April 27, 1937. A. H. HANNON 2,078,381

SEMIAUTOMATIC ELECTROPLATING MACHINE

Filed April 11, 1934 5 Sheets-Sheet 1

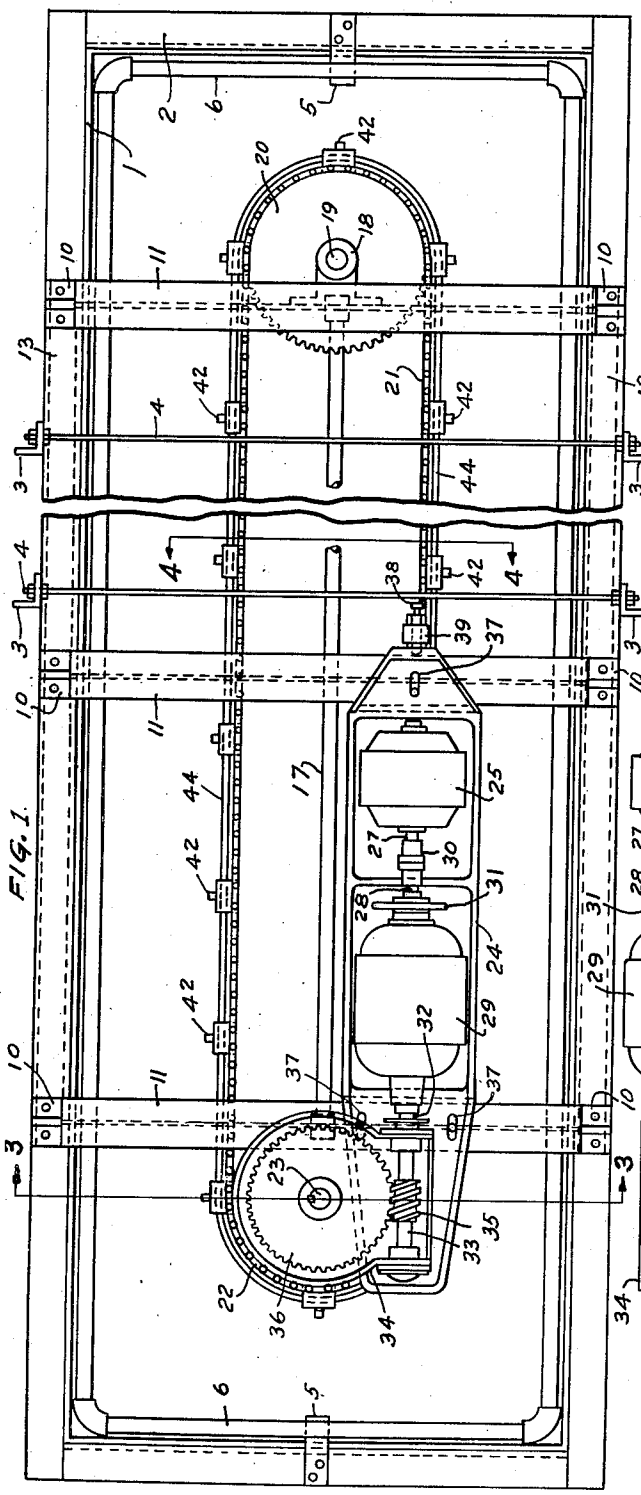


FIG. 1.

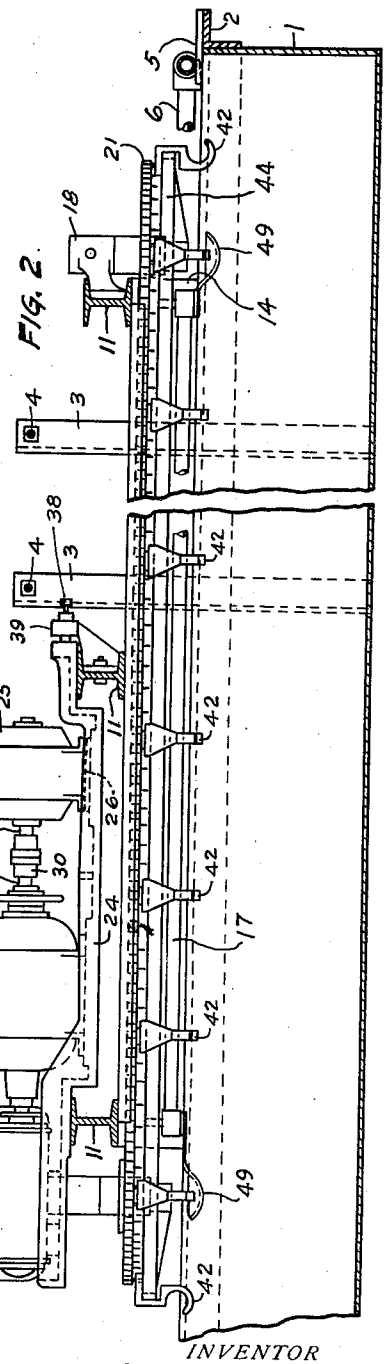


FIG. 2.

