Aug. 14, 1945. O. W. WOOD 2,382,194

CONVEYING APPARATUS

Filed Dec. 23, 1943 3 Sheets-Sheet 1

Fig. 1.

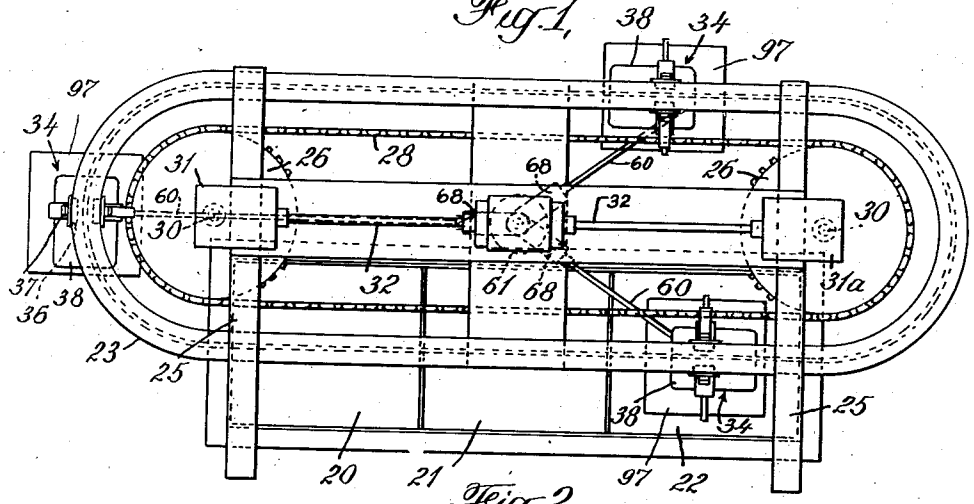
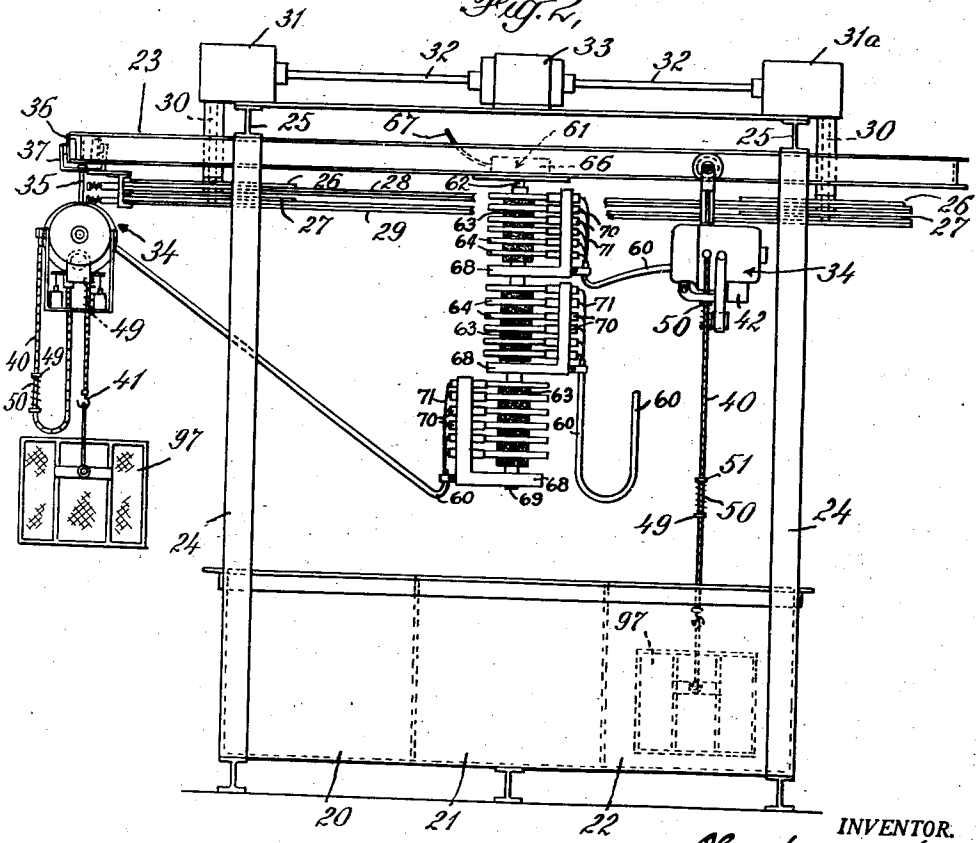


Fig. 2.



