June 24, 1958 C. R. MERVYN ET AL 2,840,219

AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

Filed April 30, 1957 5 Sheets-Sheet 1

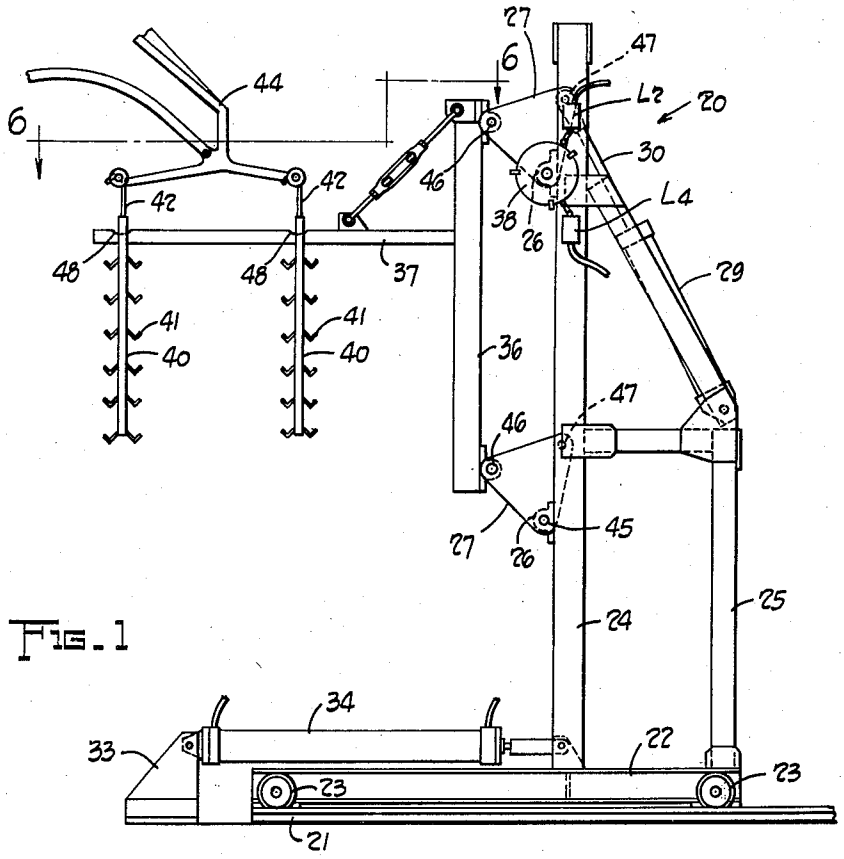

Fig. 1

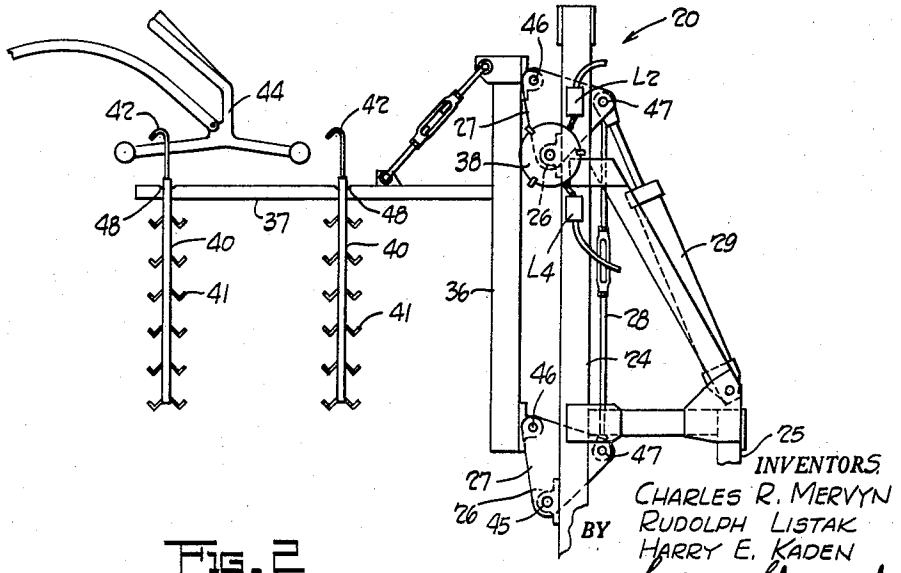

Fig. 2

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AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

