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PROCESSING MACHINE HAVING A TREATMENT
TANK AND AN ELEVATOR MECHANISM

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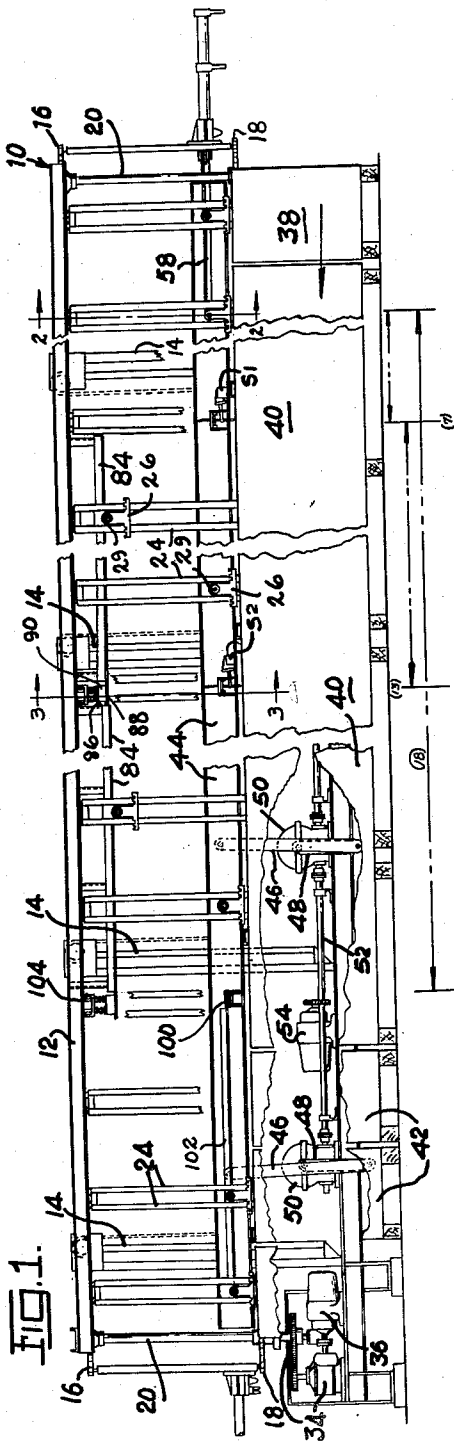


FIG. 10

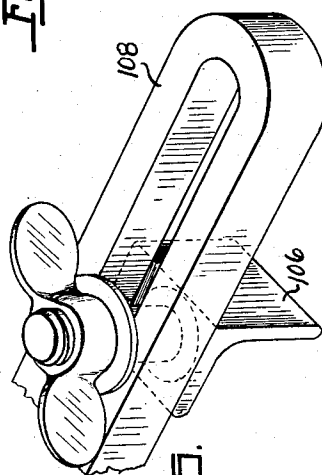
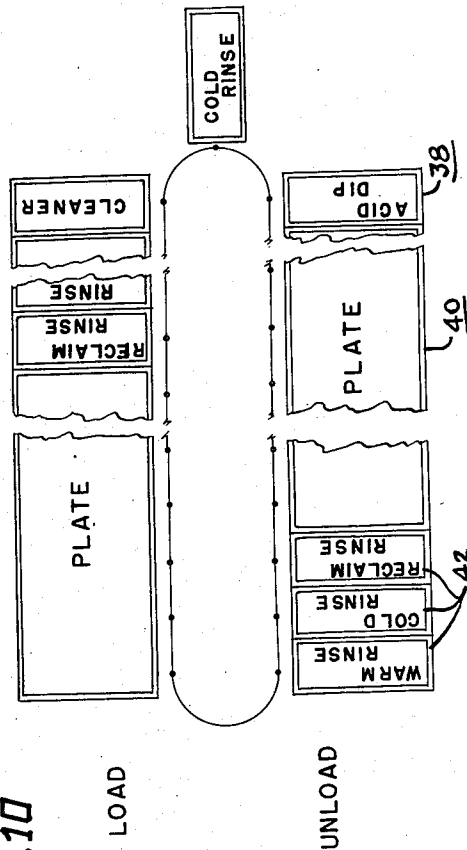