INVENTOR.
Oliver Wendell Wood
BY
Pennie Davis Marvin Edmonds
ATTORNEYS

Aug. 14, 1945. O. W. WOOD 2,382,194

CONVEYING APPARATUS

Filed Dec. 23, 1943 3 Sheets-Sheet 2

Fig. 3,

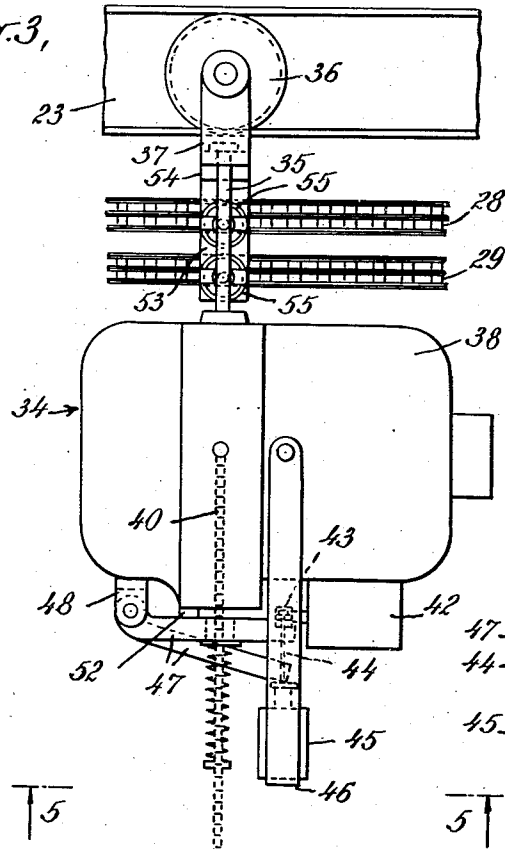


Fig. 4,

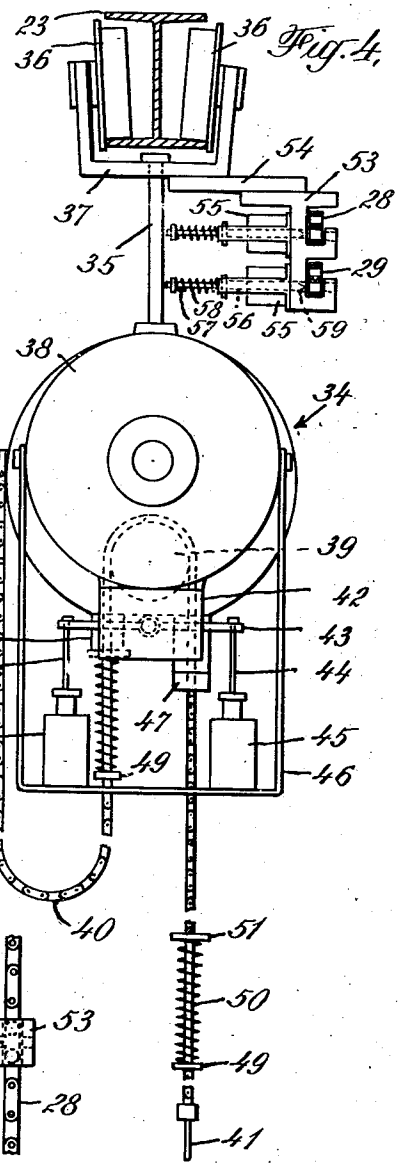


Fig. 6,

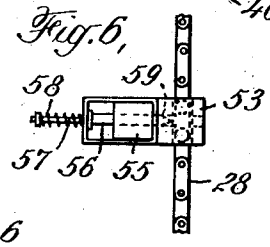
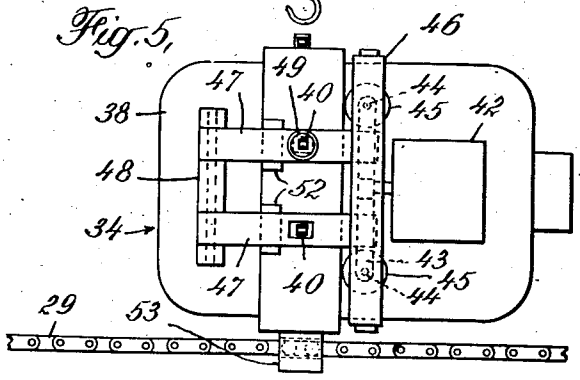


