

June 14, 1955

P. A. HAUCK ET AL

2,710,698

PROCESSING MACHINERY FOR ELECTROPLATING AND THE LIKE

Filed Sept. 20, 1954

3 Sheets-Sheet 1

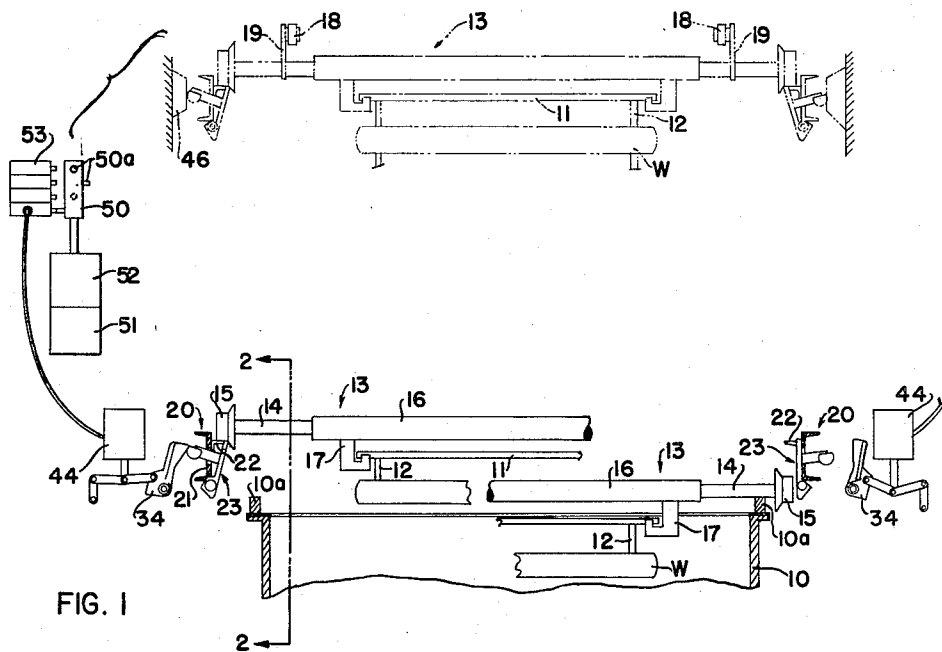


FIG. 1