Filed April 30, 1957 5 Sheets-Sheet 2

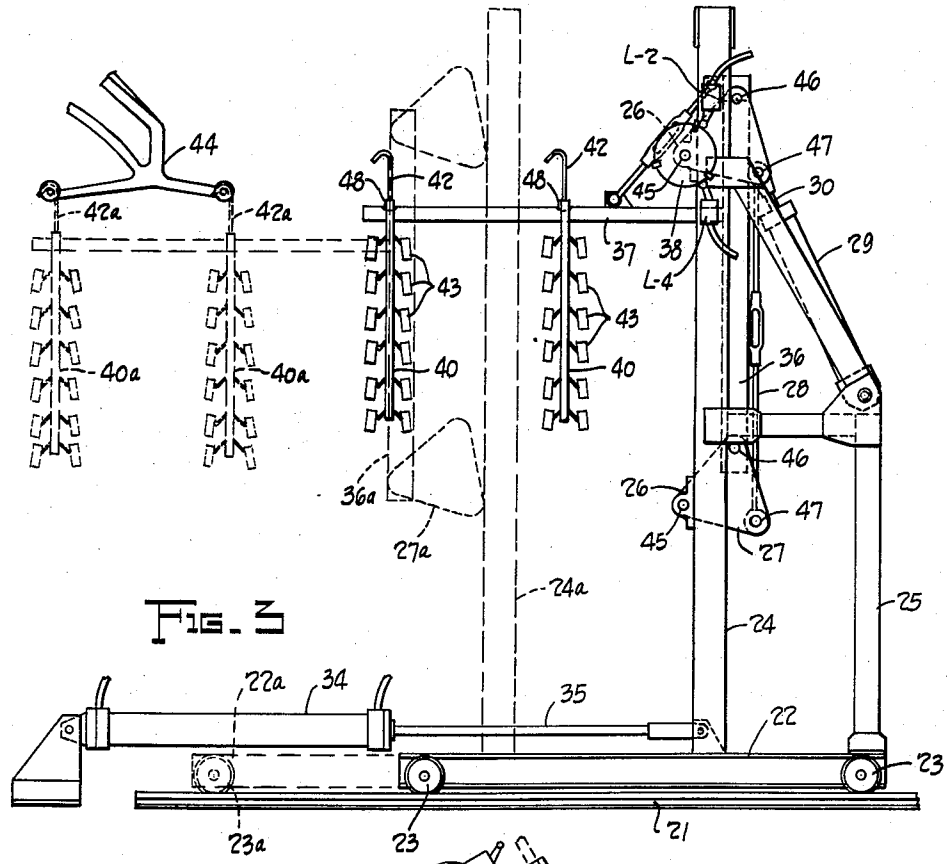

FIG. 3

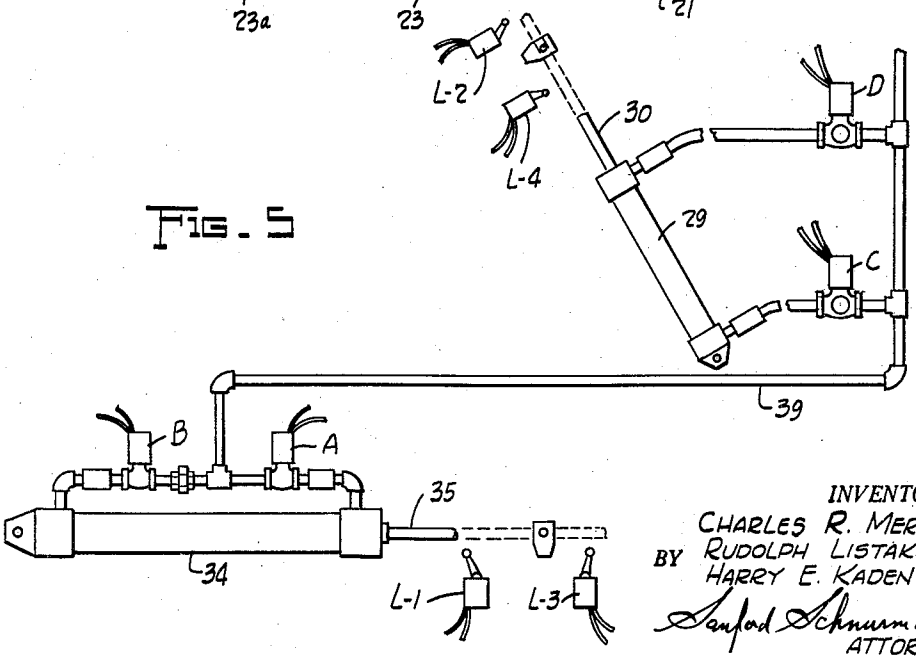

FIG. 5

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AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