Fig. 5,



INVENTOR.
Oliver Wendell Wood
BY
Lance Davis Marvin Edwards
ATTORNEYS

Aug. 14, 1945. O. W. WOOD 2,382,194

CONVEYING APPARATUS

Filed Dec. 23, 1943 3 Sheets-Sheet 3

Fig. 7,

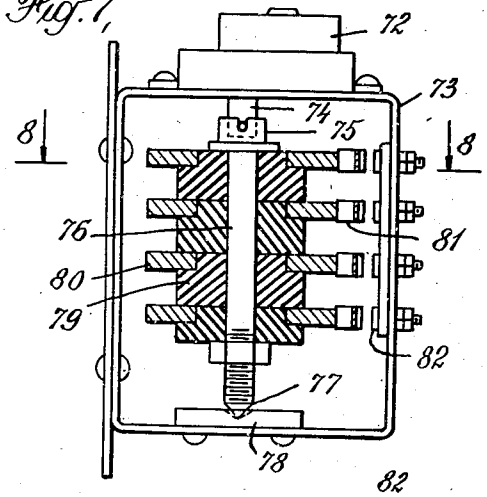


Fig. 9,

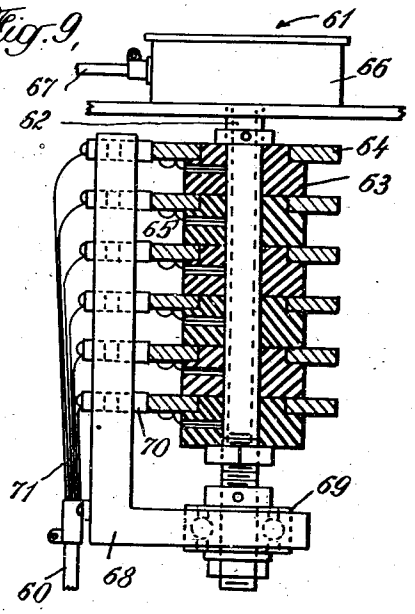


Fig. 8,

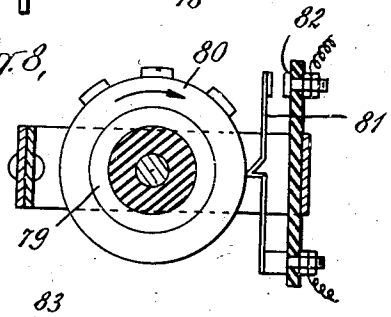
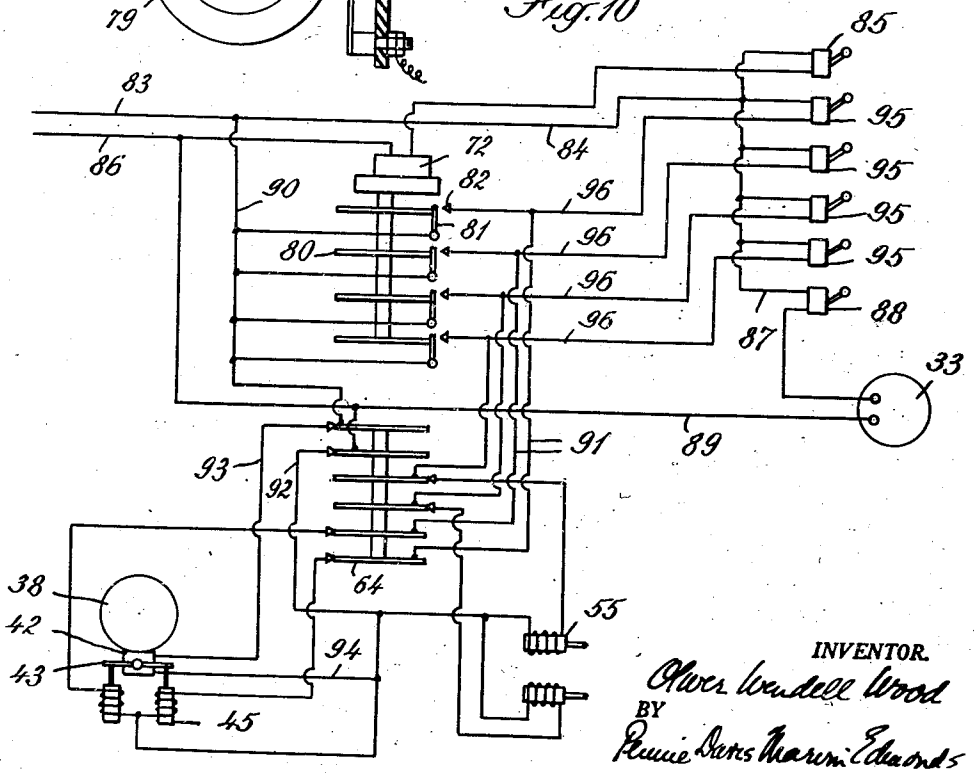