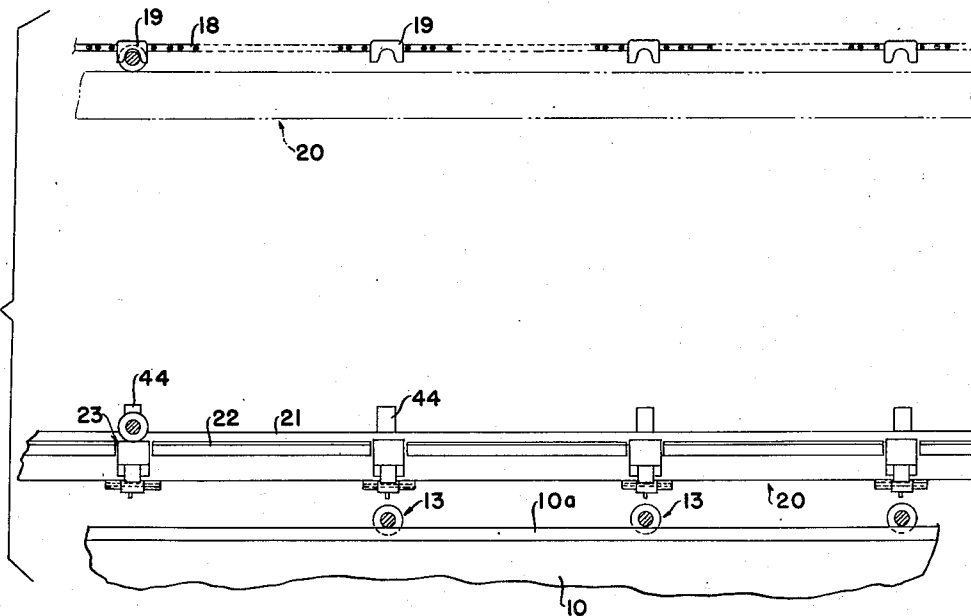


FIG. 2

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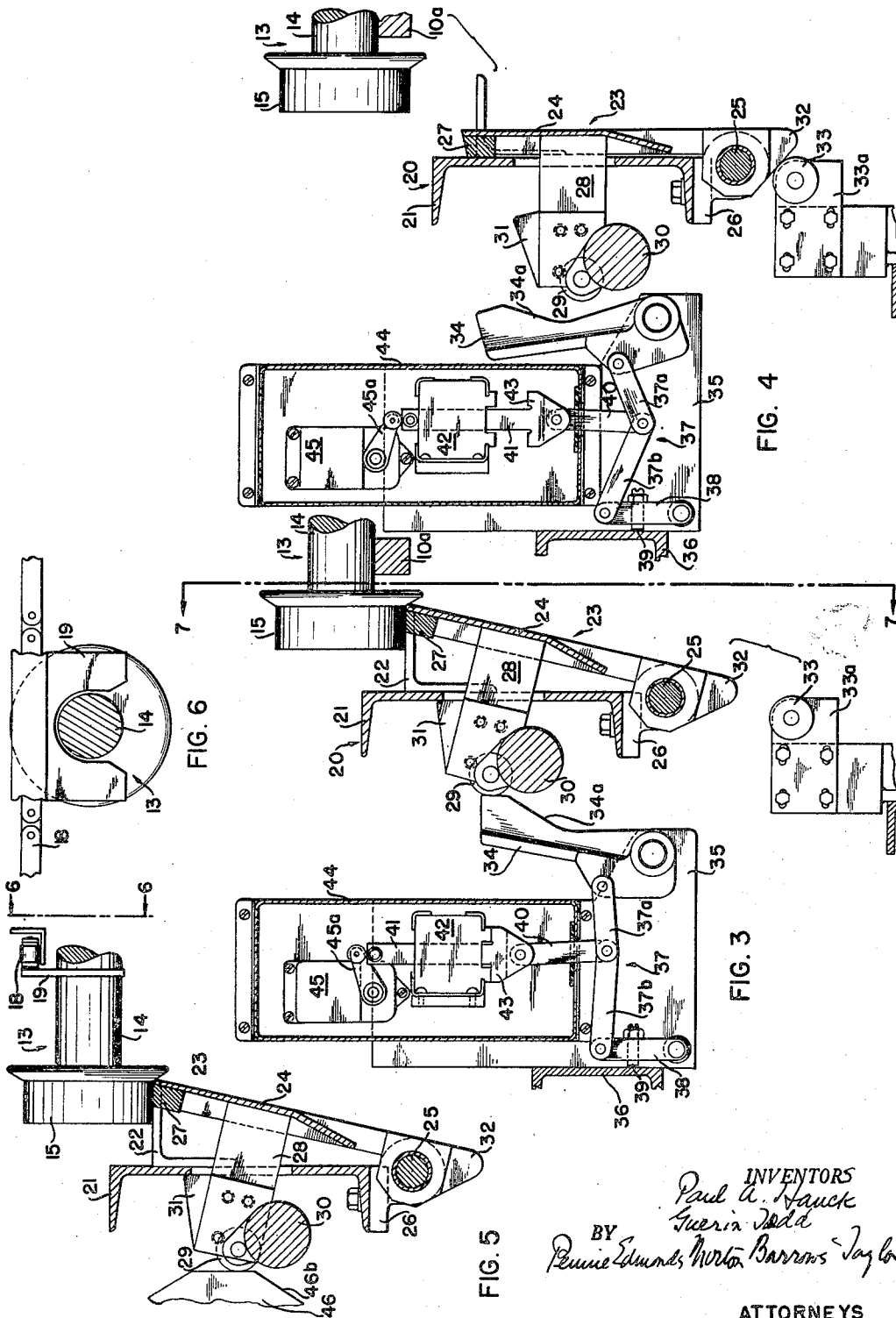
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3 Sheets-Sheet 3