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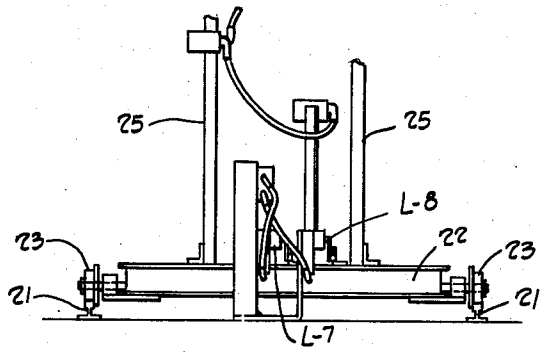

Fig. 4

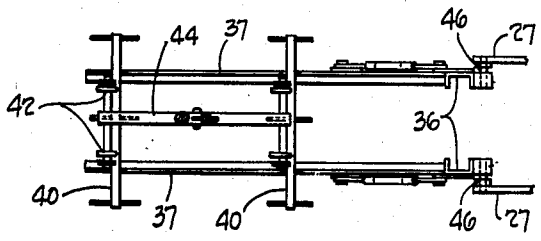

Fig. 6

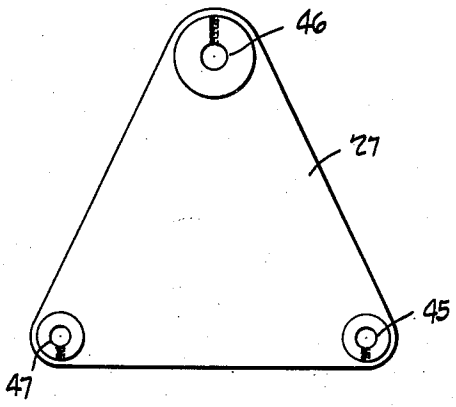

Fig. 7

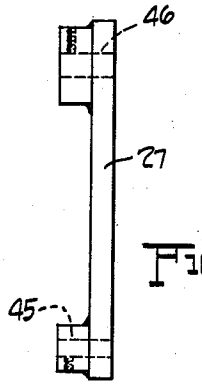

Fig. 8

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AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

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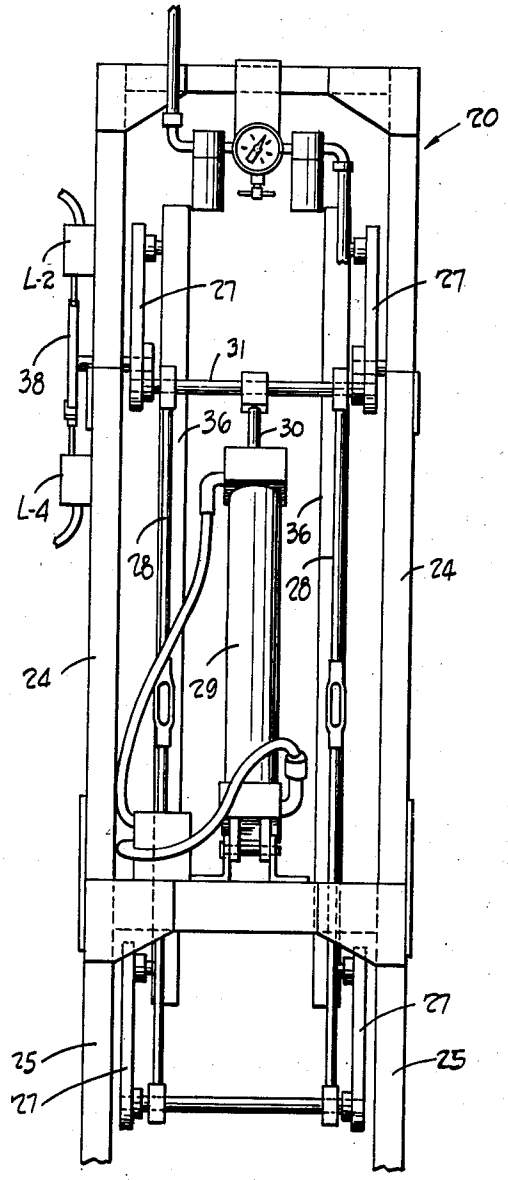

