May 19, 1959 L. E. LANCY 2,887,447

ELECTROTREATING APPARATUS AND PROCESS

Filed Oct. 18, 1956 3 Sheets-Sheet 1

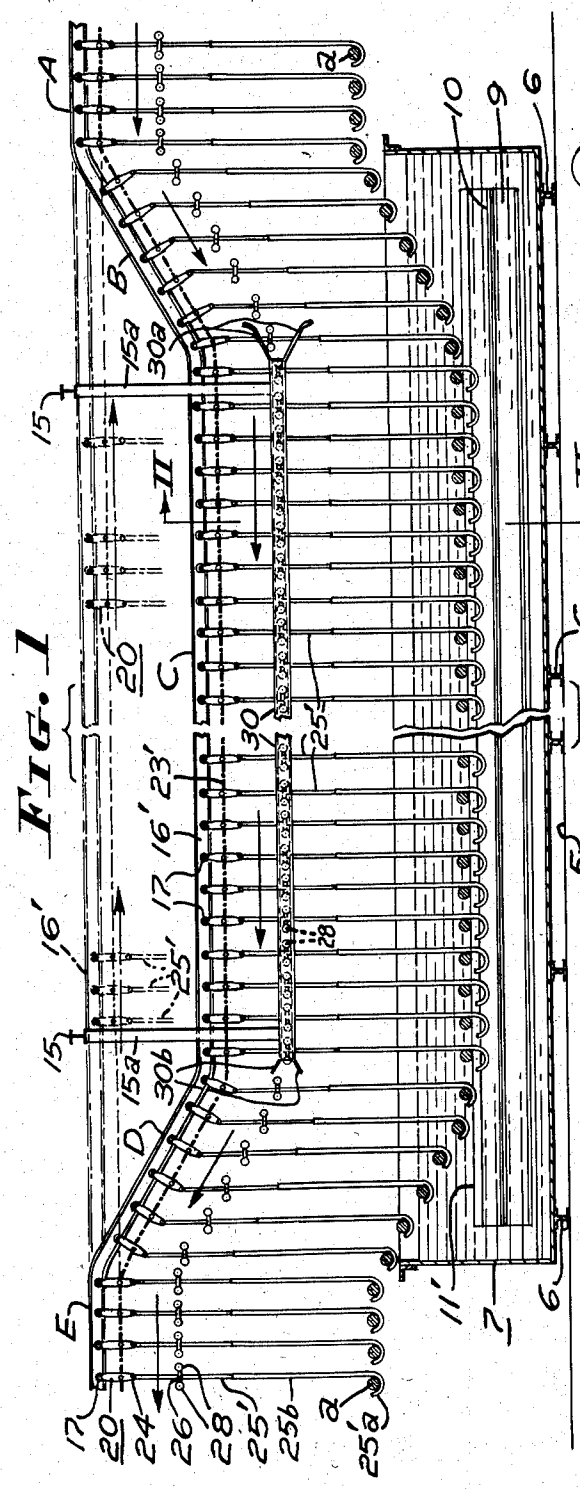


FIG. 1

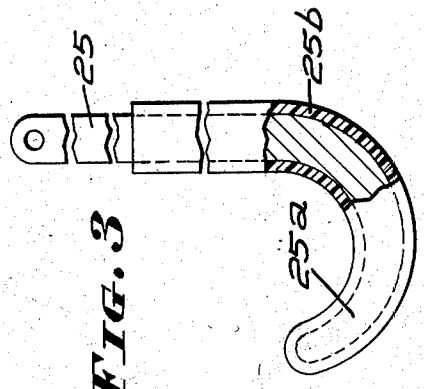