Fig. 10



INVENTOR.
Oliver Wendell Wood
BY
Ennis Davis Marvin Edwards
ATTORNEYS

Patented Aug. 14, 1945 2,382,194

UNITED STATES PATENT OFFICE

2,382,194

CONVEYING APPARATUS

Oliver Wendell Wood, Rahway, N. J., assignor to M. C. Hoy and C. I. Knecht, copartners doing business as The Plating Products Co., Newark, N. J.

Application December 23, 1943, Serial No. 515,378

15 Claims. (Cl. 212—131)

This invention relates to apparatus for handling articles which are to be subjected to a series of treatments, as, for example, by being immersed successively in a number of different baths. More particularly, the invention is concerned with a novel apparatus of the type referred to, which is largely automatic in operation and functions to convey the articles to successive stations, where the articles remain for selected periods of time, without manual intervention beyond the supplying of articles to be treated to the apparatus and the removal of treated articles therefrom. The apparatus may be employed merely for automatic conveying to a series of stations, with the articles conveyed pausing at the stations, or the apparatus may be used to effect such conveying together with the lowering and raising of the articles during the pauses, as, for example, for the purpose of causing the articles to enter treating baths. In the latter case, the apparatus may be advantageously employed in the carrying on of pickling or similar treatments preliminary to electroplating and, as in such use, the full benefits of the invention are afforded, an embodiment of the invention suitable for automatic pickling will be illustrated and described in detail for purposes of explanation.

The new apparatus in a form adapted for automatic pickling includes one or more motor driven hoists movable along a track extending over tanks containing the treating solutions. Each hoist is provided with means for attachment thereto of an article or a container for a number of articles and the hoist motor may be operated through a reversing switch to raise and lower the attached article or hold it stationary. Electrical means, such as solenoids, on each hoist control the reversing switch of that hoist. A traveling element, such as a chain, moves along the track, or, if desired, two chains may be employed, the chains moving in the same or opposite directions at the same or different speeds. Each hoist is provided with electrically operable means for connecting it to the traveling element, the connecting means being selectively operable in case two elements are employed. The motor, the switch operating means, and the connecting means are supplied with current through a distributor and a program device is provided for controlling the current to the switch operating and connecting means. With this construction, the hoist functions under control of its program device to advance an article from a supply and delivery station to a number of tanks arranged in sequence and, at each tank, the hoist stops, lowers the article into the tank for a selected time, raises the article out of the tank, and conveys the article to the next tank where the cycle is repeated. When the hoist returns to the first station, the hoist stops and lowers the treated article to a delivery floor, where the attendant removes the articles and attaches an untreated one, whereupon the hoist raises the article off the floor and proceeds to the first tank.

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

Fig. 1 is a plan view of a pickling apparatus constructed in accordance with the invention;

Fig. 2 is an elevational view, with parts removed, of the apparatus shown in Fig. 1;

Fig. 3 is an elevational view of one of the hoists employed in the apparatus;

Fig. 4 is a view similar to Fig. 3 but at right angles thereto;

Fig. 5 is a sectional view on the line 5—5 of Fig. 3;

Fig. 6 is a plan view of a part of the connecting means employed on the hoist;

Fig. 7 is a view in elevation with parts broken away of the program device;

Fig. 8 is a sectional view on the line 8—8 of Fig. 7;

Fig. 9 is a view in elevation with parts broken away of the current distributing mechanism; and

Fig. 10 is a diagram of the circuits employed in the apparatus.

