49a

arranged in a manner similar to bolts 47 and as illustrated in Fig. 7. The interconnecting bolts 49a are electrically insulated from bus bars 35 and frame 37 so that frame 37 cannot form part of the electrical circuit to the anodes 48. The electrodeposition current is therefore confined to the bus bars 35, angle members 45, anode supports 47, and anodes 48. The frame 37 carries a pair of lower supports formed from insulation material indicated at 50. Each of the supports 50 is provided with an engaging ledge like recess 51 as shown more particularly in Fig. 14. The frame 52 for carrying articles to be plated is shown in detail in Figs. 15-20. Frame 52 is stiffened by a horizontally extending interconnecting member 54. Frame 52 and member 54 are formed from metal having low electrical resistivity and high conductivity, such as copper. The frame 52 and member 54 are covered with insulation material indicated generally at 53 in Fig. 20 so that there is minimum exposure of the frame or member 54 with respect to the plating bath when the frame is immersed in the bath. The frame 52 carries a pair of trunnion members 55 adjacent the lower edge thereof for engaging the ledge like recesses 51 in the insulated lower supports 50 when the frame 52 is mounted in position adjacent anodes 48 on frame 37. Frame 52 is provided with a pair of symmetrically arranged hook shaped suspension members and negative bus connectors 56. The suspension and negative bus connectors 56 are electrically and mechanically connected to frame 52 through rivets or other connection means 57.

Frame 52 carries a plurality of article engaging members, certain of which I have indicated at 58 and others of which I have shown at 59. When the apparatus of my invention is used in chromium plating, the article engaging members 58 and 59 may be formed from nickel or metal which is not attacked in the electroplating bath in which the articles to be plated are immersed. The article engaging members 58 and 59 are directly secured to the metallic parts of the frame 52 and laterally extending member 54 before the insulated covering 53 is applied to the frame 52 and member 54. I have shown the article engaging member 59 suitably slotted to embrace opposite sides of the metallic strip constituting frame 52 with rivet 60 passing through article engaging member 59 and the metallic strip of the frame for establishing a good electrical and mechanical connection.

Each of the article engaging members 59 is provided with a socket 59a as shown more particularly in Fig. 19 into which the renewable article engaging member 61 is removably and adjustably carried. The article engaging member 61 may be formed from Monel metal or nickel when used in a chromium plating bath as such metals are subject to minimum attack by the plating bath in a chromium plating process. Each of the article engaging members 59 is provided with an adjustable set screw for securing the renewable article engaging member 61 in a selected position in socket 59a according to the manner in which the articles carried by frame 52 are mounted with respect to the frame. Each of the article engaging members 61 are notched on the end thereof as indicated at 63 for engaging the articles to be plated.

In Fig. 6 I have shown on an enlarged scale, the manner of mounting kitchen or table utensil covers 64 in position on frame 52 for purposes of plating. I have indicated the articles 64 as hav-

ing rim portions 65 which engage notches 63 in at least two of the spaced article engaging members 61, the article 64 being resiliently pressed into engagement with notches 63 in at least two of the members 61 by means of the resilient article engaging members 58. It will be understood that the process of my invention is applicable to many kinds of articles of a variety of shapes and sizes and that various lengths of renewable article engaging members 61 may be employed in the sockets 59a of the article engaging members 59 to coact with the resilient article engaging members 58 for securing such articles in position. When the articles to be plated are mounted in position on the frame 52 and the frame 37 elevated from tank 3 as illustrated in Fig. 9, frame 52 may be mounted in position with respect to frame 37 by resting the trunnions 55 of frame 52 in the ledge like recesses 51 in insulated members 50 and moving frame 52 from a slightly tilted or angularly disposed position to a position in spaced parallel relation to frame 37 and allowing the notched latches of the insulation material 66 to engage the upper edge of the frame 52. Frame 52 is thus maintained in parallel spaced relation with respect to frame 37 and insulated therefrom with the articles 64 carried thereby centered in spaced relation to anodes 48 but spaced and insulated therefrom. The notched latches 66 are pivoted at 67 on frame 37 and are formed from insulation material so that there is no tendency for the passage of the electrodeposition current between frame 52 and frame 37.