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SEMIAUTOMATIC ELECTROPLATING MACHINE

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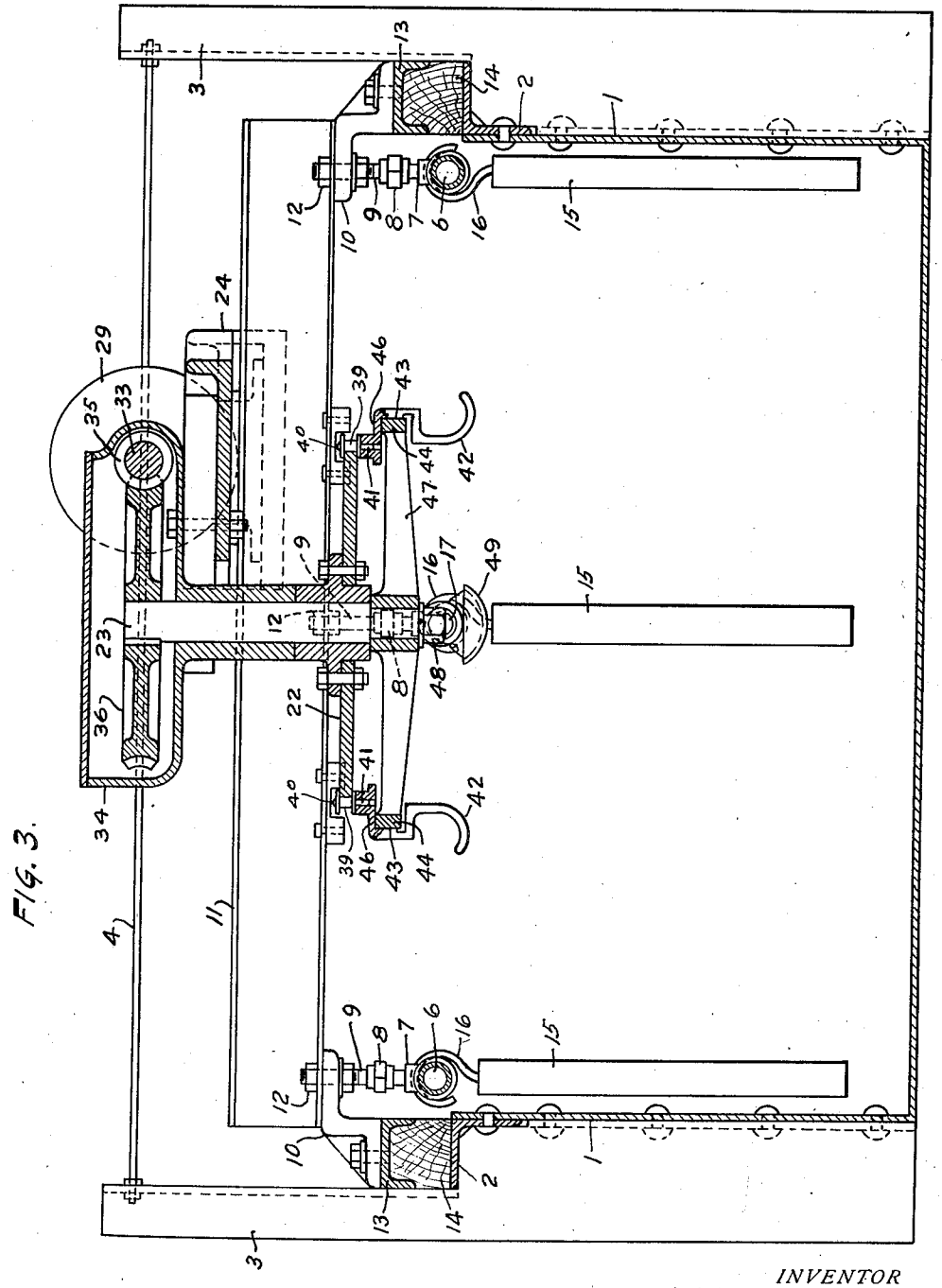


FIG. 3.

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SEMIAUTOMATIC ELECTROPLATING MACHINE

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FIG. 4.