FIG. 6

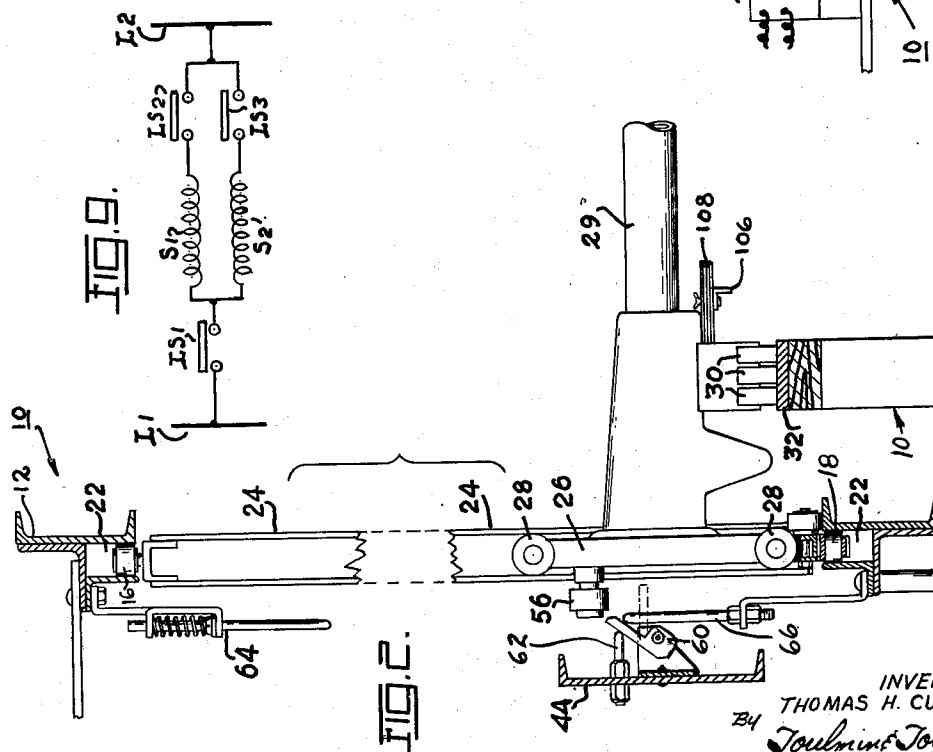
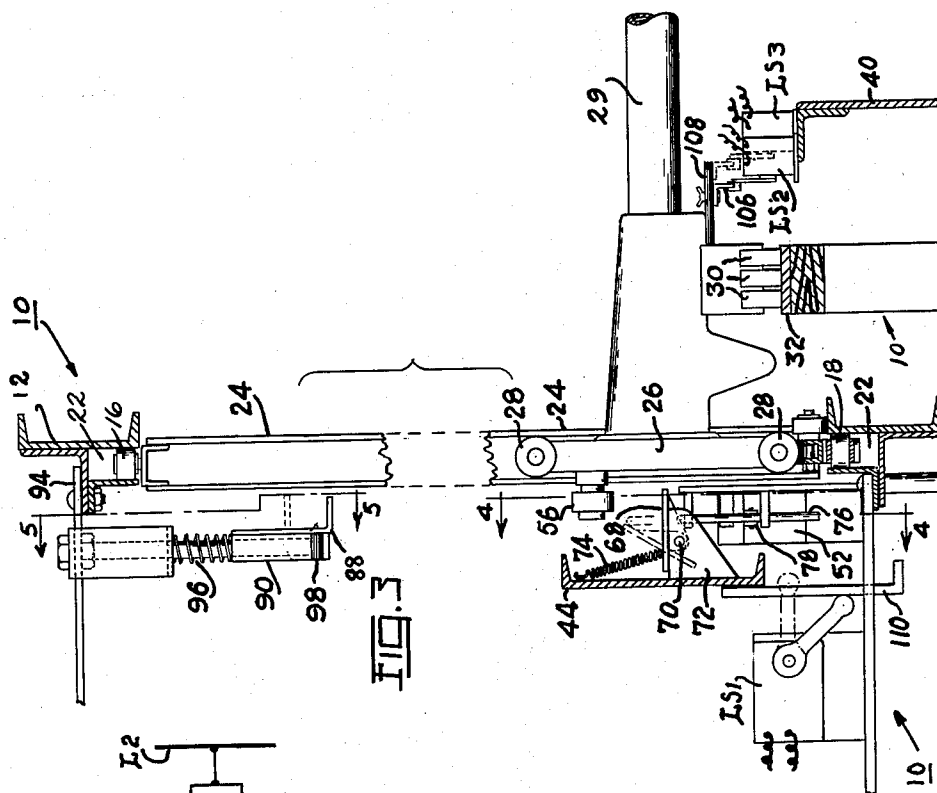


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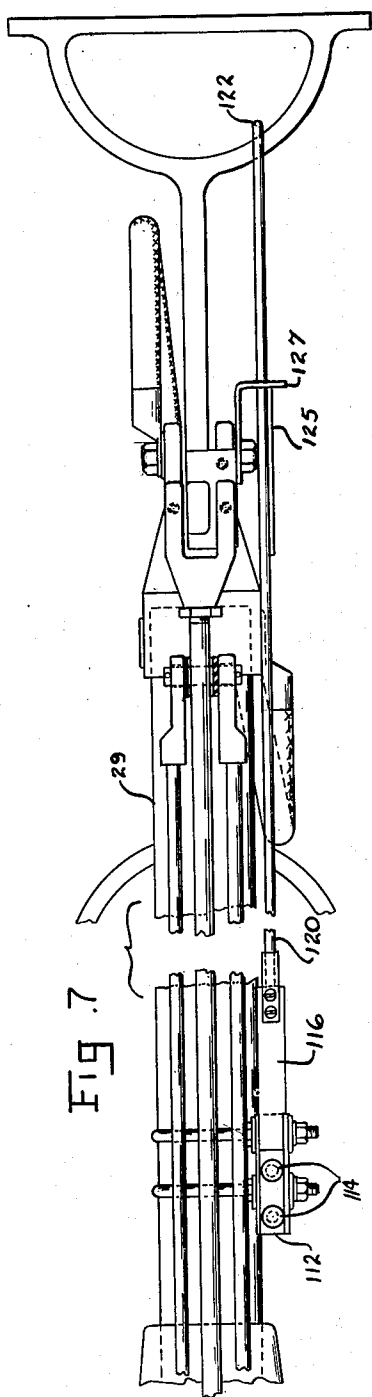


