Aug. 21, 1934. A. H. HANNON 1,970,850

ELECTROCHEMICAL TREATMENT MACHINE

Filed Oct. 1, 1931 2 Sheets-Sheet 1

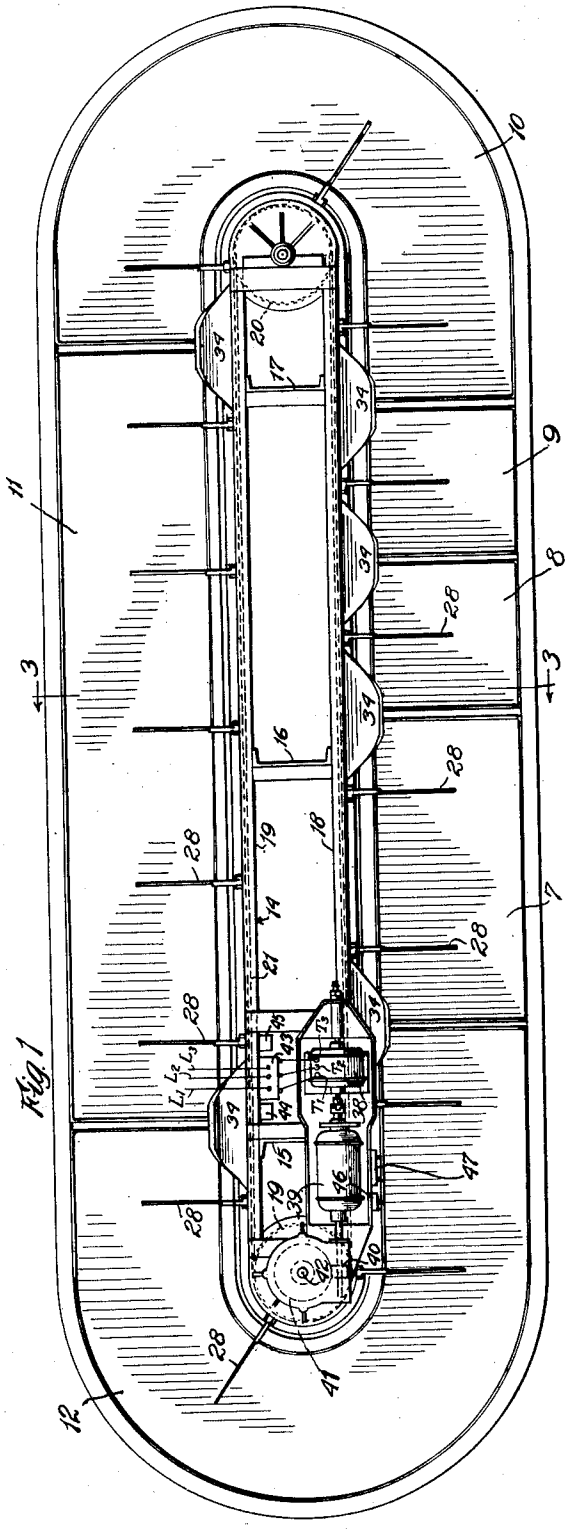


Fig. 1

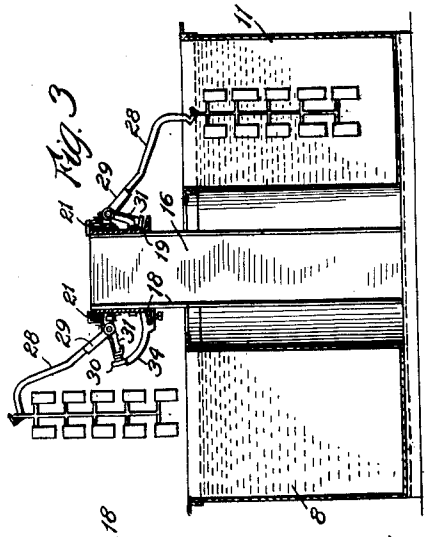


Fig. 3

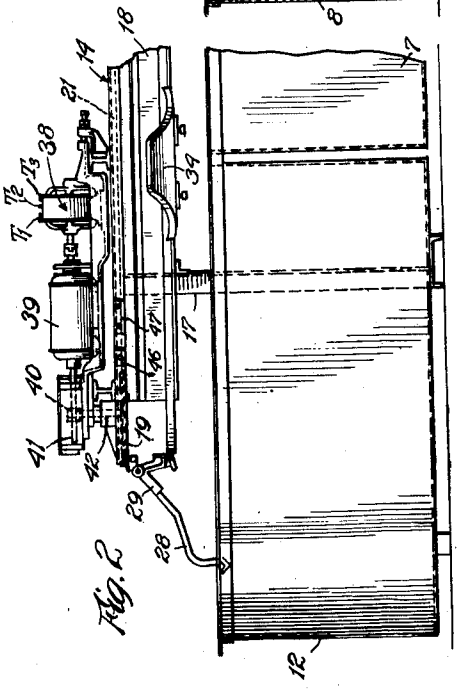


Fig. 2

Inventor
Albert H. Hannon
John E. Titus
Atty.