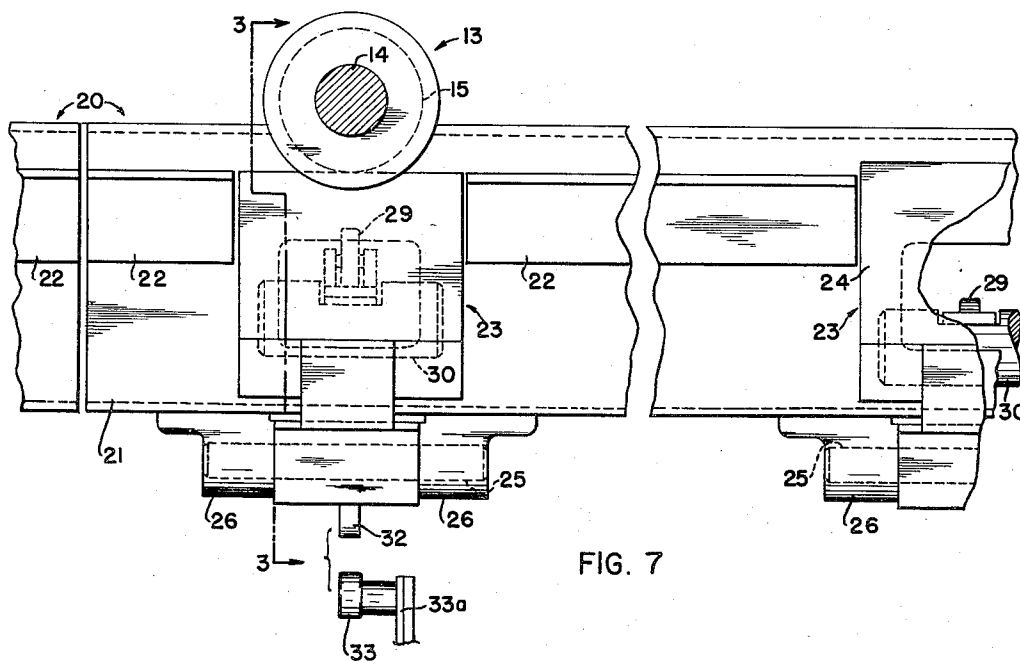


FIG. 7

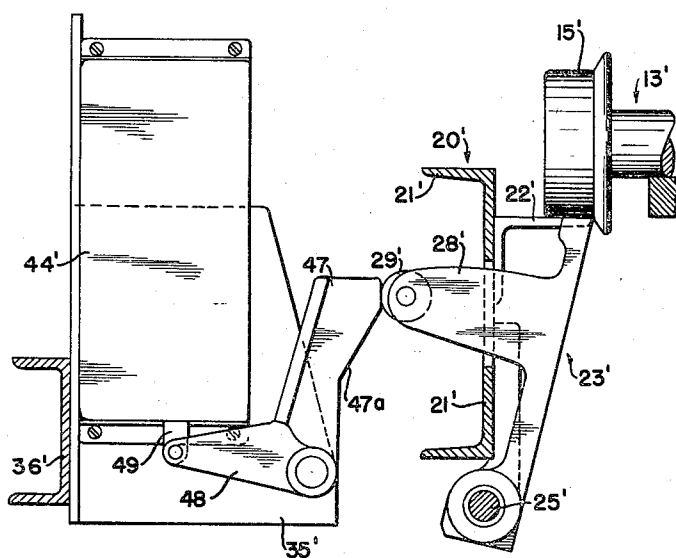


FIG. 8

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2,710,698

PROCESSING MACHINERY FOR ELECTRO- PLATING AND THE LIKE

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Application September 20, 1954, Serial No. 457,256

7 Claims. (Cl. 214—89)

This invention relates to processing machinery, in which workpieces are automatically transported to successive work stations to undergo different processing treatments in a sequence. More particularly, the invention is concerned with improvements in a processing machine, in which some treatments given the workpieces take longer than others, so that the workpiece carriers must remain at rest at some stations for greater periods of time than at others. The processing machine of the invention may be used for various purposes, but, since all of the advantages of the invention are realized in its application to electroplating, a machine for such use, which embodies the invention, will be illustrated and described for purposes of explanation.