The pickling apparatus illustrated in the drawings comprises a group of tanks 20, 21, and 22 arranged in a line and mounted on a suitable support. These tanks contain solutions in which the articles to be treated are immersed and the baths may be an acid bath, a water bath, and a cyanide bath or other baths, as desired.

A track 23 is mounted on a framework including standards 24 at a suitable height above the tanks and, in the construction shown, the track is made of an I-beam and it includes a straight stretch directly over the row of tanks, semicircular end sections, and a second straight stretch parallel to the first. The standards 24 at the ends of the row of tanks are connected by a cross beam 25 and within the track at each end and below the plane thereof are a pair of sprocket wheels 26, 27 around which are trained chains 28, 29. The pair of sprocket wheels at each end of the track is mounted on a shaft 30 journaled in bearings mounted on the framework in any suitable manner and one of the sprocket wheels is fast and the other is loose on the shaft. The

shafts 30 extend into gear boxes 31, 31a containing gearing connecting the shafts to a motor 33 and the sets of gears in the boxes 31 and 31a are such that the driven sprockets at opposite ends of the rack rotate in the same direction at different speeds, so that one of the chains moves more rapidly than the other.

A plurality of hoists, generally designated 34, are mounted for movement along the track and, in the construction illustrated, there are three such hoists, but any other suitable number may be employed, as desired. Each hoist is suspended by a rod 35 from a trolley, which includes a pair of rollers 36 running on top of the lower flange of beam 23 on opposite sides of the central web and the rollers have axles mounted in a U-shaped member 37 to which rod 35 is attached. Each hoist includes a motor 38 which drives a sprocket wheel 39 through suitable reduction gearing and a chain 40 is trained about the sprocket wheel and has one end secured to the motor casing. The free end of the chain is raised or lowered, depending on the direction of rotation of motor 38, and it is provided with a hook 41 by which an article or a container for articles to be treated may be attached to the chain.

The direction of rotation of the hoist motor is controlled by a reversing switch 42 attached to the motor casing and operable by a lever 43. The ends of the lever are connected to rods 44 which are, in turn, connected to cores in solenoids 45 mounted on a bracket 46 depending from the motor casing, and upon energization of one or the other of the solenoids, the lever 43 may be swung to operate the switch. To prevent overrunning of the motor, there are provided two limit arms 47 pivotally mounted on a bracket 48 on the motor housing and these arms have openings through which the slack and load stretches of chain 40 pass. The arms 47 extend beneath the lever 43 and normally hang down in the position illustrated in Fig. 3 in which they are ineffective to interfere with the swinging of the lever 43 by the solenoids. On each stretch of the chain, there is adjustably mounted a disc 49 against which bears a spring 50 encircling the chain and supporting a disc 51. When the chain is being taken up or let out by rotation of the sprocket wheel 39, overrunning is prevented by the lifting of one of the limit arms 47 by disc 51 on the rising stretch of the chain. As the arm moves up, it engages lever 43 and restores it to the horizontal position in which the switch is in neutral and the current supply of the rotor is cut off. Stops 52 on the motor casing engageable by the limit arms prevent those arms from rising to move lever 43 past neutral position and the springs 50 on which discs 51 are supported prevent injury to the parts, in the event that the chain continues to move after the effective limit arm has engaged its stop.

The hoist may be connected to one or the other of chains 28, 29 by a locking device which comprises a chain guide member 53 which may be mounted on an arm 54 attached to the member 37 of the trolley. The chain guide has upper and lower openings through which the chains 28, 29 pass and aligned with each opening is a solenoid 55 having a core 56, which is attached at one end to a rod 57 lying outside the solenoid. A spring 58 encircling the rod acts to hold the rod and core in retracted position. Each of the chains is of the duplex type and the core of each solenoid lies in alignment with one row of links of its chain. The core is provided with a pointed end 59 which, upon energization of the solenoid, enters a link in in its chain and thus connects the chain to the locking device so that the chain advances the hoist along the track.