Aug. 21, 1934. A. H. HANNON 1,970,850

ELECTROCHEMICAL TREATMENT MACHINE

Filed Oct. 1, 1931 2 Sheets-Sheet 2

Fig. 4

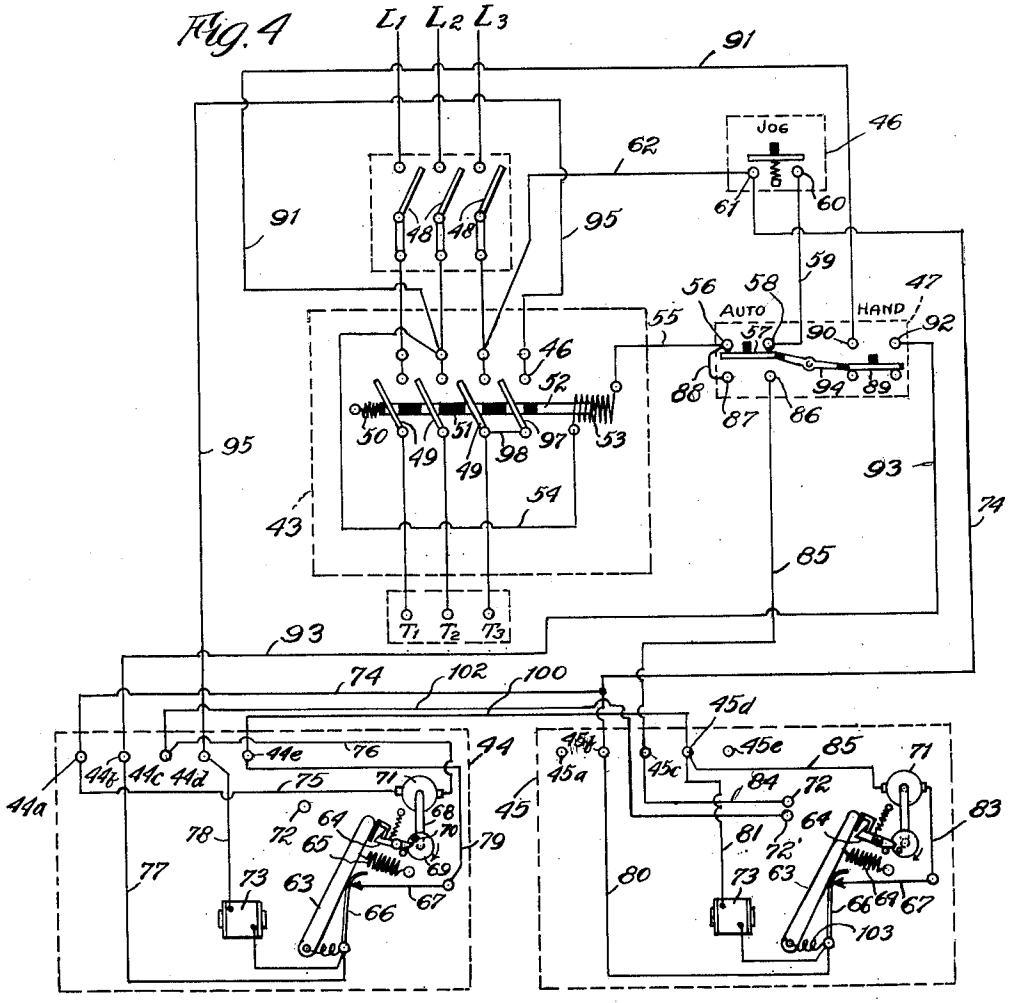


Fig. 5

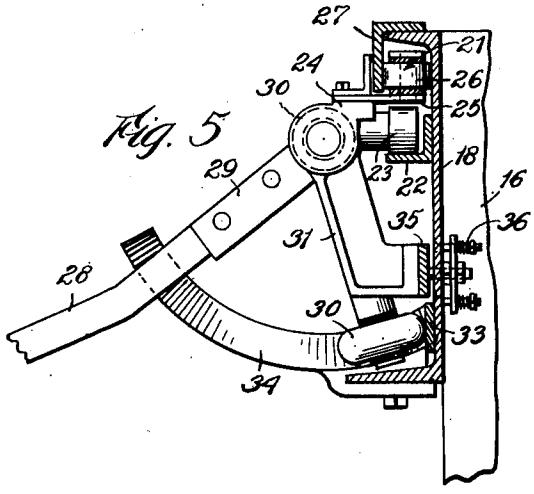
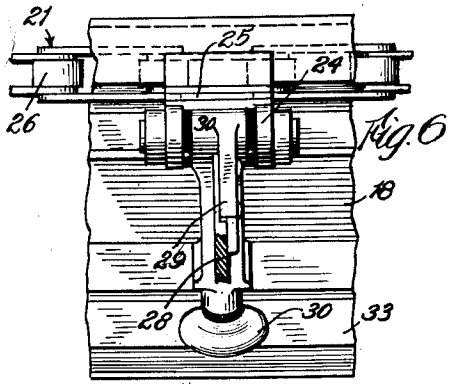


Fig. 6



Inventor
Albert H. Hannon
John C. Tittus
Atty

Patented Aug. 21, 1934 1,970,850

UNITED STATES PATENT OFFICE

1,970,850

ELECTROCHEMICAL TREATMENT MACHINE

Albert H. Hannon, Springfield, Ohio

Application October 1, 1931, Serial No. 566,356

4 Claims. (Cl. 204—5)

This invention relates to improvements in machines for electroplating or electrochemical treatment, more especially in machines which comprise a series of solution tanks through which the work, or objects being plated, are carried automatically and in a continuous and automatic manner.

One of the objects of this invention is to accomplish the transfer of the work from one tank to the next quickly so as to prevent oxidation and drying of the work by shortening the exposure of the work to the air. In some kinds of plating, such as chromium, cadmium, cyanide solutions and the like, a quick transfer is not essential to the quality of the work; but in some plating sequences, such as for soft metals like nickel on brass, acid on steel, a quick transfer becomes necessary. Further objects are to accomplish the quick transfer in a machine of simple construction, such as a machine where the work support arms are permanently connected to the conveyor and not removed or disconnected during the transfer operation.

Other objects and advantages will become apparent in the following description, with reference to the accompanying drawings, in which an illustrative embodiment of the invention is shown.

Fig. 1 is a plan view of the plating machine.

Fig. 2 is an elevation of the left end of Fig. 1.

Fig. 3 is a transverse section of the machine, taken on the line 3—3 of Fig. 1.

Fig. 4 is a diagram of a system of electrical control circuits for the driving motor of the conveyor.

Fig. 5 is a fragmental cross section of the machine as shown in Fig. 3, drawn on an enlarged scale.

Fig. 6 is a side elevation of the parts shown in Fig. 5.