Automatic electroplating machines commonly have a plurality of preparation tanks for cleaning, rinsing, etching, and like treatments of the workpieces, one or more plating tanks, and a plurality of finishing tanks for reclaim, hot, and cold rinsing, etc. In such machines as usually constructed, the workpiece carriers are advanced along the machine step by step by a conveyer, and an elevator operating in timed relation with the conveyer raises and lowers the carriers, so that they may be moved in raised position over the end of each tank and then lowered to immerse their workpieces in the following tank. Most of the preparation and finishing tanks are of unit size, so that a carrier is advanced from one tank to the next on each step of the conveyer, but the plating operation requires a long time compared to any of the preparation and finishing treatments and, accordingly, in some machines, the plating is carried on in tanks of multiple unit size, which provide a plurality of plating positions. A carrier is then lowered to immerse its workpieces at the first plating position in the first tank and is advanced in the down position along the tank for a number of conveyer steps before being raised and lowered into the next tank.

Many objects can be satisfactorily plated by moving them through a plating tank between laterally disposed anodes, but some articles have such shapes that they cannot be plated properly, if they are moved through the tank during plating. The reason is that, if the anodes are spaced to permit the articles to be moved between them through the tank, all parts of the articles will not lie at the same spacing from the anodes and the variation in spacing will be sufficient to produce a variation in the thickness of the plating on different parts of the articles. Automobile bumper bars are typical of the articles, which cannot be satisfactorily plated in movement through a plating tank, and such articles may best be plated in a machine functioning in a skip-stop cycle.

In a skip-stop machine, the plating is carried on at a number of working positions in one or more tanks and, at each position, there is a group of anodes so placed that a carrier may be lowered to immerse its workpieces into the solution within the group of anodes and in such relation to the anodes that all parts of the workpieces receive an equally heavy plating. The workpiece car-

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riers are delivered to and removed from the working positions by a conveyer and an elevator and, in the operation of the machine, the carriers are moved along the preparation tanks in the usual way and are then transferred from the final preparation tank to successive working positions at the plating station, until all the positions are filled. The carrier in the first position is then removed and delivered to the first finishing tank and a carrier is transferred from the last preparation tank to the vacated first position. The carrier in the second working position is next removed, delivered to the first finishing tank, and replaced by a carrier from the last preparation tank, this sequence of operations being continued until all the carriers in all the working positions have been removed and replaced, whereupon the cycle is repeated. The carriers delivered to the first finishing tank are moved along the tanks of that group in the usual way and finally reach an unloading station.

The present invention is directed to the provision of novel means for use in a skip-stop machine for delivering the workpiece carriers to and removing them from the working positions of the treatment station. Such means include a conveyer operable to move the carriages lengthwise of and above the station, and an elevator extending the length of the station and having improved lifting elements, which are selectively operable by new devices for the purpose. The lifting elements are controlled in such manner that the elevator structure raises the carriages one at a time from the working positions in accordance with a cycle, while leaving behind the carriages whose workpieces require further treatment. The lifting elements are of simple construction and the means for operating them are reliable and effective in action.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which:

Fig. 1 is a diagrammatic transverse vertical sectional view of a machine embodying the invention;

Fig. 2 is a diagrammatic sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary transverse sectional view showing the operating means for one of the lifting elements;

Fig. 4 is a view similar to Fig. 3, with the lifting element and its operating means in inoperative position;

Fig. 5 is a fragmentary transverse sectional view showing the elevator structure in raised position;

Fig. 6 is a sectional view on the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary sectional view on the line 7—7 of Fig. 3; and

Fig. 8 is a diagrammatic view similar to Fig. 3 but showing a modified form of the operating means for the lifting elements.