In a position adjacent the top of tank 1 and located adjacent one side thereof, I provide a support indicated generally at 68 which carries a pair of spaced journal members 69 in which shaft 70 is journaled for angular movement. Shaft 70 carries switch arm 71 which is movable through an acute angle to establish connection with fixed contact or switch jaws 74 for closing an electrical circuit through the negative bus bar 75. Shaft 70 also carries a pair of lever arms in the nature of bell crank extensions 72. Each of the lever arms 72 carry a terminal member 73 projecting in opposite directions. The arrangement of the lever arm 72 with respect to shaft 70 is entirely symmetrical and the assembly is counterbalanced in movement by means of a counterbalanced guide rod 76 extending through shaft 70 on an obtuse angle with respect to the lever arms 72. The guide rod 76 carries an adjustable counterweight 77 thereon having a suitable set screw 77a for fixing the counterweight in selected position on the guide rod 76. There is an insulated stop 78 disposed between each of the lever arms 72 and the adjacent positive bus bar 7 to limit the downward movement of lever arm 72 and prevent contact between the lever arm 72 and the positive bus bar 7 when the lever arms are in the lowermost position, illustrated in Fig. 10.

The positive bus bar 7 provides supports for the spaced anodes 79 which depend by means of contact hooks 80 from the positive bus bar 7.

In the operation of the electrical plating apparatus of my invention, a multiplicity of racks 52 may be employed and the articles to be plated may be assembled on the racks preparatory to the plating operation. It is only necessary for an operative to pick up the relatively light weight rack with the articles secured in position thereon and mount the rack with respect to the frame 37 when the frame is in elevated position, shown

in Fig. 9, counterbalanced by weight 33. The operative rests the trunnions 55 on frame 52 in the ledge like recesses 51 of the insulated lower supports 50 of frame 37 and moves the frame 52 toward frame 37 to a position where the notches of the insulated latches 66 engage the upper edge of frame 52 whereupon frame 52 and the articles to be plated are secured in position in spaced relation to the frame 37 and anodes 48. Because of the normal bias force of switch 71, due to adjustable counterweight 77, lever arms 72 are maintained out of the path of frame 37 as illustrated in Fig. 9 allowing the operative adequate space by which to introduce frame 37 and the articles to be plated into the electroplating bath without accidentally touching either the positive or negative buses or terminals. The operative applies a slight manual force against frame 37 for causing the frame to move into the electroplating bath. The frame descends against the restraint offered by the counterweight 33. When the frame 37 descends to a position substantially level with the negative bus terminals 73 carried by lever arm 72, the operative swings the frame 37 slightly to the rear engaging hook shaped suspension members and negative bus conductors 56 over the negative terminal members 73. The operative continues to apply a downward force to frame 37 reaching a position of descent similar to that illustrated in Fig. 2. When this position is reached, rotary member 24 has arrived at a position where the eccentric cam portion 26 commences to act as a lever arm overcoming the shorter lever arm established by the radius of the cylindrical portion 27 of the rotary member upon which weight 33 is effective and as a result, frame 37 descends more rapidly into the electroplating bath. The articles to be plated are thus immersed and immediately upon complete immersion, switch arm 71 establishes connection with contact 74 closing the circuit from negative bus 75 through contact 74, switch arm 71, shaft 70, lever arms 72, terminals 73, hook shaped suspension members 56, frame 52, to the articles to be plated 64 as cathodes. The path of the electrodeposition current through the bath passes from the cathodes 64 to the anodes 48 and 79. A path of return from anode 79 includes hook supports 80, positive bus bars 7, and positive connecting bus 10 to the common positive return 15 to the potential source. The path from anodes 48 extends through supports 47, angle members 45, positive bus bar connections 35, connections 36 to horizontal bar 19, foldable, extensible and retractible frame 16 through positive depending frame 16 through positive depending buses 14 through the common return conductor 15.