FIG. 9

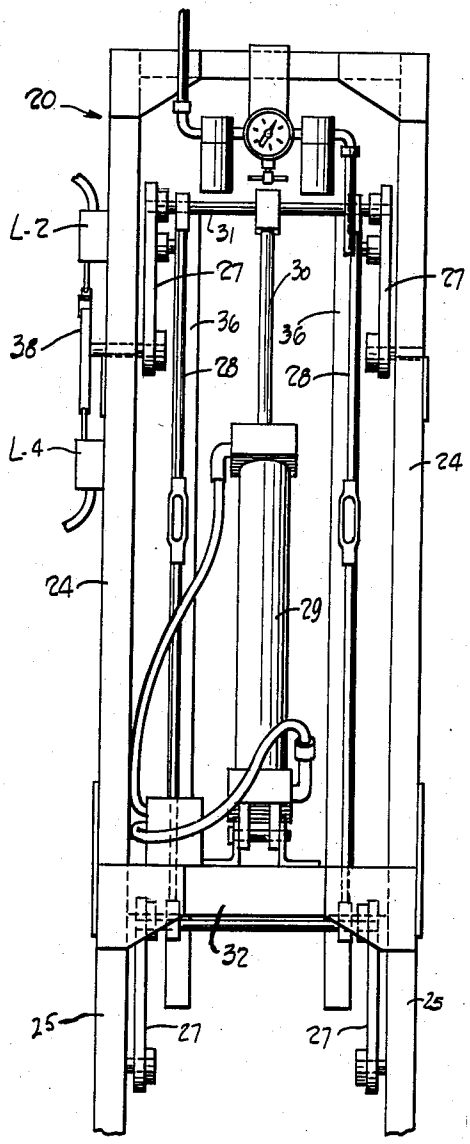

FIG. 10

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AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

Filed April 30, 1957 5 Sheets-Sheet 5

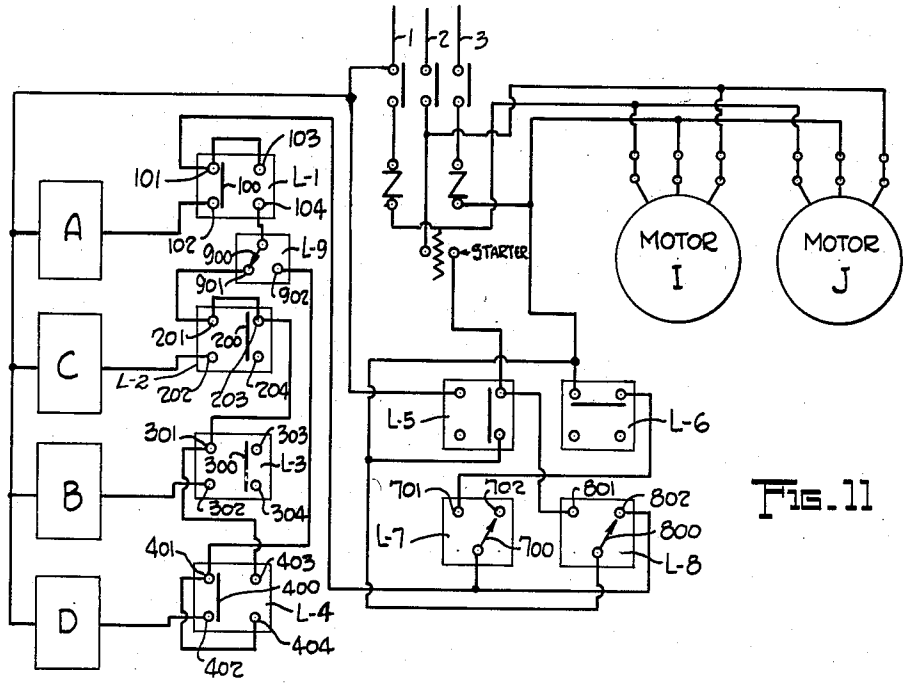

Fig. 11

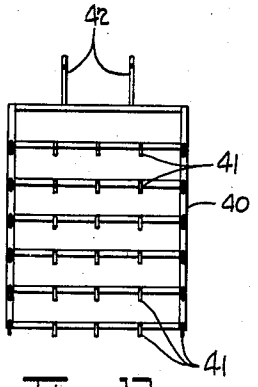

Fig. 12

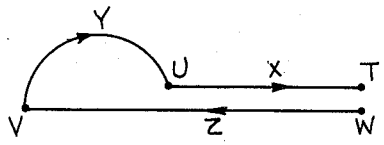

Fig. 13

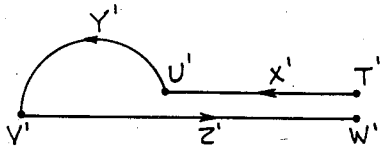

Fig. 14

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United States Patent Office 2,840,219 Patented June 24, 1958

2,840,219

AUTOMATIC RACK UN-LOADER AND LOADER FOR PLATING MACHINES

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Application April 30, 1957, Serial No. 656,140

3 Claims. (Cl. 198—20)

This invention relates to automatic loading devices and particularly to a rack loader for continuous plating machine conveyors.

Conducive to a better understanding of the invention, it may be well to point out that in the electro-plating of small objects, such as electric switch boxes; which are stamped from sheet steel and therefore require a corrosion resistant plating of zinc or cadmium metal; it is customary to carry out the plating process with a so-called continuous plating machine.