In the drawings, the machine is illustrated as including a plating tank 10 of conventional construction having a plurality of working positions, of which four are shown. The workpieces W are mounted on carriers, which comprise a top bar 11 with depending arms 12 having supports for the workpieces, and the carriers are mounted on carriages 13, which comprise an axle 14 having flanged wheels 15 at its ends and a sleeve 16 encircling its middle section and having a pair of depending hooks 17, in which the ends of the top bar of a carrier are received. In the machine, the carriages are advanced from the last preparation tank to the working positions of the plating tank by means of a conveyer, which is of conventional construction and includes a pair of chains 18 (Fig. 6) having aligned yokes 19 at intervals, the yokes of a pair on the respective chains being adapted to straddle the axle of a carriage and move the carriage with the chains.

The carriages are moved along the plating tank on tracks on an elevator structure 20, which may be of the general type shown in Curtis patent 2,626,621. The structure includes a pair of longitudinal beams 21, which

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lie on opposite sides of the plating tank and carry angle irons 22 secured to the opposed faces of the beams with horizontal flanges of the angle irons providing tracks for the wheels 15 of the carriages. Opposite each working station of the tank, the angle irons are cut away, so that the tracks have openings, and lifting elements 23 are provided for closing the respective openings and thereby completing the tracks.

Each lifting element 23 comprises a plate 24 mounted for swinging movement on a pin 25 extending between brackets 26 secured to the bottom flange of the beam 21. The plate has a cross-bar 27 at its top and an arm 28 extends outwardly from the middle of the plate through an opening in the web of the beam 21 and carries a roller 29 exposed at its end. The arm also carries a counterweight 30 tending to swing the plate to inoperative vertical position against the web of beam 21, and a stop 31, which is adapted to engage the outer face of the web and limit the movement of the plate away from the web. Below the pin 25, the plate is provided with a projection 32, which is engageable with a roller 33 mounted on a plate 33a attached to the machine framework at the lower end of the path of travel of the elevator structure. When the elevator moves down to its lower position, the engagement of roller 33 with projection 32 insures that the lifter element will be swung against the web of beam 21.

The aligned pairs of lifter elements 23 mounted on the elevator structure on opposite sides of the plating tank at the working positions of the tank are selectively operable, so that, when the structure rises, a workpiece carriage may be raised from a selected working position. When the elevator moves down with a carriage 13 thereon, the carriage comes to rest on rails 10a on opposite sides of the tank and the structure then moves farther down, so that the rollers 33 engage the projections on the lifting elements and swing the elements against the webs of the beams 21, if the elements are not already in that position. The lifting elements in such positions are ineffective to engage the wheels 15 of carriages 13 resting on the rails 10a and the elements for lifting a carriage at the selected working position are made effective by the following means.

A pair of cam plates 34 are disposed outside the elevator structure at each working station of the plating tank, and each cam plate is pivotally mounted on a fixed plate 35 attached to a structural member 36 of the machine frame. The plate 34 is formed with a cam surface 34a in position to be engaged by the roller 29 on the adjacent lifter element and, when a plate 34 is in the position illustrated in Fig. 3, the upward movement of the elevator structure from its down position causes the roller 29 to roll along surface 34a and swing its lifter element to effective position. In such position, the cross-bar 27 of the element completes its track 22 at the working position, from which a carriage is to be raised, so that, when the elevator structure rises, the bar 27 engages the roller of the carriage at the position and lifts it.

The movement of the cam plate 34 to and from its effective position is accomplished by means of a toggle 37 having a link 37a connected at one end to plate 34 and at the other end to one end of a link 37b having its other end connected to one end of link 38. The other end of link 38 is pivotally mounted on the plate 35 and the angular position of link 38 in relation to its pivot is adjustable by means of a screw 39. A link 40 is connected at one end to the middle pin of toggle 37 and at its other end to the plunger 41 of a solenoid 42. The plunger carries a stop 43 limiting its upward movement. When the solenoid is de-energized, the plunger drops to the position shown in Fig. 4 and link 40 moves down to shorten the length of the toggle and swing the plate 34 away from the roller 29 on its associated lifting element. Energization of the solenoid raises the plunger and increases the length of the toggle so as to make the cam,

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plate 34 effective to insure that its lifting element will be moved to operative position. The effective position of the cam surface 34a on cam plate 34 in relation to the path of movement of roller 29 can be accurately adjusted by varying the position of link 38 by its screw 39.