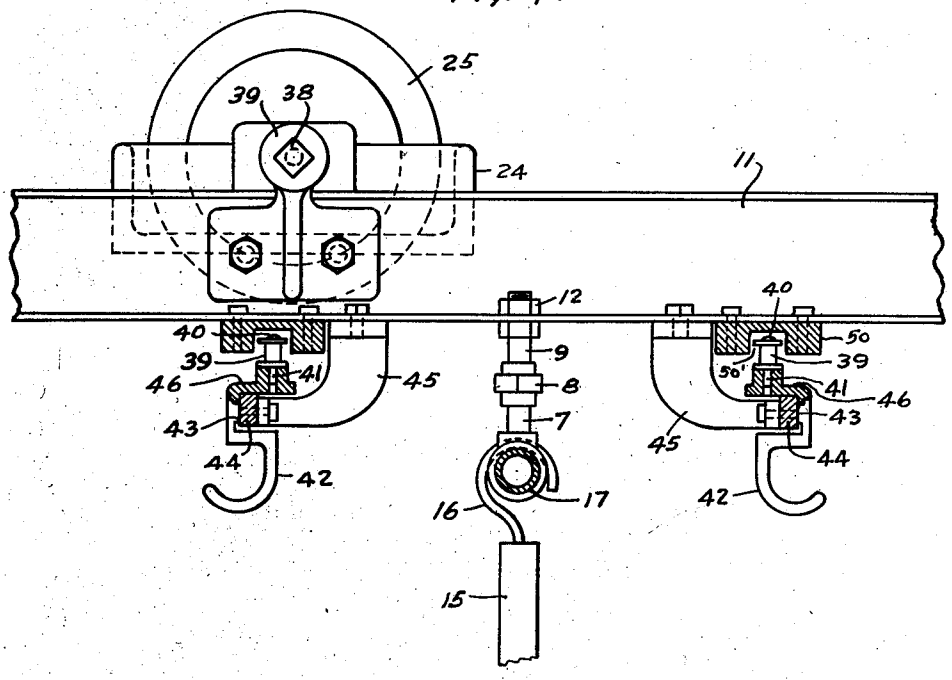
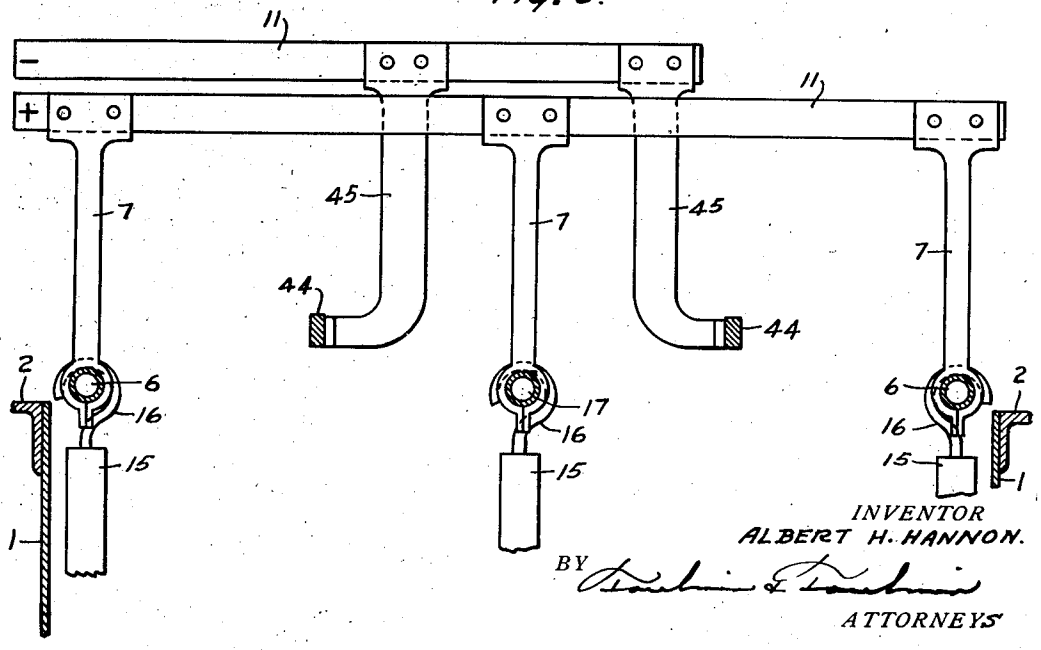


FIG. 5.



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SEMIAUTOMATIC ELECTROPLATING MACHINE

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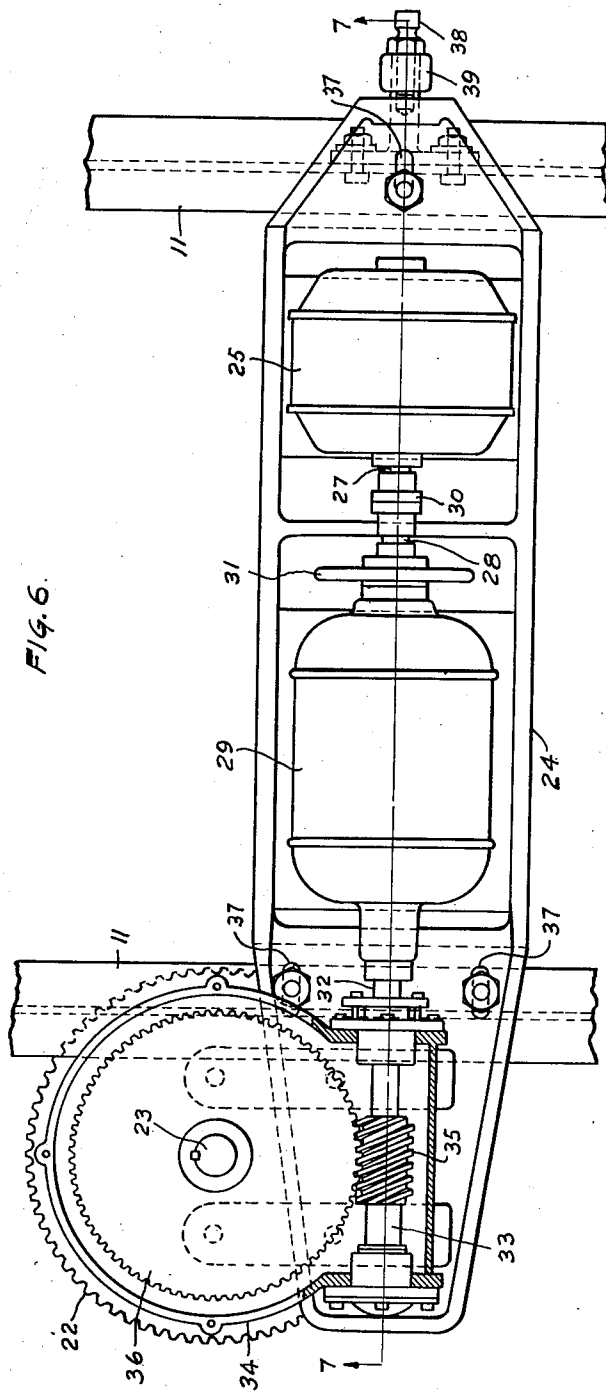