Such a machine embodies a series of washing, plating, and rinsing baths which are arranged in a closed circle. It is usual to have a circular conveyor system associated with the baths, which embodies a series of pivoted arms which carry the objects to be plated and dips them, progressively, in the various baths required by the plating process. The arms are carried past the various baths or tanks by an endless chain, and the arms are made to dip and lift the objects to be plated, in and out of the tanks, by means of cams operable by a suitable timing device. The objects to be plated are placed on the conveyor arms at a loading point. The arms are then indexed from tank to tank through the plating process, and automatically returned to their starting point with the objects completely processed.

In the case of small objects, such as electric switch boxes, it is economically impractical to plate them one at a time, and it is therefore customary to load them on a plating rack accommodating 50 or 60 boxes; the racks being suspended in pairs on the plating conveyor arms, which carry them from station to station through the plating cycle.

The plated switch boxes are unloaded manually from the racks, and then the racks must be lifted from the conveyor arm and reloaded with unplated boxes. The loaded rack must then be lifted and re-placed on the conveyor arm. This requires considerable physical effort on the part of the operator, since the loading racks are very heavy. Furthermore, there is an inclination on the part of the operator to load less than the maximum number of boxes on each rack in order to reduce the weight to be lifted. Again, the speed of the manual rack loading operation, determines the speed of the conveyor, since the conveyor cannot advance until the loaded rack is replaced on the conveyor arm. Both of these factors tend to reduce the operational efficiency of the plating machine.

The primary object of this invention, therefore, is to provide an automatic rack loader for conveyor arms that will lift empty racks off the conveyor arm, carry them to a manual loading position, and then return the loaded racks to the conveyor arm and replace them thereon.

Another object is to provide a device whose operational steps are controlled by a cyclic mechanical and electrical circuit, requiring no manual supervision and acting entirely independently of the speed of the human manual box loader.

Still another object is to provide such a device that is integrated with the movements of the conveyor arms, so that it only moves when the conveyor arm is in its loading position.

A further object is to provide an automatic rack loader, of the type stated, that requires no physical effort on the part of the operator other than that required to place the individual objects to be plated on the racks.

Another object is to provide such a device that is rugged in structure and reliable in operation.

These and other objects of the invention will become apparent from a reading of the following specification and claims, together with the accompanying drawings, wherein like parts are referred to and indicated by like reference characters, and wherein:

Figure 1 is a side elevation of the rack loading machine that is the subject of this invention, showing it in its rack unloading position, at the moment prior to the lifting of the racks off a conveyor arm;

Figure 2 is a side elevation of the same, showing it in an intermediate unloading position wherein the racks have been lifted off the conveyor arm and are supported on the bracket fingers of the loader;

Figure 3 is a side elevation of the unloader in its fully retracted manual loading position, with the racks loaded with unplated boxes, and also showing the bracket and supported loaded racks in an alternate, conveyor arm engaging position, indicated in broken outline;

Figure 4 is a rear elevation of the carriage and track, showing the location of certain limit switches;

Figure 5 is a schematic layout of the pneumatic system;

Figure 6 is a top plan view of the device taken along the line and in the direction of the arrows **6—6** of Figure 1;

Figure 7 is a front elevation of one of the bell cranks;

Figure 8 is a right end view of the same;

Figure 9 is a rear view of the carriage showing the vertical pneumatic cylinder in its retracted condition;

Figure 10 is a view of the same showing the pneumatic cylinder in its extended condition;

Figure 11 is a schematic layout of the electrical control circuits;

Figure 12 is a front view of one of the racks;

Figure 13 is a schematic layout of the movements of the rack unloading cycle; and

Figure 14 is a schematic layout of the movements of the rack loading cycle.

Referring more particularly to the drawings, there is seen the rack loader that is the subject of this invention, broadly indicated by the reference numeral **20**.

Reference numeral **21** indicates a base including a pair of spaced parallel rails, upon which a carriage **22** having wheels **23** is movably mounted. The rails, or track **21** extend from the loading station of the conveyor arm **44**, outwardly therefrom, to the manual rack loading position of the device.

The carriage has a pair of upright members **24** mounted thereon, and a second pair of shorter uprights **25** connected thereto, at the rear thereof, the uprights **25** are connected together through a cross-brace **32**, which provides a frame or base for supporting the upright pneumatic cylinder **29**, described hereinafter.

A horizontal pneumatic cylinder **34** is mounted on an anchor plate **33** at the forward end of the track **21**, as shown in Figure 1, with its piston-rod **35** connected to the carriage **22** at the base of the upright member **24**. The movement of the piston rod **35**, in and out of the pneumatic cylinder **34** acts to move the carriage **22** between first and second positions, longitudinally of the track **21**, as described hereinafter. Two pair of vertically spaced and horizontally aligned bearing blocks **26** are mounted on the front face of the uprights **24**.