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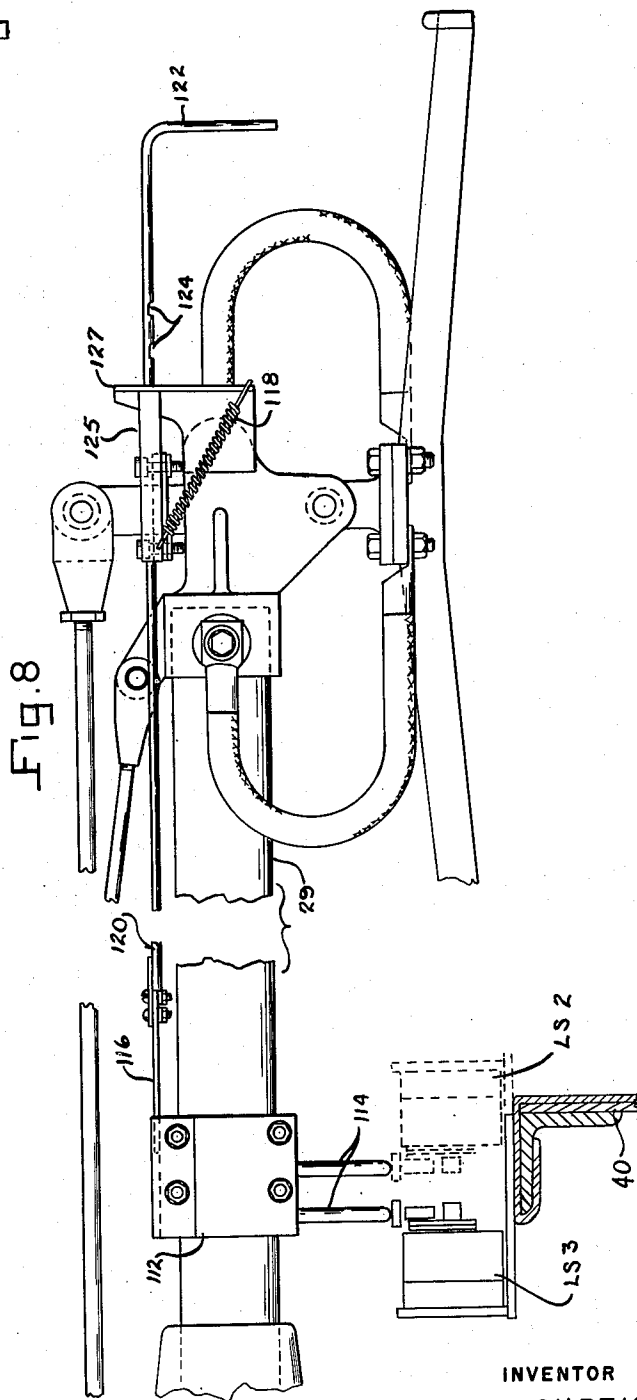
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PROCESSING MACHINE HAVING A TREATMENT TANK AND AN ELEVATOR MECHANISM

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17 Claims. (Cl. 134—57)

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This invention relates to processing machines such as electroplating machines, and particularly to methods of and devices for selectively elevating the work piece supporting arms of the processing machine.

In the processing of work pieces, such as in the electroplating of such articles as automobile hardware, building hardware, radio and typewriter parts, and the like, it is sometimes desirable to provide for different thicknesses of plating on different groups of said articles. This is true in connection with automobile hardware, where it is desired to have a heavier deposit on exterior hardware than on inside hardware, due to the different weather conditions to which they are exposed.

The same situation exists in connection with building hardware and with radio and typewriter parts, and the like. Those which are to be used where atmospheric conditions are highly corrosive should be more heavily plated than others.

It is not always practical to provide different plating set-ups for different groups of work pieces which are to be plated with different thicknesses because the quantities thereof being operated are not always sufficient to justify this additional labor and expense. A preferable manner of obtaining the different thicknesses of plate is to utilize one and the same machine for all the work pieces and to vary the treatment of the said work pieces during their passage through the machine to obtain the desired thickness of plating thereon.

Inasmuch as the desired quality and brightness of deposit in an electroplating process is only obtained within a very narrow range of combination of conditions of current density, bath temperature, and bath composition, it is not practical to vary these factors in order to vary the thickness of the deposit. Furthermore, the quality of deposit plated on to a work piece is seriously impaired if the work piece is disconnected from the current source after it has been plated to the desired thickness and thereafter allowed to travel through the remainder of the plating bath.