FIG. 6.

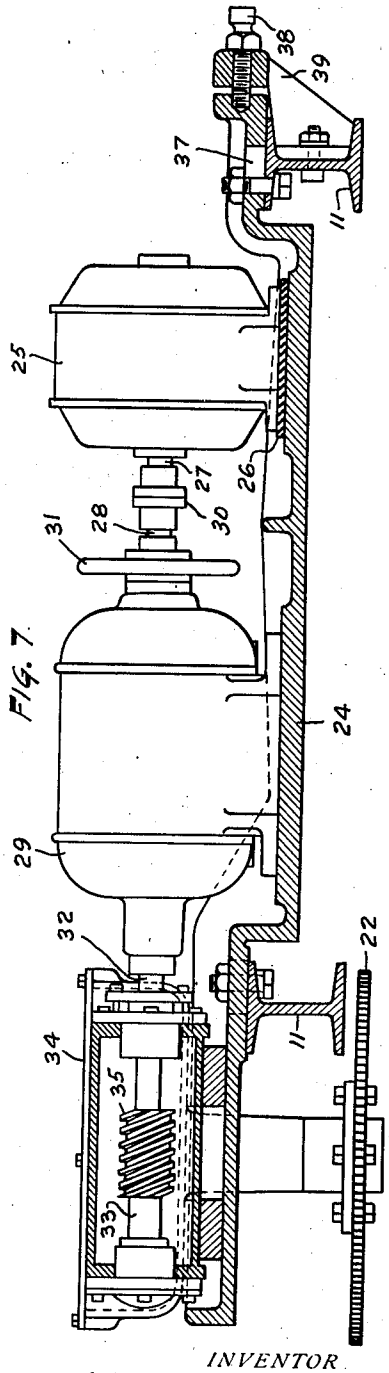


FIG. 7.

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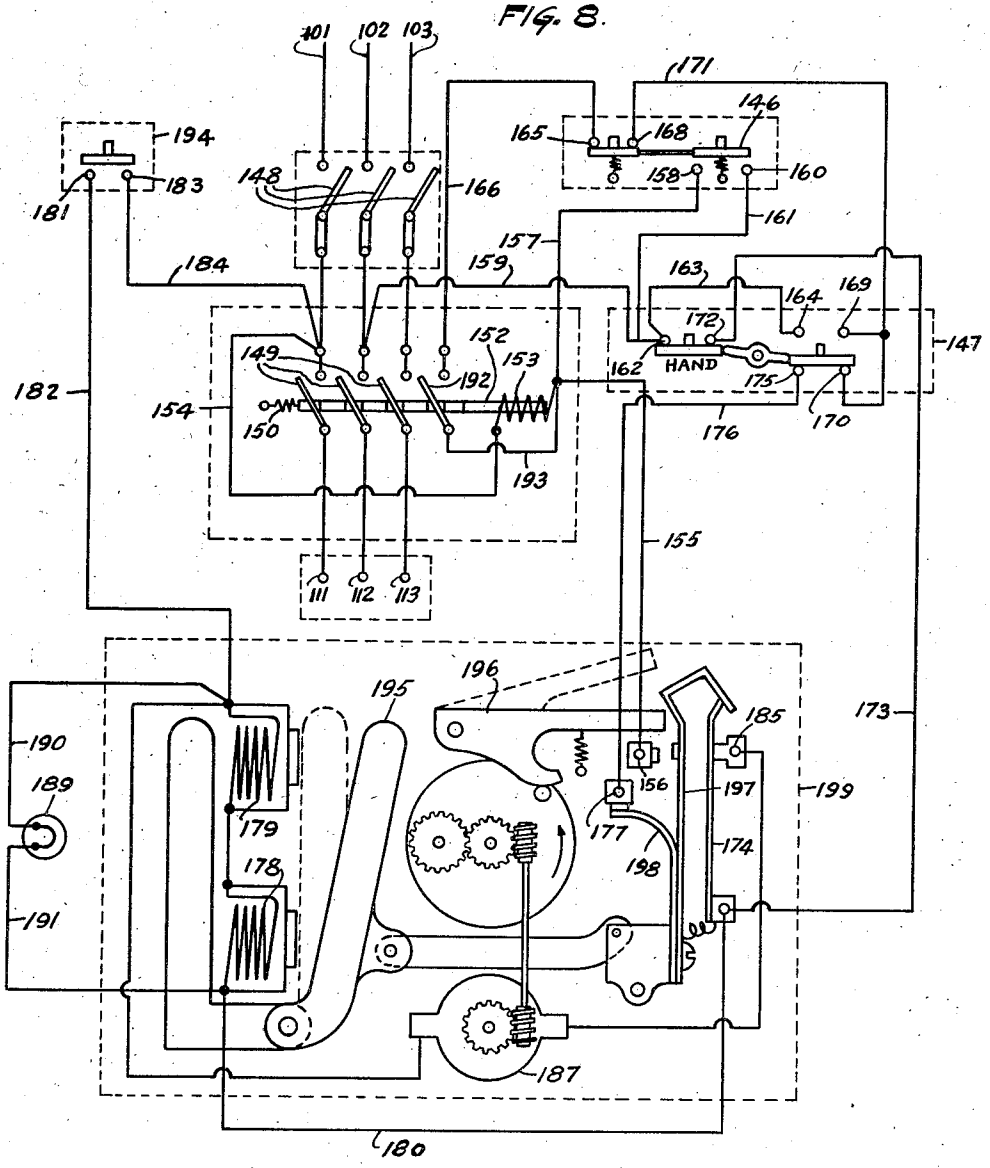
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SEMIAUTOMATIC ELECTROPLATING MACHINE