Four triangularly shaped bell cranks **27** are mounted

at their apices 45 on short shafts journaled in the bearing boxes 26. The upper pair of bell cranks 27, at apices 47, are connected to the lower pair of bell cranks, at their apices 47, through links 28, as seen most clearly in Figures 2, 3, 9 and 10. The upper pair of bell cranks are connected, at apices 47, through a cross bar 31. Thus all four bell cranks 27 will pivot simultaneously, on their apices 45, through the same arc of travel upon movement of the cross-bar 31.

A pneumatic cylinder 29 is anchored on the cross-brace 32 connecting the top of the uprights 25. The piston rod 30 of the cylinder 29 is connected to the bell crank cross-bar 31. Movement of the piston rod 30 in and out of the pneumatic cylinder 29, between first and second positions, causes the four bell cranks 27 to simultaneously pivot between retracted and extended positions, respectively, on their bearing blocks 26, as described hereinafter.

A bracket member 36 is pivotally mounted on the four bell cranks at their apices 46. The bracket 36 has two forwardly extending horizontal fingers 37. The fingers 37 are notched at 48 to receive the racks 40, as described hereinafter.

The racks 40, as illustrated in Figure 12, are rectangular in shape and have two mounting hooks 42 extending upwardly of the top edge thereof. Reference numerals 41 indicate a plurality of pegs secured to the rack frame which function as supports for the switch boxes 43. It is of course to be understood that any type or size article may be supported on the racks 40, in which case the spacing and shape of the pegs 41 may have to be altered to suit the articles being plated.

Referring to Figure 5, there is seen the schematic layout of the pneumatic system. Reference numeral 39 indicates a compressed air line leading from a source of compressed air, not shown. Reference characters A, B and C, D indicate solenoid controlled air valves which control the flow of air to the two pneumatic cylinders 34 and 39, respectively. Reference characters L–1 and L–3 indicate limit switches which actuate solenoids A and B, respectively. Reference characters L–2 and L–4 indicate limit switches which actuate solenoids C and D respectively.

The motions through which carriage 22 and bracket 36 go, upon activation of the various valves A, B, C and D is as follows:

Activation of valve A causes the carriage 22 to be pulled forward toward the conveyor arm 44. Activation of valve B causes the carriage 22 to be pushed away from conveyor arm 44, and back to its original position.

Activation of valve C causes piston-rod 30 of pneumatic cylinder 29 to push upward, thereby pivoting bell-cranks 27 forward, and carrying the attached brackets 36 upward and forward in a circular counter-clockwise arc, to the position illustrated in Figure 1.

Activation of valve D causes the piston-rod 30 to be pulled downward into cylinder 29, thereby pivoting the bell cranks 27 backward to their original positions, and carrying the bracket 36 upward and backward in a clockwise arc, to the position illustrated in Figure 3, in full line.

A study of Figure 1 of the drawings will reveal that the racks 40 are suspended from the conveyor arm 44 by means of forwardly curved hooks 42. In order to remove the racks 40 from the conveyor arm 44 it is necessary to slide the bracket fingers 37 through the rack frames and then lift the racks upwardly in a vertical arcuate clockwise path in order to un-hook the racks from the conveyor arm 44, as illustrated in Figure 2. Once they are unhooked it is necessary to lower them so that they will pass under the conveyor arm and then they are moved horizontally away from the conveyor arm to the manual box loading position, as illustrated in Figure 3.

Figure 11 is a schematic layout of the electrical cycling circuits which effect these various movements automatically. It will be seen that the electrical control circuits of the loader 20 and the conveyor operational motors I and J are integrated so that none of them will function in a conflicting manner. The motor I controls the lifting and lowering action of the conveyor arm 44, while the motor J controls the lateral transfer or indexing motion of the plater conveyor arms 44, as explained hereinbefore.

In the following explanation of the operation of the device through its unloading and loading cycle, the following meaning of the terms "closed" and "open" is indicated with reference to Figure 11.

Limit switch L–1, "closed" means terminals 101 and 102 are contacted by bar 100; "open" means terminals 103 and 104 are contacted by bar 100.

Limit switch L–2, "closed" means terminals 201 and 202 are contacted by bar 200; "open" means terminals 203 and 204 are contacted by bar 200.

Limit switch L–3, "closed" means terminals 301 and 302 are contacted by bar 300; "open" means terminals 303 and 304 are contacted by bar 300.

Limit switch L–4, "closed" means terminals 401 and 402 are contacted by bar 400; "open" means terminals 403 and 404 are contacted by bar 400.

Limit switch L–7, "closed" means bar 700 is contacting terminal 702; "open" means bar 700 is contacting terminal 701.