The primary object of the instant invention is to provide an arrangement whereby the thickness of the plating on work pieces being conveyed through a processing machine can be varied but without in any way varying the optimum conditions of plating, such as current density, bath composition, and the like.

Another object of this invention is the provision of means in an electroprocessing machine having a plurality of carrier arms for selectively shortening the travel of any of the carrier arms

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through the plating bath, thereby to control the thickness of deposit on the work pieces carried thereby.

A still further object of this invention is to provide an electroprocessing machine having a plating bath for a plurality of carrier arms in which the carrier arms can be selectively adjusted to traverse any part or all of the plating bath.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevational view of an electroprocessing machine constructed according to my invention;

Figure 2 is a vertical section indicated by line 2—2 on Figure 1 and showing one of the transfer stations where the work piece supporting arms are lifted over a partition between two adjacent tanks;

Figure 3 is a vertical section indicated by the line 3—3 on Figure 1 and showing one of the stations intermediate the ends of the plating tank where some of the work piece supporting arms are lifted out of the plating bath in order to halt the deposition of material on the work pieces carried thereby;

Figure 4 is a sectional view indicated by line 4—4 on Figure 3 and showing a part of the control means whereby work piece supporting arms are selectively lifted at the station shown in Figure 3;

Figure 5 is a sectional view indicated by line 5—5 on Figure 3 and showing a part of the supporting track at the top of the processing machine for maintaining the carrier arms which have been lifted out of the plating bath in their elevated position;

Figure 6 is a perspective view showing an adjustable cam carried by the carrier arms for determining the length of travel of the carrier arms in the plating bath;

Figures 7 and 8 are plan and side views, respectively, of the carrier arm embodying a different cam arrangement than that shown in Figure 6;

Figure 9 is a diagrammatic view of an electrical system for controlling the operation of the actuating solenoids for the auxiliary lifting stations of the machine; and

Figure 10 is a plan view showing diagrammatically a typical work cycle adapted for being practiced according to the method of this invention and by utilizing the apparatus of this invention.

Referring to the drawings, the processing machine shown in Figure 1 comprises a frame,

generally indicated at 10, and including upper longitudinally extending side channels 12 and suitable supporting columns 14 resting on base members not shown. Upper and lower conveyor chains pass around suitable supporting sprockets at opposite ends of the frame of the machine and which sprockets are mounted on the vertical shafts 20 journaled in the frame 10. The chains 16 and 18 are guided along the opposite sides of the frame in suitable channels extending along the top and bottom of the machine, as indicated at 22 in Figures 2 and 3 which show one side of the machine. Spaced along the chains 16 and 18 are a plurality of vertical guide cages 24 of well known construction, and each of which comprises a pair of spaced channels opening toward each other and connected at their opposite ends by blocks which are, in turn, secured to corresponding points on the chains 16 and 18.

Mounted within the guides 24 are the skate-like members 26 having rollers 28 engaging the guides so as to be vertically reciprocable therein. Extending outwardly from members 26 are arms 29 which act as hangers for articles to be plated or as supports for other hangers on which the articles being plated are placed. Electrical energy is supplied to the work pieces being plated by contact elements 30 associated with arms 29 and bearing on rail 32 mounted on the frame 10 of the processing machine.

The conveyor chains 16 and 18 are driven by driving one of the shafts 20 as through the gearing and speed-reducer indicated at 34 in Figure 1. Motor 36 may supply motive power to the speed reducer and gearing as illustrated.

The machine shown in Figure 1 comprises a plurality of tanks setting about the frame 10. As shown, the movement of the conveyor and the work piece supporting arms thereon is from right to left, along the side of the machine shown, and the work pieces are first treated on the far side of the machine to clean them or otherwise treat them preparatory to the final plating by conveying them through a plurality of stations according to well known practices. For example, on the far side of the machine, the workpieces may pass through a copperplating bath, rinses, an electric cleaning bath and then another rinse before reaching the tank 38 on the near side of the machine. On the near side of the machine the workpiece are first treated in an acid tank 38 and are thereafter conveyed to the plating tank 40. The final treatment of the work pieces is in the rinse tanks 42, of which there may be several, if desired, including reclaim, cold and warm rinses according to well known practices. A typical work cycle is shown in diagrammatic plan in Figure 10.

The work piece supporting arms must be elevated to clear the partitions between the tanks, and to this end, there is vertically reciprocable in the frame 10 an elevator construction comprising spaced channels 44 rigidly connected together and as a unit connected with the bars or rods 46 which are in turn connected with the cranks 48 that are driven through the speed reducers 50 by a shaft 52 geared to a drive motor 54. It will be evident that rotation of motor 54 will bring about rotation of cranks 48 and therethrough cause up and down movement of the elevator.

The work piece supporting arms have rollers 56 thereon extending toward the adjacent elevator channel 44. At the right end of the machine, the channel 44 carries an angle 58 which extends beneath the rollers 56 so that the carrier

arms are lifted when the elevator goes up. The driving of the elevator and of the conveyor is so interrelated that the upward movement of the elevator takes place in the absence of any conveyor movement. Thereafter, the conveyor moves to move the carrier arms longitudinally of the machine and then comes to a halt before the elevator again moves down.