Current is supplied for the operation of each hoist through a cable 60 which leads from the hoist to a current distributing device, generally designated 61. This distributor is mounted centrally of the track on a suitable cross member of the framework and it includes a fixed vertical hollow shaft 62 on which are mounted insulating spacing discs 63. A conducting ring 64 is seated in a channel in each disc and each ring is connected to a conductor 65 which extends upward through the hollow shaft 62 and enters a junction box 66 where the conductor is connected to a conductor in a cable 67.

The horizontal leg of an L-shaped arm 68 is mounted on a ball bearing 69 at the lower end of the shaft 62 and the vertical leg of arm 68 carries a number of spring pressed contacts 70 engaging the respective rings 64. The contacts are connected to conductors 71 within a cable 60 and, as the hoist to which cable 60 leads, moves around the track, the pull of the cable causes arm 68 to swing around shaft 62 as an axis. During this movement of arm 68, the contact members 70 continuously make contact with rings 64 so that the supply of current to the hoist may be maintained at all times. In the apparatus illustrated, the distributor includes slip rings and contacts for only one hoist, but if additional hoists are employed, the distributor will include a set of slip rings and their contacts and an arm 68 for each hoist and these parts may be mounted one above the other on the same shaft 62.

Current is supplied to the slip rings of the distributor for each hoist by a program device which may be mounted at any suitable point relative to the track. Each such program device includes a synchronous clock motor 72 mounted on a frame 73 and driving a shaft 74 extending into the interior of the frame. Shaft 74 is connected through a quick detachable slot and pin driving connection 75 to shaft 76 terminating in a hardened point 77 seated in a socket bearing member 78 attached to frame 73. A plurality of discs 79 of insulating material are mounted on shaft 76 and each disc is provided with a channel containing a metal control disc 80. Each of the control discs, although shown as circular in form, is in reality provided with various high and low peripheral portions, which engage a spring contact member 81 mounted on frame 73. Contact member 81 cooperates with a fixed contact 82 on the frame and is movable into engagement therewith by a high spot on its control disc. There are four control discs on each shaft 76 and the two upper discs control the flow of current, respectively, to solenoids 45 which actuate the reversing switch 42 of the hoist motor, while the two lower control discs of the program device, respectively, control the current to solenoids 55, which operate the means for connecting the hoist to the chains. The arrangement of the high and low spots on the peripheral portion of each disc depends on the cycle of operations of the hoist and, when a change in the cycle is to be made, the shaft 76 with its control discs is removed from frame 73 and a new set with control discs of appropriate shape is substituted. The use of the quick detachable driving connection 75 facilitates the substitution of one shaft 76 for another.

As illustrated in the circuit diagram, current for the operation of the apparatus is supplied from a

source through a line 83 which is connected to a branch circuit 84 leading to motor 72 of the program device and including a switch 85 at a central control station. The motor 72 is connected to a common return 86. Line 83 supplies another branch circuit 87 which leads to motor 33 for driving the chains and this circuit includes a switch 88 at the control station, by means of which motor 33 may be started and stopped. The motor is connected through line 89 to the common return 86.

Line 83 is connected through a branch 90 to each of the movable contacts 81 of the program device and the fixed contacts of the device are connected by lines 91 to four different slip rings 64 in the distributor. These slip rings are connected to the respective solenoids 45 and 55 and the solenoids are connected to a common return line 92 connected to another of the slip rings of the distributing device, this ring being in turn connected to the common return 86. Branch 90 also supplies a slip ring of the distributor device which is connected by a line 93 to one of the terminals of the reversing switch 42, the other terminal being connected by a line 94 to the common return 92 from the solenoids.

With this arrangement, upon the closing of switches 85 and 88, the program device begins to function and the chains begin to move along the track. As the control discs of the program device rotate, they close their contacts in the selected order, with the result that the hoist motor is caused to raise or lower the article attached to its chain as determined by the condition of the reversing switch. Also, the hoist is connected to one or the other of the chains and disconnected therefrom by solenoids 55 at times determined by the program device. While the apparatus may function wholly automatically, an occasion sometimes arises when the attendant may wish to operate the hoist motor to raise or lower the object or to connect the hoist to one or the other of the chains to move the hoist along the track in a manner different from that determined by the program device. For this purpose, four switches 95 are provided at the control station and these switches are connected in circuits 96 in parallel with the circuits supplied by branch 90 and including the movable terminals 81, 82. Accordingly, although the terminals 81, 82 controlling the flow to a particular solenoid 45, 55 may be open, the attendant may supply current to that solenoid by actuation of the proper switch 95 and cause the solenoid to be energized. The switches 95 are preferably held open by spring action, so that they cannot be accidentally left closed.