After the plating operation, the operative elevates frame 37 as indicated in Fig. 2 and as the articles to be plated are about to leave the plating bath, switch arm 71 moves away from contact 74 opening the electrodeposition current circuit through negative bus 75. The operative continues to raise frame 37. Lever arms 72 swing in a predetermined arc by virtue of the normal bias applied by counterbalance 77 on the counterbalanced guide rod 76. The operative swings frame 37 slightly forward freeing the hook shaped suspension members and negative bus conductors 56 from terminal members 73. At this position of elevation, counterweight 33 has reached a position of complete counterbalance of loaded frame 37 as illustrated in Fig. 2 and the operative with very little effort shifts the

retractible frame 16 upwardly to the position illustrated in Fig. 3. During this process, the lever arm originally afforded by the distance between the journal of rotary member 24 and the connection 28 of the cam has effectively reduced to the diameter of the cylindrical portion 27 so that counterweight 33 more than overbalances the mass of frame 37. The frame 37 is elevated until abutting face 30 of eccentric cam portion 26 abuts against abutment stop 31 on overhead frame 11 as illustrated in Fig. 3. The operative now slightly raises insulated latches 66 releasing the upper edge of frame 52. Frame 52 is then shifted at a slight angle on trunnions 55 and the frame carrying the plated work quickly removed. Thereafter, the plated ware may be removed from the frame 52 and the frame made ready to mount succeeding articles while other frames are in the plating bath.

The structure of my invention enables lead anodes to be used without destroying the peroxide film. The work of the operatives is vastly speeded up with the apparatus of my invention as the carrier may be loaded and unloaded rapidly and there is no loss of time in the cutting on of the electrodeposition current circuit as soon as the articles to be plated are submerged. The fact that the operatives may disregard entirely the electrical operation of the plating bath either to cut on the current or cut off the current allows the operatives to give full attention to loading and unloading and the mounting and renewal of the ware with respect to the frame. The variation in rate of movement of the elevator affords an automatic timing for the entire equipment which facilitates the electroplating operation.

Because of the fact that the article engaging members 58—59—61 are formed from nickel or Monel metal or other material not subject to attack by chrome acid, the article supporting means functions particularly well in a chromium plating bath.

While I have described my invention in certain of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. Electroplating apparatus comprising a tank for an electroplating bath, a switch pivotally mounted adjacent the top of the tank, a lever arm connected with said switch and projectible to a substantially central position over said tank, a frame, means for raising and lowering said frame with respect to said tank, a separate article carrying frame detachably connected with the aforementioned frame and a member extending from said article carrying frame and engageable with said lever arm for closing said switch when said frames are lowered to a position for immersing articles in the electroplating bath.

2. Electroplating apparatus comprising a tank for an electroplating bath, a shaft member journaled adjacent one side of said tank, a pair of arms carried by said shaft member and movable to a position centrally over said tank, a terminal member disposed adjacent the extremity of each of said arms, a switch blade carried by said shaft, a contact aligned with said switch blade and a rack carrying articles to be plated having hook members engageable with the terminal members on said arms as said rack is lowered

into said tank for moving said switch blade to a position establishing electrical connection with said contact.

5 3. Electroplating apparatus comprising a tank for an electroplating bath, a shaft member jour-
naled adjacent one side of said tank, a pair of
arms carried by said shaft member and movable
to a position centrally over said tank, a terminal
member disposed adjacent the extremity of each
10 of said arms, a switch blade carried by said
shaft, a contact aligned with said switch blade,
a rack carrying articles to be plated having hook
members engageable with the terminal members
on said arms as said rack is lowered into said
15 tank for moving said switch blade to a position
establishing electrical connection with said con-
tact, and means for normally biasing said switch
blade to open position with respect to said con-
tact.

20 4. In an electroplating apparatus, a tank con-
taining an electroplating bath, an article carrier
for immersing and removing articles with respect
to said electroplating bath, means for projecting
and retracting said article carrier with respect

to said electroplating bath comprising a rotary
member including an eccentric cam portion and
a drum portion, cables connecting said eccentric
cam portion and said article carrier in predeter-
mined operative relation with respect to the level
5 of said bath, and a belt connected at one end
to said drum and to a counterweight at the other
end, whereby a differentially effective elevating
force is applied to said article carrier according
to the position thereof with respect to the level
10 of the bath in said tank.

5. Electroplating apparatus comprising a
frame immersible in an electroplating bath, a
multiplicity of anodes mechanically supported by
said frame but electrically insulated therefrom
15 and electrically bonded together, an article car-
rying frame, insulated socket and latch means
for detachably mounting said article carrying
frame with respect to said immersible frame,
and means for establishing electrical connection
20 with articles carried by said article carrying
frame as cathodes in the electroplating bath.

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