The elevator preferably dwells in its down position for a predetermined time, and then again moves upwardly, all without any further movement of the conveyor, and the cycle is repeated. It will be evident that the carrier arms approaching the acid tank 38 will be engaged by angle 58 and elevated so they will pass over the partition at the end of the tank. Thereafter, the carrier arms are lifted over the partitions between the acid tank and the plating tank. When the arm is set down in the plating tank it is desired that it remain down when the elevator makes its next upward movement, and for this purpose the arrangement shown in Figure 2 is employed.

Angle 58 ends immediately rightwardly of the first carrier arm in tank 40, and at the end of angle 58 is a flipper or shifter plate 60, Figure 2, which is normally tilted, as shown in full lines, due to its distribution of weight about its pivot. A pin 62 on channel 44 provides a stop for plate 60 so it does not tilt beyond the position where it can be engaged by rod 64. When the elevator moves upwardly, a rod 64 engages the flipper 60 and moves it down into operative position, so that when the conveyor moves, the carrier arm, which has been in tank 38 and which is now supported on angle 58, can be carried thereby onto flipper plate 60 to be supported by this plate. When the elevator then moves downwardly, and the carrier arms again are supported by the frame of the machine, flipper 60 is released and again pivots due to this weight distribution, to a position where it will clear roller 56 when the elevator again moves upwardly. Rod 66 may be provided for engaging plate 60 and moving it upwardly into inoperative position so that the said plate is positively actuated and will not stick. The above-described construction is substantially conventional and forms the means whereby carrier arms are transferred first to tank 38, and then into tank 40, and are then left in their lower position for continued travel in tank 40 for the plating of a deposit on the work pieces supported by the arms.

As indicated on Figure 1, tank 40 may extend along the frame 10 for a distance of 18 carrier arms. Normally, a carrier arm introduced into tank 40 at the right end thereof would remain therein during 18 cycles of movement of the elevator, and a predetermined thickness of deposit plated thereon. As mentioned before, it may be desirable to shorten the plating cycle for the work pieces on some of the carrier arms, and for this purpose, means are provided at the seventh and thirteenth stations from the right end of tank 40 for lifting certain of the carrier arms upwardly out of tank 40 and for retaining them in their upper position during the remainder of their travel along the said tank.

According to this invention, this means may take the form shown in Figures 3 and 4. Figure 3, which is a section taken through station 13 of the plating tank, shows that there is a lifting plate 68 pivoted at 70 on a bracket 72 mounted on the elevator channel 44. A spring 74 normally urges plate 68 into operative or lifting position.

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Mounted on frame 10 so as to be positioned beneath plate 68 is a plunger 76 which is connected to be reciprocated by a bell crank lever 78 pivoted at 80 and having one arm connected with the solenoid S2 and another arm connected with a spring 82. Spring 82 normally biases lever 78 in a clockwise direction about pivot 80 to thrust plate 68 upwardly into inoperative position. Energization of solenoid S2 is effective for moving lever 78 against the bias of spring 82 to retract plunger 76 downwardly whereby spring 74 moves plate 68 to operative position.

It will be evident at this time that whenever elevator channel 44 moves upwardly with solenoid S2 energized, plate 68 is in its operative position, and the adjacent carrier arm is lifted. However, if solenoid S2 is not energized, plate 68 is in inoperative position, and the elevator bypasses the adjacent carrier arm, leaving it in its down position.

The carrier arms which are lifted at stations 7 and 13 in accordance with the arrangement described above, remain elevated during the remainder of their travel along tank 40. This is accomplished by suspending an angle 84 along frame 10 adjacent the top thereof for engagement with rollers 56 of the lifted carrier arms. The angle 84 at station 7 terminates immediately leftwardly of plate 68, so that arms lifted by plate 68 at station 7 can roll directly onto angle 84 when the conveyor is actuated.

At station 13, a bridge must be provided in the track formed by angle 84 so that the arms lifted at station 13 can enter the track and so that arms which have been lifted at station 7 can pass over station 13. The form which this bridge takes is best shown in Figure 5. In this view it will be seen that the angle 84 is discontinuous, having a gap as at 86 therein in alignment with station 13. This gap is closed by a bridge plate 88 carried on the bottom of a block 90 slidable on rods 92 rigidly mounted on a suitable supporting plate 94 which is rigid with frame 10. Spring means 96 continuously urges block 90 downwardly to position plate 88, as shown in Figure 5.

As will be seen in Figure 3, there may be placed beneath block 90 and above the heads on the lower ends of rods 92, the resilient bumper means 98, as, for example, rubber, for eliminating shock and noise when the said block is sprung downwardly. The uppermost position to which plate 68 moves is indicated in dot-dash outline in Figure 5, and it will be observed that in this position it exactly registers with the left hand reach of angle 84 so that when a carrier arm is lifted by the said plate and the conveyor is then actuated, the supporting roller 56 of the arm will roll directly onto angle 84. At the same time, if no carrier arm has been lifted by plate 68, and a lifted carrier arm is being supported by the track 84 immediately rightwardly of the bridge plate 88, then movement of the conveyor will move the said arm so that its supporting roller will roll directly onto the bridge plate 88, as shown in Figure 5. It will be evident that the bridge arrangement permits any arm lifted in that station to roll directly onto angle 84 to be supported thereby for the remainder of the travel of the arm along tank 40.