For the purpose of illustrating this invention, a machine is chosen which comprises a series of tanks, 7, 8, 9, 10, 11, and 12, which are placed in an endless arrangement around a conveyor frame 14, supported on channel section standards 15, 16, and 17. The end tanks 10 and 12 have semicircular portions, and the tanks are in closely abutting end to end relation and equally spaced from the sides of the frame.

The frame comprises two channel members 18 and 19 which are horizontally disposed, one at each side of the upper ends of the standards with the flange portions projecting outwardly, and riveted to the standards. At the ends of the frame are mounted the sprocket wheels 19 and 20 for supporting the endless chain conveyor belt 21. The chain extends under the upper flanges of the horizontal channels, along the sides of the frame, and is supported by angle members 22, secured to the webs of the channels. The members 22 provide tracks for the rollers 23 which are mounted on each of the work support arm brackets 24, secured at regular intervals to specially formed lower side plates 25 of the chain.

The rollers 26, of the chain, are engaged between the adjacent web portions of the channels and the depending flange of an angle member 27 which is secured to the upper flanges of the horizontal channels. Thus, in effect, the brackets 24 are slidably supported for horizontal movement around the frame.

The work support arms are pivotally mounted on the brackets and are insulated therefrom. The arms consist of a bar 28 which projects over the tanks and is riveted to the outwardly projecting arm 29 of a bell crank member 30 which is rotatably mounted, for horizontal movement, on the bracket, and insulated therefrom. The other arm 31 of the bell crank projects downwardly and is provided with an insulated roller 32 which rides against a track 33, secured to the lower portions of the webs of the channels. The arm is thereby supported in rotational position as it is moved along the frame, and at the ends of the tanks arcurate, outwardly projecting cams 34, secured to the frame, are provided which rotate the bell crank member to raise and lower the arm to lift the work out of one tank and lower it into the next.