Limit switch L–8, "open" means bar 800 is contacting terminal 802; "closed" means bar 800 is contacting terminal 801.

Limit switch L–9, "closed" means bar 900 is contacting terminal 901; "open" means bar 900 is contacting terminal 902.

The limit switches L–1 and L–3 are mechanically tripped by the to and fro movement of the carriage 22. The limit switches L–2 and L–4 are mechanically tripped by a circular cam 38 mounted on one of the bell cranks 27at its pivot shaft.

The limit switches L–7 and L–8 are located to the rear of the track 21, as shown in Figure 4, and are tripped by contact with the moving carriage 22.

The limit switch L–9 is located at the front end of the track 22 and is tripped by contact with the carriage 22.

This mechanism performs two basic operations—first, unloading manually emptied plating racks from the plater conveyor arms, and, second, loading manually loaded plating racks on to the conveyor arms. These two basic operations constitute two separate basic cycles, which are hereinafter referred to as "loading" and "unloading" cycles. Each of the two basic cycles comprise three separate motions which are graphically illustrated in Figures 13 and 14. Figure 13 illustrates the "unloading cycle," while Figure 14 illustrates the "loading cycle."

At the start of the unloading cycle the carriage is back at point W of Figure 13, with the bracket 36 in its extended position as illustrated in Figure 1. At point W the condition of the various limit switches illustrated in Figure 11 is as follows:

L–1 is closed
L–2 is open
L–3 is open
L–4 is closed
L–7 is closed
L–8 is open
L–9 is closed

It is to be understood that under these conditions and with the conveyor arm indexed to its unloading position in front of track 21, the plating machine timer control will energize the loader circuit. Following this activation solenoid valve A is energized, causing the carriage 22 to move from point W to point V through horizontal motion Z. At this point the bracket fingers 37 will be thrust through the racks 40 which are still suspended from the conveyor arm 44, as illustrated in Figure 1.

At point V:
L–1 is mechanically tripped open
L–2 is open
L–3 is mechanically tripped closed
L–4 is closed
L–7 is closed
L–8 is open
L–9 is mechanically tripped open

Following the schematic layout of Figure 11, it is seen that solenoid valve D is actuated. This causes the piston-rod **30** to be pulled down into cylinder **29**, thereby pivoting the bell cranks **27** rearwardly. The bracket fingers **37** are moved from point V to point U through an arcuate clockwise path Y. This lifts the rack hooks **42** up and off the conveyor arm **44**, as illustrated in Figure 2. The racks **40** are now seated across the fingers **37** in notches **48**, which hold them in position on the fingers **37**. At point U the tops of the rack hooks **42** are below the arm, so that the forward hook may pass under the arm **44** during the next movement.

At point U:
L–1 is open
L–2 is mechanically tripped closed
L–3 is closed
L–4 is mechanically tripped open
L–7 is closed
L–8 is open
L–9 is open

Following the schematic layout of Figure 11 it is now seen that solenoid valve B is activated, causing the carriage **22** to travel from point U to manual loading station T, through horizontal motion X. The racks **40** suspended on the fingers **37** are now at the manual loading station, as illustrated in full outline in Figure 3. The unloading cycle has now been completed. After a time interval controlled by the timer of the plating machine, the loading cycle is initiated.

The loading cycle motions are illustrated schematically in Figure 14, wherein point T of Figure 13 becomes point T′ of Figure 14.

At point T′:
L–1 is mechanically tripped closed
L–2 is closed
L–3 is mechanically tripped open
L–4 is open
L–7 is mechanically tripped open
L–8 is mechanically tripped closed
L–9 is open

Following the schematic layout of Figure 11 it is seen that solenoid valve A is activated, causing the carriage to move from point T′ to U′ through horizontal motion X′.

At point U′:
L–1 is mechanically tripped open
L–2 is closed
L–3 is mechanically tripped closed
L–4 is open
L–7 is open
L–8 is closed
L–9 is mechanically tripped closed

Following the schematic layout of Figure 11 it is seen that solenoid valve C is activated causing the piston-rod **30** of cylinder **29** to be pushed upward, thereby pivoting the bell cranks **27** forward in a counter-clockwise motion. The bracket fingers **37** move from point U′ to point V′ through counter-clockwise arcuate path Y′, thus re-hooking the racks **40** on to the conveyor arm **44**, as indicated in dotted outline in Figure 3.

At point V′:
L–1 is open
L–2 is mechanically tripped open
L–3 is closed
L–4 is mechanically tripped closed
L–7 is open
L–8 is closed
L–9 is closed

Following the schematic layout of Figure 11, it is seen that solenoid valve B is actuated. The carriage **22** is now moved back from point V′ to point W′ through horizontal motion Z′. Thus the racks **40** are left suspended on the conveyor arm **44**, which is ready to the first position of the plating process.