Also, any arms which have previously been lifted and which are supported on angle 84 will roll across the bridge plate 88 so as to continue in their elevated position.

At the left end of tank 40, any carrier arms which are in their lowered position will be picked

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up by a flipper plate 100, which is similar in operation to the previously described flipper plate 60, except that it is normally biased toward operative position by a spring. This flipper will raise the carrier arms from the left end of tank 40, and they will then move on to angle 102. When the elevator thereafter moves downwardly, flipper plate 100 will cam over roller 56 of the arm then at the left hand end of tank 40 and be in position to elevate it when the elevator again moves upwardly. No actuating rods are required for this plate. A supporting angle 102 extends along the elevator channel at the left end thereof similarly to the angle 58 at the right end thereof, so the carrier arms are lifted into and out of the rinse tanks 42. It will be evident that a bridge 104 is required at the extreme left-hand station of tank 40 so that arms which have been lifted at stations 7 and 13 can pass from angle 84 to angle 102.

According to this invention means are mounted on the carrier arms for determining the station in the plating tank at which they will be lifted. This means may take the form of the adjustable cam 106 supported on the arm 108 and adapted for engaging one or the other of limit switches LS2 and LS3 mounted on the edge of tank 40 or on frame 10. Cam 106 can also be adjusted so as to engage neither of these limit switches, if so desired.

Connected in circuit with switches LS2 and LS3 is another limit switch LS1 mounted on frame 10 and adapted for being actuated into closed position by a cam plate 110 on elevator channel 44 when the elevator approaches its lowermost position. The exact circuit arrangement employed is shown in Figure 9 wherein it will be seen that solenoid S1 at station 7 is in series with LS2 and solenoid S2 at station 13 is in series with LS3, and that in series with both is LS1. It will be evident that closing of LS2 or LS3 will bring about energization of the associated solenoid when the elevator moves downwardly. The provision of switch LS1 permits switches LS2 and LS3 to be relatively small and to have relatively long life because all the making and breaking of the solenoid circuits takes place by switch LS1.

In operation, assuming that there are three classes of work pieces to be plated, one class is placed on carrier arms on which the cam 106 is moved to inoperative position. These carrier arms will traverse the entire length of tank 40, and a heavy deposit will be plated on the work pieces. The next class of work pieces are placed on carrier arms on which the cam 106 has been adjusted to engage switch LS3, and these carrier arms will traverse the tank 40 to station 13 before being lifted and will, accordingly, have an intermediate deposit.

The third class of work pieces will be placed on arms having the cam 106 adjusted to engage switch LS2, and these arms will be lifted from tank 40 at station 7, and the work pieces will, accordingly, have the lightest deposit.

It will be evident that as many auxiliary lift stations could be provided along tank 40 as required, and as many or as few thereof employed as desired. Also, any numerical proportion can exist between the different classes of work pieces to be plated, and it is only necessary to segregate them as regards their supporting arms and to ascertain that the cams 106 on the said arms are adjusted to the proper positions. It will also be observed that the indicated length of tank 40 is

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only exemplary, as likewise are the particular positions of the auxiliary stations at positions 7 and 13 along the tank.

Figures 7 and 8 show a somewhat modified arrangement for controlling the actuation of the control limit switches LS2 and LS3. In these figures, there is secured to the arm 29 a block 112 carrying a pair of plungers 114, each positioned to strike one of the operating levers of limit switches LS2 and LS3. Normally, the plungers 114 merely ride over the switch arms without actuating the switches, the said switches offering sufficient resistance to accomplish the lifting of the plungers, but the said plungers may be held downwardly so as to actuate the switches by movement of a plate 116 slidable in block 112 and connected with a shift rod 120 having handle 122 at its right end and adapted for being locked in any of its operative positions by notches 124 in the underside of rod 120 and plate 125 which cooperate with apertured member 127. A spring 118 may be provided to urge rod 120 rightwardly and downwardly so the said rod has, by virtue of notches 124 and plate 125, three operative positions.

The arrangement shown in Figures 7 and 8 provides for the locking of one or both of the plungers 114 to lift arm 28 at either of two selected stations or the unlocking of both of the plungers to permit the arm to traverse the entire length of the plating tank. By the arrangement shown in Figures 7 and 8, the hangers having a certain class of work pieces thereon could be placed on the carrier arms, and the rod 120 adjusted into proper position at the same time. This would involve no loss of time whatsoever, and full production on the plating machine could be maintained at all times, even while operating several classes of work pieces.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a processing machine including a treatment tank, a conveyor extending along the tank, carrier arms on the conveyor and an elevator adjacent said conveyor for lifting said arms over the end partitions of the tank; an auxiliary lift station on said elevator intermediate the ends of said tank, and control means for making said station effective for lifting some of said arms from the tank during their passage therethrough to shorten the treatment cycle of work pieces thereon, and support means for maintaining the arms so lifted in an elevated position during the remainder of their travel along said tank.