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FIG. 8.



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Patented Apr. 27, 1937 2,078,381

UNITED STATES PATENT OFFICE

2,078,381

SEMIAUTOMATIC ELECTROPLATING MACHINE

Albert H. Hannon, Springfield, Ohio

Application April 11, 1934, Serial No. 720,086

1 Claim. (Cl. 204—5)

This invention relates to electroplating machines and, in particular, to semi-automatic electroplating machines, where the work being plated moves through the plating tanks and is attached and detached manually.

One object of my invention is to provide a a semi-automatic electroplating machine having an endless conveyor chain, the drive for which is adjustable as a unit to adjust the tension in said chain.

Another object is to provide such a machine in which the work is suspended from carriers attached to the conveyor chain, which carriers make contact with and receive current from a conductor rail along which they slide.

Another object is to provide an electroplating machine having an endless conveyor chain wherein the motor drive unit is self-contained upon its own base and is supported upon cross members, the drive unit being adaptable to tanks of different widths, merely by substituting cross members of different widths for supporting the drive unit.

Another object is to provide an electroplating tank having anode rods of adjustable height and adapted to support anodes hung therefrom in various parts of the solution.

Another object is to provide an electroplating machine wherein the cross brackets which support the driving unit of the machine are mounted upon wooden members which in turn are supported upon the metal tank and its side uprights.

Another object is to provide an electroplating machine having a drive unit which is adjustable as a whole upon its own base to take up slack in the conveyor chain, the action of the conveyor chain being intermittent, so that the conveyor chain will be moving during the times the articles being plated are submerged in the tanks, and will be at rest while the articles are being loaded or unloaded.

Another object is to provide an electroplating machine having a single tank wherein the conveyor chain and drive unit are electrically interconnected, and wherein the machine is provided with a conductor insulated therefrom and adapted to support the articles connected to a source of electricity. Longitudinally extending rails **50**, provided with guiding grooves **50'**, are bolted or otherwise secured to the under surfaces of the transverse bridging members. Within the grooves **50'** the rollers **39** run freely, and normally out of contact with the side walls of the grooves. This relationship between the grooves and rollers is accurately maintained by the adjustment afforded through the slots **37** and screw **38**. By this construction there will be no deflection of the chain to cause the rollers to engage the walls of the grooves **50'**, and a nicely balanced relationship between the parts may be maintained, the result being that the rollers run in the guide grooves without friction, and at the same time are so positioned that any abnormal tilting of the hooks will be prevented through engagement, at that time, between the rollers and the walls of the grooves **50'**.

In the drawings:

Figure 1 is a top plan view, partly broken away, of the electroplating machine of my invention;

Figure 2 is a side elevation of the electroplating machine shown in Figure 1;

Figure 3 is a vertical section through the drive shaft of the driven conveyor sprocket, along the line **3—3** of Figure 1;

Figure 4 is an enlarged vertical section along the line **4—4** of Figure 1, showing the details of the conveyor chain and anode and cathode supports;

Figure 5 is a diagrammatic view showing the electrical connection of the anode rods and cathode rails;

Figure 6 is an enlarged top plan view, partly in section, of the motor drive unit of my machine;

Figure 7 is a vertical section on the line **7—7** of Figure 6;

Figure 8 is a diagrammatic view of the electrical and mechanical apparatus for causing the machine to operate intermittently.