The apparatus illustrated may be used in the pickling of single articles of considerable size, which are attached directly to the hooks 41 of the hoists or it may be used in the treatment of a large quantity of small articles carried in baskets 97 suspended from the hoists. In each instance, the program device is so set up that, at a particular point along the track which serves as a supply and delivery station, each hoist is brought to rest by disconnection of the hoist from the traveling chains 28, 29 by deenergization of its solenoids 55. While the hoist is at rest, its motor may be actuated through the reversing switch to lower the basket, for example, to a receiving floor and the attendant then disconnects the basket and hooks on a new one. The period of rest provided by the program device is sufficiently long to enable the attendant to perform these operations and, when the new basket has been attached, the hoist motor is operated to raise the basket free of the floor. At about the same time, the hoist is connected to the slow chain by energization of one of its solenoids 55 and the hoist is advanced until it arrives over the first of the treating tanks. At that point, the hoist is disconnected from the traveling chain so as to come to rest and the appropriate reversing switch solenoid is energized to cause the hoist motor to lower the basket into the tank and then come to rest. The basket remains in the tank for a period of time determined by the program device and, after that interval, the hoist motor is supplied with current to cause it to raise the basket out of the tank. At about the same time, the hoist is connected to the slow chain and advanced over the second tank where the cycle of operations is repeated. After immersion of the basket and its contents in the second tank, the hoist again raises the basket and carries it to the third tank for immersion therein. When the basket is raised from the third tank, the hoist is connected to the fast chain and it advances rapidly to the supply and delivery station, where the basket is removed and a new one hooked on.

In the apparatus shown, there are three hoists, but more or less hoists may be provided, as desired. These hoists are individually supplied with current and controlled and they all function through the same cycle of operations, the program devices for the individual hoists being so coordinated and synchronized that the hoists will function without interference with one another. The timing is such that the attendant can keep the hoists in use without extended periods of idle time and in the use of the apparatus, the attendant is not required to exercise any control over the individual hoists. If necessary, however, he can stop the program device of any hoist by opening its switch 85, whereupon the hoist remains at rest until its program device is started again.

I claim:

1. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, means for supplying current to the motor throughout the movement of the hoist along the track, a reversing switch on the hoist for controlling the supply of current to the motor to cause it to operate for raising and lowering, electrical means on the hoist for operating the switch, a traveling element movable along the track, means on the hoist for connecting the hoist to the element to be moved along the track thereby, and program means for controlling the switch operating and the connecting means.

2. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, means for supplying current to the motor throughout the movement of the hoist along the track, a reversing switch on the hoist for controlling the supply of current to the motor to cause it to operate for raising and lowering, electrical means on the hoist for operating the switch, separate means for moving the hoist along the track at different speeds, and program means for controlling the operation of the hoist moving and switch operating means.

3. An apparatus for handling articles to be

treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, means for supplying current to the motor throughout the movement of the hoist along the track, a reversing switch on the hoist for controlling the supply of current to the motor to cause it to operate for raising and lowering, electrical means on the hoist for operating the switch, a traveling element movable along the track, electrically operated means on the hoist for connecting the hoist to the element to be moved along the track thereby, and program means for controlling the operation of the connecting and switch operating means.

4. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, means for supplying current to the motor throughout the movement of the hoist along the track, a reversing switch on the hoist for controlling the supply of current to the motor to cause it to operate for raising and lowering, electrical means on the hoist for operating the switch, a pair of traveling elements movable along the track with different motions, electrical means for connecting the hoist to the traveling elements selectively for movement along the track therewith, and program means for controlling the operation of the connecting means and the switch operating means.

5. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, a rotary current distributing device disposed adjacent the track and provided with a plurality of distributing elements, connections between the motor terminals and a pair of the distributing elements, a reversing switch in the connections for controlling the supply of current to the motor to cause it to raise and lower the attachment means and article, electrical means for actuating the switch, said means being connected to another pair of distributing elements, a supply of current, and program means for connecting the distributing elements to the current supply in a desired sequence.

6. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to raise and lower the attachment means and article, a rotary current distributing device disposed adjacent the track, connections between the motor terminals and the distributing device, a reversing switch in the connections, electrical means for actuating the switch, said means being connected to the distributing device, a current supply connected to the distributing device, and program means for controlling the supply of current through the distributing device to the switch actuating means.

7. An apparatus for handling articles to be treated which comprises an endless track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to cause the hoist to raise and lower the attachment means and article, a current distributing device disposed centrally of the track, connections between the motor terminals and the distributing device, a reversing switch in the connections, electrical means for actuating the switch, said means being connected to the distributing device, a current supply connected to the distributing device, and program means for controlling the supply of current through the distributing device to the switch actuating means.

8. An apparatus for handling articles to be treated which comprises a track, a motor driven hoist movable along the track and provided with means for attachment to an article, the motor being operable to raise and lower the attachment means and article, a current distributing device disposed adjacent the track, connections between the motor terminals and the distributing device, a reversing switch in the connections, electrical means for actuating the switch, said means being connected to the distributing device, a pair of traveling elements moving along the track with different motions, electrical means for connecting the hoist selectively to the individual elements to travel therewith, connections between the distributing device and connecting means, a current supply connected to the distributing device, and program means for controlling the flow of current through the device to the switch actuating and connecting means.

9. An apparatus for handling articles to be treated which comprises a track, a motor driven hoist movable along the track and provided with means for attachment to an article, the motor being operable to raise and lower the attachment means and article, a current distributing device disposed adjacent the track, connections between the motor terminals and the distributing device, a reversing switch in the connections, electrical means for actuating the switch, said means being connected to the distributing device, a traveling element moving along the track, electrical means for connecting the hoist to the traveling element to travel therewith, connections between said connecting means and distributing device, a current supply connected to the distributing device, and program means for controlling the supply of current through the distributing device to the switch actuating means.

10. An apparatus for handling articles to be treated which comprises an endless track, a motor driven hoist movable along the track and provided with means for attachment to an article, the motor being operable to cause the hoist to raise and lower the attachment means and article, a current distributing device disposed centrally of the track and provided with slip rings and contacts movable around the rings, connections between respective contacts and the motor terminals, a reversing switch in the connections, electrical means for actuating the switch, connections between the electrical means and other contacts, a current supply connected to the slip rings, and a program device for controlling the flow of current from the supply to the slip rings.

11. An apparatus for handling articles to be treated which comprises an endless track, a motor driven hoist movable along the track and provided with means for attachment to an article, the motor being operable to cause the hoist to raise and lower the attachment means and article, a current distributing device disposed centrally of the track and provided with slip rings and contacts movable around the rings, connections between respective contacts and the motor terminals, a reversing switch in the connections, electrical means for actuating the switch, connections between the electrical means and other

contacts, a traveling element moving along the track, electrical means on the hoist for connecting it to the element to move therewith, connections between said means and other contacts, a current supply connected to the slip rings, and a program device for controlling the flow of current to the slip rings to cause the switch actuating and electrical connecting means to operate in a selected sequence.

12. In apparatus for handling articles, the combination of a track, a hoist movable along the track and comprising a motor driving a sprocket wheel, a chain trained about the sprocket wheel, means on the chain for attachment to an article, a reversing switch for controlling current flow to the motor to cause it to raise or lower the chain and the article carried thereby, and a pair of solenoids for operating the switch, a traveling element moving along the track, and electrically operated means on the hoist for connecting it to the traveling element to travel therewith along the track.

13. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to cause it to raise and lower the article, an element traveling along the track, means on the hoist for connecting it to the element to travel therewith, and remotely controllable means for controlling the operation of the motor and of the connecting means.

14. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to cause it to raise and lower the article, electrically operated means on the hoist for controlling the action of the motor, an element traveling along the track, electrically operated means on the hoist for connecting it to the element to travel therewith, and means remote from the hoist for controlling the operation of the motor control means and the connecting means.

15. An apparatus for handling articles to be treated which comprises a track, a hoist movable along the track and provided with means for attachment to an article, a motor on the hoist operable to drive the hoist to raise or lower the article attached thereto, a rotary current distributing device remote from the hoist for supplying current to the motor, connections between the device and the motor, electrical means on the hoist receiving current from the distributing device and operable to control the supply of current to the motor, and program means remote from the hoist and controlling the supply of current to the distributing device.

OLIVER WENDELL WOOD.