2. In a processing machine including a treatment tank, a conveyor extending along the tank, a plurality of carrier arms spaced along the conveyor and extending over the tank, an elevator adjacent said conveyor having means at the end partitions of the tank for engagement with the carrier arms for lifting them over said partitions, other means on said elevator intermediate the partitions of said tank for lifting engagement with said arms and normally inoperative, and means controlled by said arms for selectively making said other means effective for lifting said arms from the tank to shorten the treatment cycle of work pieces thereon.

3. In a processing machine including a treatment tank, a conveyor extending along said tank,

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a plurality of carrier arms spaced along said conveyor and extending over the tank, an elevator adjacent said conveyor having means for lifting the carrier arms over the end partitions of the tank, other means on the elevator intermediate the ends of the tank for lifting engagement with said arms and normally ineffective, and means controlled by some of said arms for making said other means effective for lifting the said some of said arms whereby the treatment cycle of the work pieces on the said some of said arms is shortened.

4. In a processing machine having a frame with a conveyor thereon for moving carrier arms along a tank, a plurality of carrier arms spaced along the conveyor, an elevator reciprocable on said frame and having means for lifting the arms over the end partitions of the tank, said conveyor being operative only while said elevator is adjacent its uppermost position, auxiliary lift means on said elevator intermediate the ends of the tank and normally in inoperative position, electrical means energizable for bringing about movement of said lift means into operative position, and means on said arms selectively adjustable for energizing said electrical means when said arms move into operative alignment with said lift means.

5. In a processing machine having a frame with a conveyor thereon for moving carrier arms along a tank, a plurality of carrier arms spaced along the conveyor, an elevator reciprocable on said frame and having means for lifting the arms over the end partitions of the tank, said conveyor being operative only while said elevator is adjacent its uppermost position, auxiliary lift means on said elevator intermediate the ends of the tank and normally in inoperative position, electrical means energizable for bringing about movement of said lift means into operative position, means on said arms selectively adjustable for energizing said electrical means when said arms move into operative alignment with said lift means, and support means on said frame for engagement with the arms lifted by said lift means for supporting them in elevated position during the remainder of their travel along the tank.

6. In a processing machine; a frame having a conveyor thereon for conveying work pieces along a tank and a vertically reciprocable elevator adjacent the conveyor, said conveyor being operative only while said elevator is in its elevated position, a plurality of carrier arms vertically slidable on said conveyor spaced therealong and having parts for engagement by said elevator for being lifted thereby, means on the elevator at the ends of the tank for engagement by said parts for lifting the arms over the end partitions of the tank, auxiliary lift members pivoted to said elevator intermediate said means and resiliently urged toward operative position, spring means normally holding said members in inoperative position, and electrical means energizable for overcoming said spring means.

7. In a processing machine having a frame with a conveyor thereon and a vertically reciprocable elevator adjacent the conveyor, said conveyor being operative only while said elevator is in elevated position, a plurality of carrier arms vertically reciprocable on said conveyor and having parts for engagement by said elevator, and lift members pivoted to said elevator and resiliently urged toward operative position, spring means normally holding said members in inoperative position, electrical means energizable for

overcoming said spring means, switch means for energizing said electrical means, and means on said arms adjustable for actuating engagement with said switch means as said arms move into operative alignment with said lift members.

8. In a processing machine having a frame with a conveyor, the conveyor having a plurality of carrier arms spaced therealong and also reciprocable thereon, an elevator on said frame reciprocable for lifting said arms, said conveyor being operative only when said elevator is in upper position, and means for making said elevator effective for lifting selected of said arms at different positions along said frame comprising lift plates pivoted to said elevator at said positions and normally in inoperative position, electrical means for each plate energizable for bringing about movement of the associated plate into operative position, a limit switch for each said electrical means located to be aligned with the carrier arms as they pass through said positions, and switch actuating members on said arms adjustable for by-passing all of said switches or for engaging any one thereof.

9. In a processing machine having a frame with a conveyor, the conveyor having a plurality of carrier arms spaced therealong and also reciprocable thereon, an elevator on said frame reciprocable for lifting said arms, said conveyor being operative only when said elevator is in upper position, and means for making said elevator effective for lifting selected of said arms at different positions along said frame comprising; lift plates pivoted to said elevator at said positions and normally in inoperative position, electrical means for each lift plate energizable for bringing about movement of the associated plate into operative position, a limit switch for each said electrical means located to be aligned with the carrier arms as they pass through said positions, and switch actuating members on said arms adjustable for by-passing all of said switches or for engaging any one thereof, all of said limit switches and electrical means being connected in parallel, a main switch in series with said parallelly connected limit switches and electrical means, and means for closing said main switch only when said elevator is adjacent its lowermost position whereby all of the circuits for said electrical means are established and interrupted by the contacts of said main switch.