The connection of plunger 41 to solenoid 42 to plate 34 through toggle 37 makes it possible to employ a solenoid of low power, since the solenoid is required only to hold the links of the toggle in aligned position and is not required to hold plate 34 against the force applied to it, as it moves its associated lifting element to effective position. The use of the toggle connection is particularly desirable in installations, in which the carriages are moved in pairs into and out of the working positions of the plating tanks, since, in such installations, it is preferable to provide lifting elements extending between a pair of working stations rather than lifting elements at individual stations. The long lifting elements with their counterweights are relatively heavy and their movement would require powerful solenoids, if the toggle connections were not used.

The solenoid 42 and its plunger 41 are mounted within a housing 44 attached to the machine frame and the housing contains a switch 45 having an operating arm 45a with a roller engageable by a pin on the upper end of plunger 41. Switch 45 associated with the solenoid operating the cam plate of a given lifting element is in circuit with a similar switch, which is operated by the solenoid controlling the position of the cam plate 34a for the aligned lifting element across the plating tank. The circuit also controls the operation of the elevator structure and, if a carriage is to be raised from a working position of the plating tank, the elevator cannot function, unless both solenoids at that position have operated and closed their related switches 45. The switches thus prevent the possibility that the load of workpieces on a carriage will be dropped upon upward movement of the elevator structure, because only one solenoid of a pair functioned to make its lifting element operative.

When the elevator structure rises to its upper position, a carriage thereon is engaged by yokes on the conveyor chains and moved along the elevator tracks. It is, accordingly, necessary that the tracks be continuous, when the elevator structure is up, and the lifting members 23, which were inoperative during the rise of the elevator structure, must be swung to effective position to close the openings and complete the tracks. For this purpose, a plate 46 is mounted on the machine structure at each working position of the plating tank and in position to be engaged by the roller 29 on the adjacent lifting element, as the elevator approaches its upper position. Each plate 46 has a cam surface 46a and, as the roller 29 moves along the surface, the element is swung away from its beam 21 and into effective position.

In the alternative construction, illustrated in Fig. 8, the lifting element 23', pivoted at 25' on a beam 21' of the elevator structure, has an arm 28' with a roller 29' engageable with a cam surface 47a on a cam plate 47 pivoted on a plate 35' attached to a structural member 36' of the machine frame. The plate 47 has an arm 48 connected to the plunger 49 of a solenoid similar to solenoid 42 and lying within a housing 44'. When the solenoid is energized, the plunger 49 is raised and plate 47 is swung, so that, as roller 29' moves up the cam surface 47a upon the rise of the elevator structure, the plate 23' is swung to effective position to close the opening in track 22' and engage and lift the wheel 15' of a carriage 13'. The arm 28' and roller 29' are sufficiently heavy to serve as a counterweight tending to hold the element 23' in inoperative position.

The lifter elements have been illustrated and described as being operated by cam plates brought into operation by electrical means in the form of solenoids, but it will be apparent that the cam plates can be actuated me-

chanically or by fluid-operated means, such as hydraulic or air cylinders. Similarly, while the use of such cam plates is desirable, they may be dispensed with and the individual elements may be operated by devices acting directly thereon and actuated electrically, mechanically, or by fluid-operated means. The lifter elements associated with each track may be operated by a master member, such as a shaft carrying cams and rotated stepwise to cause the cams to operate the lifter elements at the different working positions in the desired sequence, and such master members may be mounted on the elevator structure or adjacent the paths of the lifter elements. The selection of the lifter elements may occur as the elements are moved down with the elevator structure, when the structure is at rest at the bottom of its path, or when the structure starts to rise. Other forms of direct actuators for the individual lifter elements may be selectively operated through flexible cable connections and like means, and they may be mounted on the elevator or adjacent the path of the elements. The various ways of operating the lifter elements selectively will readily occur to those familiar with such elements.