At point W′:
L–1 is mechanically tripped closed
L–2 is open
L–3 is mechanically tripped open
L–4 is closed
L–7 is mechanically tripped closed
L–8 is mechanically tripped open
L–9 is closed

The rack loader **20** is now back at its original position, clear of the conveyor arm **44**, free of racks **40** and ready for another unloading cycle, starting at point W of Figure 13.

The next unloading cycle, however, cannot start until the next conveyor arm, carrying empty racks, has indexed into its unloading position, since the plater circuits control the initial activation of the loader circuits, as seen in Figure 11.

Note that limit switches L–2 and L–4 work on cam **38**. One will always be closed when the other is open. Similarly switches L–1 and L–3; and L–7 and L–8 will always be paired alternately open and closed. Limit switch L–9 will trip only when L–1 and L–3 are tripped.

The rack loader just described will function to automatically unload and load racks as long as the plating machine is in operation, without requiring any physical or mental action on the part of the operator.

It will now be clear that there has been provided a device which accomplishes the objectives heretofore set forth. While the invention has been disclosed in its preferred form, it is to be understood that the specific embodiment thereof as described and illustrated herein is not to be considered in a limited sense as there may be other forms or modifications of the invention which should also be construed to come within the scope of the appended claims.

We claim:

1. In combination with a conveyor of the type having a plurality of arms for suspending work holding racks; the conveyor arms being cyclically indexed past a loading position when the racks are empty; a rack loader, comprising, a base member including a track aligned at one end with the aforesaid conveyor loading position and extending away therefrom to a work loading position; a carriage member mounted on said track and movable longitudinally thereof between said conveyor loading and work loading positions; a bell crank pivotally mounted on the carriage and movable between a first and a second position; a bracket member mounted on the bell crank and movable thereby through a vertical arcuate path relative to said carriage between a first extended position and a second retracted position; the bracket having two, spaced, parallel and forwardly extending fingers; means for moving said carriage toward the conveyor arm when the arm is in its loading position and the bracket in its first, extended position, wherein the bracket fingers are aligned with the empty racks suspended on the conveyor arm; means for pivoting the bell crank to its second position whereby the bracket member is moved to its second, retracted, position, wherein the racks are lifted from the conveyor arm by the fingers and supported thereby; means

for moving the carriage and supported racks longitudinally of the track to the work loading position; means for returning the carriage and loaded racks along the track to the conveyor arm; means for pivoting the bell crank and bracket to their first positions, wherein the bracket fingers are aligned with the conveyor arm and the racks supported on the fingers are replaced on the conveyor arm; and means for moving the carriage longitudinally of the track, clear of the conveyor loading position.

2. A device of the type defined in claim number 1 and further characterized by the means for moving the carriage longitudinally of the track being a first pneumatic cylinder and the means for pivoting the bell crank between its first and second position being a second pneumatic cylinder.

3. In combination with a conveyor of the type having a plurality of arms for suspending work holding racks; the conveyor arms being cyclically indexed past a loading position when the racks are empty; a rack loader, comprising, a base member including a track aligned at one end with the aforesaid conveyor loading position and extending away therefrom to a work loading position; a carriage member mounted on the track and movable longitudinally thereof between a first position, at the conveyor arm, and a second position, at the work loading end of the track; a first pneumatic cylinder mounted on the base, having its piston rod connected to the carriage, the piston rod being movable between first and second positions, the carriage being in its first position when the piston rod is in its first position and in its second position when the piston rod is in its second position; the carriage having a pair of spaced upright members mounted thereon; a pair of vertically spaced bearing blocks mounted on each of the upright members, each of said paired bearing blocks being horizontally aligned with its opposite bearing block on the opposite upright member; a bell crank pivotally journaled in each of said bearing blocks, the bell cranks on the upper bearing blocks being joined through links to those on the lower bearing blocks; a bracket member mounted on the several bell cranks and movable in a vertical arcuate path between first and second positions, forwardly and rearwardly of said carriage uprights, upon the pivoting of the bell cranks between a first and second position, the said bracket having a pair of forwardly extending rack engaging fingers mounted thereon; a second pneumatic cylinder mounted on the carriage, to the rear of said upright member, having its piston rod connected to the upper bell cranks, the piston rod being movable between first and second positions wherein the bell cranks, and attached bracket member are moved between their first and second positions respectively, each of said pneumatic cylinders having electrically operated valve means and control circuits therefore, operable to energize the cylinders to cause the pistons thereof to move between their first and second positions in a predetermined sequence; and an electric cycling circuit controlled by the position of the conveyor arm and acting to initiate the loading cycle when the conveyor arm moves into its loading position.

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