10. In a processing machine, a frame, a conveyor thereon and an elevator vertically reciprocable adjacent said conveyor, said conveyor being operable only while said elevator is adjacent its uppermost position, a plurality of carrier arms vertically slidable on said conveyor and having roller means for engagement by said elevator, spaced means on said elevator for engagement with said rollers for lifting the arms over the end partitions of a tank, and auxiliary lift stations intermediate said means, each comprising a lift plate pivoted to the elevator and resiliently urged toward operative position, plungers spring urged to hold said plates out of operative position, electrical means for each plunger energizable to move the plunger against its spring to permit the associated plate to move to operative position, a limit switch for each electrical means aligned with the associated stations, cams on said arms adjustable for engagement with any one or none of said limit switches, a support track adjacent the top of the frame for receiving the arm rollers from said plates when the conveyor operates, and means in said track for receiving said rollers at the several auxiliary lift stations.

11. In a processing machine, a frame, a conveyor thereon and an elevator vertically reciprocable adjacent said conveyor, said conveyor being operable only while said elevator is adjacent its uppermost position, a plurality of carrier arms vertically slidable on said conveyor and having roller means for engagement by said elevator, spaced means on said elevator for engagement with said rollers for lifting the arms over the end partitions of a tank, and auxiliary lift stations intermediate said means, each comprising a lift plate pivoted to the elevator and resiliently urged toward operative position, plungers spring urged to hold said plates out of operative position, electrical means for each plunger energizable to move the plunger against its spring to permit the associated plate to move to operative position, a limit switch for each electrical means aligned with the associated stations, cams on said arms adjustable for engagement with any one or none of said limit switches, a support track adjacent the top of the frame for receiving the arm rollers from said plates when the conveyor operates, means in said track for receiving said rollers at the several auxiliary lift stations, said means comprising bridge members normally making said track continuous and yieldable to permit entry of the said roller means at the lifting stations.

12. In a processing machine having a frame, a conveyor in the frame having a plurality of spaced vertical guides, carrier arms slidable in said guides and having rollers extending out from one side of the conveyor, an elevator vertically reciprocable on the said one side of the conveyor, said conveyor being operative for advancing said arms one space while the elevator is in an upper position, spaced brackets on the elevator for engagement with the rollers to lift arms over end partitions of a tank, and a plurality of auxiliary lift stations on the elevator between said brackets, each comprising; a lift plate pivoted to the elevator, means normally holding the plates in inoperative position, electrical means energizable to bring about movement of the plates to operative position, a limit switch for each electrical means, switch actuating means on said arms adjustable for engagement with one or none of said switches, a support track adjacent the top of the frame extending from the first of said lift stations to the end of the tank and at a height to align with said plates when the elevator is in its uppermost position, and bridges in said track at said stations between the first thereof and the exit end of the tank movable to permit entry of rollers of arms lifted in the respective stations but providing support for the rollers of arms lifted in previous stations and conveyed across the said respective stations by said conveyor.

13. In a processing machine of the class described and having a frame with a reciprocable elevator; spaced lift brackets on said elevator for lifting carrier arms over the end partitions of a tank, a plurality of auxiliary lift stations between said brackets, each comprising a plate pivoted to said elevator and normally urged toward inoperative position, electrical means energizable for selectively bringing about movement of said plates into operative position, a support track carried by the upper part of said frame and extending from the first of said auxiliary stations to the exit end of said tank and operable for receiving carrier arms from said lift plates and for supporting them during the remainder of their travel along said tank, said track commencing

at the first of said stations and having an opening therein at each of the others thereof, and movable bridge means closing said openings.

14. In combination in a processing machine of the type described; a plurality of carrier arms, electrical means for controlling movements of said arms, limit switches to control said electrical means, a block secured to each said arm positioned to pass closely adjacent the said switches, a pair of plungers in each said block for actuating the switches and normally freely slidable in the block so as to idly pass the switches, and a control element on each said arm shiftable for selectively locking the said plungers in the block thereon against sliding movement in the said block whereby the said plungers become effective for actuating predetermined of said switches.

15. In combination in a processing machine of the type described; a plurality of carrier arms, separate electrical means for controlling movements of said arms at different points during the travel of the arms along the machine, separate limit switches for said electrical means for the control thereof, limit switch operating members carried by each said arm adapted for selective engagement with said switches, said members being normally ineffective for actuating the said limit switches upon engagement therewith, and a control element on each arm movable for making the said limit switch operating members carried by the arm selectively effective for actuating at least a predetermined one of said limit switches upon engagement therewith.

16. In a processing machine including a treatment tank, carrier members for conveying work pieces through said tank and lift means for engaging and lifting said members over the end

partitions of said tank; auxiliary lift means between the ends of the tanks positioned to align with each said member during movement thereof through the tank, said auxiliary lift means being operable when actuated for elevating the one of said members aligned therewith to shorten the treatment cycle of the work pieces on the member, and means movable in unison with said members operable for making said auxiliary lift means selectively operable when certain ones only of said members are aligned therewith.

17. An arrangement as set forth in claim 16 including means for supportingly engaging in their elevated position the said certain ones of said members that are elevated by the said auxiliary lift means to retain them in their elevated position during the remainder of their travel along said tank.

THOMAS H. CURTIS.

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