Referring to the drawings in detail, Figures 1 and 2 show the electroplating machine of my invention. The machine is provided with a tank **1** having a flanged member **2** around its top edge, and likewise having flanged uprights **3** on opposite sides thereof, these uprights being interconnected by the strain rods **4**. To the flanged member **2** are attached brackets **5** which serve to support conductor rods **6** extending around the tank **1** near the top edge thereof. The conductor rods **6** are generally anode rods, and are hereinafter designated as such, although it will be understood that for electro-cleaning operations, the conductor rods **6** may be given a negative charge instead of the usual positive charge common in electroplating practice. Suspended from the anode rod **6** at intervals around the tank are anodes **15** attached thereto by the hook portions **16**. These anodes **15** may be distributed through the tank in any desired man-

ner and in such number as may be necessary for the particular conditions under which the machine is being operated.

The tank is additionally provided with a middle anode rod 17 which runs along the mid-portion of the tank (Figure 4) and is suspended above the tank by hangers similar to those previously described, and similarly designated. These hangers are likewise secured to the cross members 11.

The anode rods 6 are likewise supported by hangers 7 which are connected to the insulating member 8 (Figure 3), above which rises the bracket portion 9. The latter is in turn attached to the bracket 10 and the cross member 11, it being held thereagainst by means of the nut 12 threaded thereon. Each cross member 11 is supplied at its opposite ends with the brackets 10, these being secured to longitudinal channel members 13 resting upon wooden beams 14. The wooden beams 14 rest upon and are supported by the metal flanged members 2 which extend around the tank at its top edge.

On one of the cross members 11 (Figures 1 and 2) near one end of the machine is mounted a bracket 18 which supports the vertical shaft 19. Loosely mounted upon the shaft 19, so as to rotate freely thereon, is the sprocket 20, commonly known as the tail sprocket. This sprocket supports the conveyor chain 21, the opposite end of which is supported by the head sprocket 22 keyed to the vertical shaft 23 and driven thereby.

The mechanism for driving the vertical shaft 23 which actuates the head srpocket 22 is supported as a unit upon the base 24 (Figures 1, 2 and 6). On this base is mounted a motor 25, insulated therefrom by the insulating layer 26. The motor 25 has a drive shaft 27 which is connected to the drive shaft 28 of the variable speed unit 29 by the insulated coupling 30. The variable speed unit 29 does not in itself constitute a feature of the present invention, hence is not described in detail. Its speed is governed by the setting of the hand wheel 31, the turning of which will vary the speed as may be desired. The opposite end of the variable speed unit 29 is provided with a drive shaft 32 connected to the drive shaft 33 of the speed reduction unit 34. The drive shaft 33 is equipped with a worm 35 which meshes with the worm gear 36. The latter is in turn keyed to the vertical shaft 23, which it drives at a greatly reduced speed, compared with the speed of the drive shaft 33 (Figure 1).

The drive motor 25, the variable speed unit 29 and the speed reduction unit 34 are thus mounted as a single piece of mechanism upon the base 24 and are adjustable as a whole when the base 24 is moved. To this end the base 24 is provided with slots 37 (Figure 1), whereby it may be moved longitudinally by turning the screw 38 mounted in the bracket 39 secured to the middle cross member 11 (Figures 2 and 6). In this manner any slack existing in the conveyor chain 21 may be immediately taken up and the proper tension thereof obtained.

The conveyor chain 21 is of the roller type. At intervals (Figures 3 and 4), the pins 40 of the rollers 39 are extended downwardly as at 41, and to these extensions are attached the hooks 42. The latter are preferably of brass and serve to support the articles being plated. The hooks 42 are provided with flattened portions 43 midway between their connections 41 and their lower ends. These flattened portions 43 bear against the conductor rails 44 and receive current therefrom. The conductor rails 44 in electroplating practice are generally provided with current of a negative polarity, hence will be hereinafter designated as the cathode rails 44. It will be understood, however, that in electro-cleaning processes the conductor rails 44 may be given a positive charge of electricity, without exceeding the scope of my invention. The cathode rails 44 are secured to and supported by brackets 45 which in turn are bolted to the cross members 11 of the machine (Figure 4). It will also be seen that the hooks 42 are of such shape that their horizontally flattened portions 46 rest upon and slide along the upper surface of the cathode rails 44, thus providing additional support for the work articles and improved electrical contact for the transmission of electricity therebetween. The cathode rails 44 are arranged in an endless form having parallel linear runs with circular ends. The circular ends of the cathode rails 44 are additionally supported by diametral cross brackets 47 (Figure 3) which are attached to the end cross member 11. The opposite curved end of the cathode rail 44 is supported by a similar bracket adjacent to the tail sprocket 20. Immediately beneath the cross brackets 47, which are held by the bolts 48 are mounted the splash guards 49. The latter are attached to the middle anode rod 17.

The tanks for the solutions which may be used in connection with the machine are made of different substances according to the nature of the solution being used. The tank 1 may be of steel for cyanide solutions or for alkaline solutions in general. Tanks of wood or of steel lined with rubber or lead, are used for acid solutions. The machine shown employs a single tank, hence it is unnecessary to insulate the conveyor chain 21 from the cathode rail 44.