On the inner portion of the arm 31 is formed a shoe which contacts, within the limits of a tank where current is used, with a bus bar 35 which is yieldably mounted on the horizontal frame members and pressed outwardly by springs 36.

In this invention the chain is moved intermittently a distance based on the spacing of the arms so that the desired time of treatment in each tank is obtained by means of the slow or still periods, and a fast motion is obtained while any of the arms are being carried over the ends of the tanks and the rollers riding over the cams.

In the machine shown this interrupted or intermittent move of the conveyor chain is accomplished by an electrical time clock control of the driving motor 38. The motor 38 is mounted on the end of the frame, and is connected through a variable speed reducer 39 and

worm 40 to a worm gear 41 which is keyed on the shaft 42 of the sprocket wheel 19.

The motor terminals T_1, T_2 and T_3 are connected to a magnetic switch mechanism 43 which is controlled by the time clock relays 44 and 45, and the manual switch mechanisms 46 and 47 which are mounted at convenient places on the machine. The electrical connections will now be described, with special reference to Fig. 4.

The power lines L_1, L_2, L_3 are connected through cut-out switches 48 and the automatically controlled switches 49 to the respective terminals T_1, T_2, and T_3. The switches 49 are normally opened by the action of a spring 50 upon a connection member 51 which is connected to each of the switch arms. The member 51 includes a solenoid plunger 52 which is attracted by a magnet 53 for closing the switches against the action of the spring 50, when the magnet is energized.

One terminal of the magnet 53 is connected by the wire 54 to L_2, and the opposite terminal by line 55 to the upper contact 56 of the "automatic" switch 57. The opposite upper contact 58, of the switch 57, is connected by the wire 59 to the contact 60 of the "jog" switch 46, the opposite contact 61 of which is joined by the wire 62 to L_3, when the cut-out switches are closed. Thus when the automatic switch is "up", the magnet may be energized to close the switches 49 and operate the motor to move the conveyor along, by depressing the "jog" switch button.

This establishes a circuit from L_2, line 54, magnet 53, wire 55, contact 56 to contact 57, wire 59, contact 60 to contact 61, wire 62 to L_3, all the other circuits of the controls, which will next be described, being open. This operation is mainly for "setting up" and coordinating the positions of the arms with reference to the cams.

The timing relays 44 and 45 are similar in construction, and each include a pivotally mounted switch lever 63. This lever is urged to the right into engagement with a latch, by a spring 65, in which position the lever presses a resilient switch finger 66 against a contactor 67. The latches are operated to release the levers by means of clock mechanisms 68, in the corresponding relays. The clock mechanisms may be of any well known construction and may be considered herein as having a disc 69 on which is fixed a pin 70 for engaging the latch when the disc is rotated to a predetermined position by the clock motor 71. The lever 63 is pulled to the left against the action of the spring 65, into engagement with a contact 72, by means of a magnet 73, one terminal of which is permanently connected to the switch finger 66.

Each timing relay has five binding posts, 44 and 45—*a*, *b*, *c*, *d*, and *e*. The contact 61, connected to L_3 by wire 62, is connected by wire 74 to binding post 44*a*, which is joined by wire 75 to one terminal of the clock motor, in relay 44, the other terminal of which is joined by wire 76 to post 44*c*. Post 44*b* is connected by wire 77 to switch finger 66; the opposite terminal of the magnet 75 is joined by wire 78 to 44*e*; and the contactor 67 by wire 79 to 44*e* which is also joined by wire 100 to the post 45*d* in the other relay. An interconnection is also made from binding post 44*c* by wire 102 to contact 72', in relay 45, which contact is engageable by the lever 63 of relay 45.

In the relay 45 the magnet and finger are connected to the second post 45*b* by wire 80, and the opposite side of the magnet to post 45*d* by wire 81. But the contactor 67 is connected by wire 83 to the clock motor and through the motor, by wire 85, to the post 45*d*; and the arm contact 72 is joined by wire 84 to the third post 45*c*, and then by wire 85 to the lower contact 87, through the jumper wire 88 to the upper contact 56 which is connected to the magnet 53 by wire 55.

The switch mechanism 47 includes the double pole, double throw switch 89, one contact 90 of which is joined by wire 91 to L_2, and the opposite contact 92 by wire 93 to binding post 44*b*, and hence by wire 77 to the corresponding switch finger 66 and to one side of the magnet. The switches 57 and 89 have a pivotal interconnection 94 for always maintaining the two switches in opposite positions.