The lifter elements shown and described are normally inoperative and are brought into action selectively to raise the carriages from the working positions in a cycle. Also, all the elements are made operative to complete the tracks, when the elevator is at the end of its upward movement. If desired, the lifter elements may be normally operative, in which case the selective raising of the carriages is achieved by rendering inoperative all the elements except the pair at the working position, from which the carriage is to be raised. When normally operative elements are used, they are urged to operative position by yielding means, such as weights, so that, as the elevator moves down, the elements may be swung aside by engagement with carriages in working positions to pass by those carriages.

The form of the control device used for controlling the action of the lifter elements will vary with the means, by which the elements are operated. When the elements are operated electrically, either directly or by means of cam plates, a simple form of control for the lifter elements for a plating tank having four working positions, such as tank 10, may comprise a drum 50 (Fig. 1) rotated by a motor 51 through a speed reducer 52. Pins 50a are mounted on the drum at an angular spacing of 90° and in position to engage the operating arms of switches 53, each of which controls the means for operating a pair of lifter elements lying aligned at opposite sides of the plating tank at a working position. Whenever a workpiece carrier has been lowered into a working position of the plating tank, the motor may be started by appropriate means, such as a limit switch actuated by the carriage as it comes to rest on the rails of the tank. The motor then rotates the drum 50 through a quarter turn and a switch 53 is closed by such movement of the drum and energizes the means for operating the lifter elements at the working position, from which the carriage is to be raised on the next upward movement of the elevator structure. If desired, the motor may move drum 50 through a complete revolution each time the motor is brought into action, in which event the switches 53 are brought successively into action by suitable relays. When the plating tank has more than four working positions, additional pins 50a are mounted on the drum and the drum is rotated in suitable steps to cause the pins to close the switches in the desired sequence.

We claim:

1. In a processing machine, the combination of an

elevator structure movable between upper and lower positions, the structure having a member providing a track interrupted by a plurality of openings spaced along the member, a lifter element mounted on the structure at each opening and movable to close its opening, the element being normally in inoperative position, means near the lower position of the structure for moving the elements into operative position on successive upward movements of the elevator, said means including a cam member for each element, the cam members being movable to an effective position, where they are engaged by a part of their respective elements and move the latter as the structure moves, and means for moving the cam members to effective position, and means operating on the inoperative elements near the upper position of the structure to move them to close their openings and complete the track.

2. A processing machine, which comprises carriages for workpieces to be treated, a treatment station having a plurality of working positions, an elevator for raising and lowering the carriages relative to the positions, the elevator having longitudinal members, which extend along the working positions in spaced relation and provide tracks for movement of the carriages, the tracks having aligned openings at respective working positions, a lifter element mounted on the elevator at each opening and operable to open and close its opening, means for operating the pairs of elements at aligned openings in a sequence, in which the elements at the respective working positions close their openings to raise the carriages one at a time from the successive working positions with the elevator and all the elements close their openings near the end of the upward movement of the elevator to complete the carriage tracks, and a conveyor for advancing the carriages along the completed tracks.

3. A processing machine as defined in claim 2, in which each lifter element is pivotally mounted on the elevator and is urged to inoperative position by a counterweight.

4. A processing machine as defined in claim 2, in which the means for operating the pairs of lifter elements include a cam member for each element, each cam member being movable to a position in which it acts on its associated element to move the latter as the elevator moves, and electromagnetic means for moving the cam member.

5. A processing machine as defined in claim 4, in which each lifter element has an arm, which engages the cam member associated with the element when the cam member is in operative position, and the member acts through the arm to move the element to effective position as the elevator rises.

6. A processing machine as defined in claim 4, in which the electromagnetic means for moving the respective cam members include a solenoid for each cam member, the solenoid having a plunger and a connection between the plunger and the cam member.

7. A processing machine as defined in claim 6, in which the connection between each cam member and the plunger of its solenoid is a toggle.

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