In operation, the machine is set in motion by starting the driving motor 25. This motor communicates power to the variable speed unit 29, the speed thereof being controlled by turning the wheel 31. The speed of the shaft 32 emerging from the variable speed unit 29 is further reduced by the speed reduction unit 34 so that the sprocket 22, which it drives, rotates at a comparatively slow speed compared with the motor shaft 27. Any slack existing in the conveyor chain 21 is taken up by adjusting the screw 38 which moves the motor drive unit base 24 bodily in a longitudinal direction.

As the sprocket 22 rotates, it causes the conveyor chain to travel in an orbital path, carrying with it the hooks 42. The tank 1 is filled with the proper solution up to a suitable level, the work articles loaded on to the hooks 42, and current supplied to the anode rods 6 and cathode rails 44. The work articles thus move through the tank in an orbital path while they are being plated (in the case of electroplating) or cleaned (in the case of electro-cleaning). It will be understood that in electro-cleaning, the polarity is reversed relative to that existing in electroplating.

The conveyor chain preferably moves in an intermittent manner according to the operation of the apparatus hereinafter described. While the work is being plated, it moves through the solution, but the mechanism stops and the conveyor chain becomes stationary at intermittent periods while the work articles are being loaded and unloaded.

Controlling apparatus for intermittent movement of machine

The machine may be operated continuously if desired, without any special arrangements. If intermittent motion is to be provided, however, the apparatus and circuit shown in Figure 8, or its equivalent, is employed.

The control circuit for intermittent movement comprises a solenoidally operated switch assembly **149**, a mechanically-operated limit switch **194** actuated by the motion of the machine through a predetermined distance, a stop switch having contacts **165** and **168**, a start switch having contacts **158** and **160**, and an automatic switch having contacts **164**, **169**, **170** and **175** interconnected with a hand switch having contacts **162** and **172**. (Figure 8). These pieces of apparatus are connected to a timing switch assembly **199** comprising a timing motor **187**, a pair of solenoids **178** and **179**, operating an armature **195** which is linked to a pivoted switch arm **197**, and a cam member drivingly connected to the timing motor **187** and operating a pawl **196** which determines whether or not the switch arm **197** is operable.

By the use of this apparatus connected in the manner shown in Figure 8, the conveyor chain will alternately come to rest, remain at rest for a predetermined time, start in motion, remain in motion for a predetermined time, and again come to rest. It will be understood, however, that mechanical indexing mechanism could be employed to accomplish the same result as the electrical apparatus shown.

The operation of the intermittent motion control apparatus is as follows: the manually operated switches **148** are first closed. If continuous motion of the machine is desired, this motion is obtained by depressing the switch marked "Hand", which opens its contacts **162** and **172**, and through the action of the interconnecting lever also opens the contacts **170** and **175** of the automatic switch and closes the contacts **164** and **169** thereof. The operation just described disconnects the automatic timing mechanism, hereinafter described, from the circuit, and the machine is then free to be started by depressing the start switch **146**, thus closing the contacts **158** and **160**. The main driving motor **25** then starts rotating by receiving current at its terminals **111**, **112** and **113** from the power lines **101**, **102** and **103**. This circuit is completed from the power line **101** along the wire **154** through the solenoid **153**, along the wire **157** through the start switch contacts **158** and **160**, along the wire **161**, through the "hand" switch contact **162**, and along the wire **159** to the power line **102**. The closing of this circuit energizes the coil of the solenoid **153**, closing the switches **149** actuated thereby, and thus connecting the power lines **101**, **102** and **103** with the terminals **111**, **112** and **113** of the main driving motor **25**. The same action also closes the switch **192** which maintains the energization of the solenoid coil **153** when the starting switch **146** is released, the energization thereof taking place through the circuit comprising the power line **101**, the wire **154**, the solenoid coil **153**, the wire **193**, the switch **192**, the wire **166**, the stop switch contacts **165** and **168**, the wire **171**, the automatic switch contacts **169** and **164**, the wire **163**, the hand switch contact **162** and the wire **159** connected to the power line **102**.

When it is desired to stop the motor and thus cause the machine to cease operating continuously, the stop switch is depressed, thereby opening its contacts **165** and **168**. This de-energizes the solenoid coil **153** and permits the spring **150** to open the switches **149** and **192**.

When it is desired to cause the machine to operate intermittently by automatic means, the automatic switch of the switch assembly **147** is depressed, this switch locking in either position. The machine is then started by pressing the start switch **146**. The main drive motor **25** is then energized through the circuit comprising the power line **101**, the wire **154**, the solenoid coil **153**, the wire **157**, the start switch contacts **158** and **160**, the wire **161**, the hand switch contact **162**, and the wire **159** to the power line **102**. This circuit energizes the solenoid coil **153** and the latter closes the switches **149** and **192** by attracting the solenoid armature **152** connected therewith. The closing of the switches **149** and **192** in this manner connects the power lines **101**, **102** and **103** to the terminals **111**, **112** and **113** of the main drive motor **25**. This circuit is maintained in energization by the closing of the switch **192** through the circuit comprising the power line **101**, the wire **154**, the solenoid coil **153**, the wire **193**, the switch **192**, the wire **166**, the stop switch contacts **165** and **168**, the wire **171**, the automatic switch contacts **170** and **175** of the switch assembly **147**, the wire **176**, the contact **177** of the timing switch assembly **199**, the contact spring **198** thereof, the wire **173**, the contacts **172** and **162** of the hand switch in the switch assembly **147**, and the wire **159** to the power line **102**.