From binding post 44*d* a wire 95 leads to a contact 96 of an auxiliary switch 97 which is operated in conjunction with the switches 49, and is connected by wire 98 to the adjacent switch 49 and thus to L_3 when the adjacent switch is closed.

During the operation of the machine the cut-out switches are of course closed, and to start the automatic operation, the switch 57 is depressed. This connects the magnet 53 to contact 72 of relay 45, and closes the connection in switch 89 between the upper contacts 90 and 92. This makes a connection from L_2 through wire 91, wire 93, wire 77, of relay 44, to the switch 66 and magnet 73, the circuit of which is open at the switch 96. From the closed switch 66, of relay 44, through wire 79 and the interconnecting wire 100 to the motor of relay 45, through wire 85, and to the magnet 73 of the same relay. The circuit for this motor is then completed through wire 83, switch 66, wire 80, wires 74 and 62 to L_3, and the magnet of 45 is then energized. At this time the circuit for the motor of relay 44 is open at contact 72'.

The clock motor of relay 45 then starts in operation and when the predetermined time period of operation has expired, the lever is unlatched and the magnet pulls the lever into engagement with contact 72'. This lever is connected by a flexible wire 103 to the switch finger 66, and thus completes the circuits for the magnet 53 and for the motor of the clock in relay 44, and breaks the circuit for its own motor by opening the switch 66.

As the magnet 53 operates to close the switches 49 and the auxiliary switch 97, the magnet 73 in the relay 44 is energized to pull its lever and break the contact at 66 when the clock in the same relay has operated to unlatch the lever.

Thus when the automatic operation is started, assuming that the operations have been interrupted while the clock in 45 was still running, the magnet in 45 is energized and the clock is started to release the lever after the completion of the unexpired time. The clock in 45 is then disconnected and the lever makes contact for energizing the magnet 53 and closing the switches for starting the conveyor motor 38. This also starts the clock and energizes the magnet in the other relay 44 for stopping the conveyor after the expiration of the allotted time. When the clock in 44 releases its lever the switch 66 is opened. This breaks the connection for the magnet in relay 45 which has been holding the switches for the conveyor motor closed,

and allows the spring to pull the lever back to de-energize the magnet 53 and allow the spring 50 to open the switches and stop the motor and operation of the conveyor after a predetermined time. The idle period of the motor is then governed by the clock in relay 45, and the conveyor started in motion again as the clock releases the lever.

Since the timing of the relays is adjustable, the periods of movement and rest may be adjusted as desired, the movement being regulated in accordance with the spacing of the work support arms, and the rest period according to the time required for the treatment. It is obvious that the same results could be accomplished in other manners without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In an electroplating apparatus, a tank having electroplating solution therein, means to suspend an article to be electroplated in said tank immersed in the solution, means to move said article and its suspension means step by step in the tank and means for conveying current to the article during the periods of motion and rest so that the article alternately moves and remains at rest while the electroplating operation continues.

2. In combination in an electroplating apparatus, a plurality of electroplating tanks, means to convey articles and suspend them in said tanks in succession, means to move said conveyor and articles step by step while immersed in the tanks, means to lift said articles from one tank and lower them into another tank and to continue their horizontal movement while being so lifted and lowered continuously, and means for conveying current to the articles during the periods of motion and rest.

3. In combination, an annular tank having straight sides and curved ends forming a similarly shaped space within the inner walls of the tank, means in said space for supporting a similarly shaped support within the inner walls of the tank and above them, means on said support extending outwardly toward and above the tanks for lifting carrier arms, an annular chain on said support, carrier arms pivoted thereon for vertical movement adapted to engage with said lifting means, driving means on said platform for said chain, timing means for controlling said driving means to move said chain intermittently whereby the arms are permitted to rest when they are in their horizontal position and are moved on their pivots when they are being moved bodily as they proceed from one part of the tank to another.

4. In combination, an annular tank having straight sides and curved ends forming a similarly shaped space within the inner walls of the tank, means in said space for supporting a similarly shaped support within the inner walls of the tank and above them, means on said support extending outwardly toward and above the tanks for lifting carrier arms, an annular chain on said support, carrier arms pivoted thereon for vertical movement adapted to engage with said lifting means, driving means on said platform for said chain, timing means for controlling said driving means to move and stop said chain intermittently whereby the arms are permitted to rest when they are in their horizontal position and are moved on their pivots when they are being moved as they proceed from one part of the tank to another, said arms being mounted on the chain at equidistant distances from one another based on a given standard of spacing, and said tank having partitions therein spaced in multiples of said given standard of spacing whereby said arms are always over said tank when in their horizontal at-rest position.

ALBERT H. HANNON.