The starting of the main drive motor **25** in this manner causes the conveyor chain **21** to pursue an orbital path until the limit switch **194** is mechanically tripped by a projection on the conveyor chain **121**, closing the limit switch contacts **181** and **183**. The main drive motor **25** is then de-energized through the circuit comprising the power line **101**, the wire **184**, the limit switch contacts **183** and **181**, the wire **182**, the armature coils **179** and **178** of the timing switch assembly **199**, the wire **180**, the switch contact spring **174**, the wire **173**, the hand switch contacts **172** and **162** of the switch assembly **147**, and the wire **159** to the power line **102**. The closing of this circuit energizes the armature coils **178** and **179** of the timing switch assembly **199**, attracting the armature **195** and withdrawing the switch arm **198** from the switch contact **177**. The opening of the latter circuit de-energizes the solenoid coil **153** and allows the spring **150** to withdraw the solenoid plunger **152**, thereby opening the solenoidal switches **149** and **192**, thus stopping the machine.

The energization of the armature coils **178** and **179** also energizes the timing switch motor **187**, which is shunted around these coils. The time switch motor **187** rotates and causes its cam to turn, lifting the pawl **196** after a predetermined time. The lifting of the pawl **196** permits the flexed spring switch arm **197** to engage the switch contact **156**. The main drive motor **25** is then energized by the closing of the circuit comprising the power line **101**, the wire **154**, the coil **153**, the wire **155**, the contact **156**, the spring switch arm **197**, the wire **173**, the contacts **172** and **162** of the hand switch in the switch assembly **147**, and the wire **159** to the power line **102**. The continued rotation of the cam operated by the timing switch motor **187** eventually allows the pawl **196** to spring back into its normal position, thus releasing the spring switch arm **197**, also operating the spring switch arm **174** and opening its contact with the switch contact **185**. The

latter de-energizes the timing motor 187 and stops it.

When the pawl 196 is in its normal position, it prevents the spring switch arm 197 from engaging the switch contact 156, even despite the attracting of the armature 195 to the armature coils 179 and 178 but the energization of the latter causes the spring switch arm 197 to be flexed. When the pawl 196 is raised through the action of the timing motor 187 and its cam, this interference ceases, and the spring switch arm 197 is permitted to engage the switch contact 156. This energizes the solenoid coil 153 and the latter closes the switches 149 and 192, re-energizing the terminals 111, 112 and 113 of the main drive motor 25 from the power lines 101, 102 and 103. The above energization of the solenoid coil 153 takes place through the circuit comprising the power line 101, the wire 154, the solenoid coil 153, the wire 155, the timing switch contact 156, the timing switch arm 197, the timing switch contact 174, the wire 173, the hand switch contacts 172 and 162 of the switch assembly 147, the wire 159 and the power line 102.

The energization of the main drive motor 25 again starts the machine and the conveyor chain 21 again starts traveling in its orbital path. As it starts to move, it mechanically releases the limit switch 194, thus opening the circuit between the contacts 181 and 183. This de-energizes the armature coils 179 and 178, releases the armature 195, allows the contacts 185 and 177 to become connected to their respective switch arms 198 and 174, and disconnects the switch arm 197 from the switch contact 156. The foregoing cycle of operations is then in a condition to repeat itself intermittently so long as the automatic switch on the switch assembly 147 is closed.

The spring arms 197 and 198 of the timing switch assembly 199 and their contacts 177 and 156 are so arranged and adjusted that the contact 177 is engaged by its spring arm 198 before the spring arm 197 is permitted to disengage itself from the switch contact 156. The purpose of this arrangement is to prevent the holding circuit through the solenoid coil 153 from being momentarily interrupted and the switch 192 allowed to open before the switch contact 177 would be engaged by its spring arm 198 and the circuit accordingly closed.

In the circuit shown in Figure 8, the wires 190 and 191 are shunted around the armature coils 179 and 178 to connect up a pilot light 189. The burning of this pilot light 189 indicates when the timing switch assembly 199 is in operation.

It will be understood that I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions and uses.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

In an electroprocessing machine, a tank, a plurality of transverse bridging members, a sprocket suspended beneath one of said bridging members, a conveyor chain of the roller type engaging said sprocket, a driving unit support mounted on others of said bridging members, a self-contained, motor-operated driving unit mounted on said support, a driven sprocket engaging said chain suspended from said driving unit in alignment with the first sprocket, and means for bodily moving said driving unit and said support relatively to said bridging members whereby to adjust said chain at the point of application of power thereto, horizontally disposed anode and cathode bus bars, a cathode rail having flat top and sides connected to the cathode bus bar and suspended beneath said bridging members, parallel guiding members having longitudinal grooves therein carried by said bridging members, hooks provided with horizontal and vertical portions for suspension from an engagement with the flat top and sides of the cathode rail, pins projecting upwardly from said hooks and axially supporting rollers of the conveyor chain, said rollers being located in the grooves of the guiding members and freely movable without normal engagement with the walls in said grooves, and an anode rail connected to the anode bus bar.

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