FIG. 3

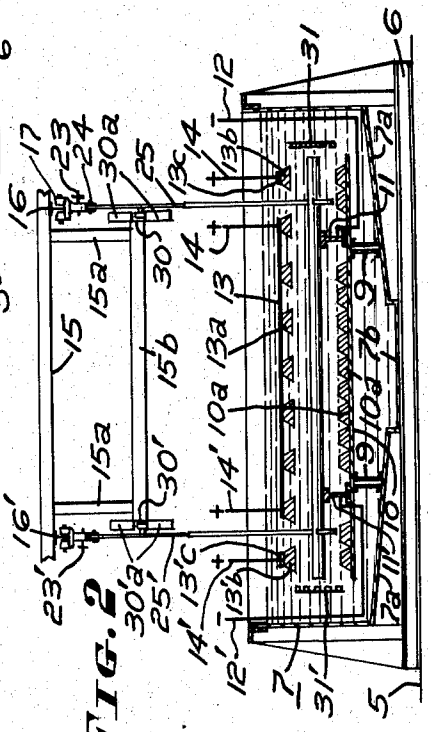


FIG. 2

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FIG. 4

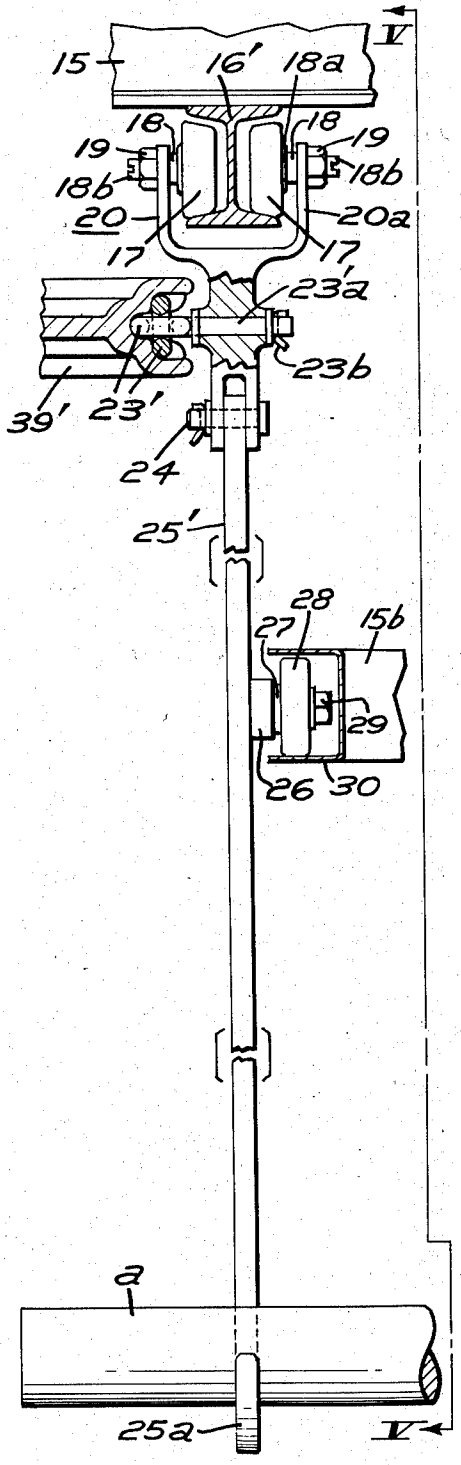
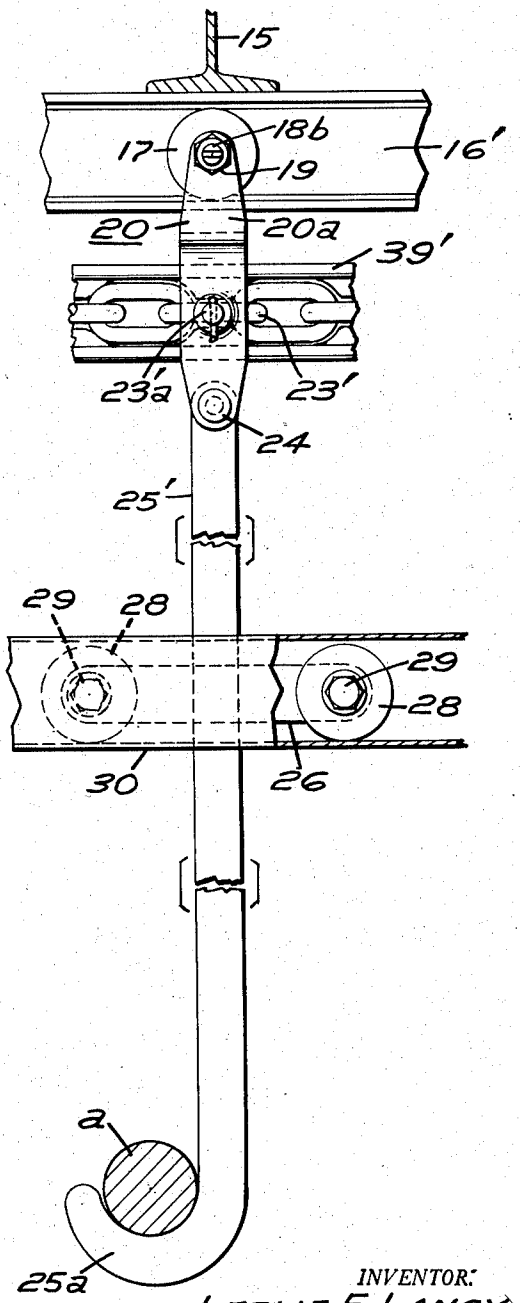


FIG. 5



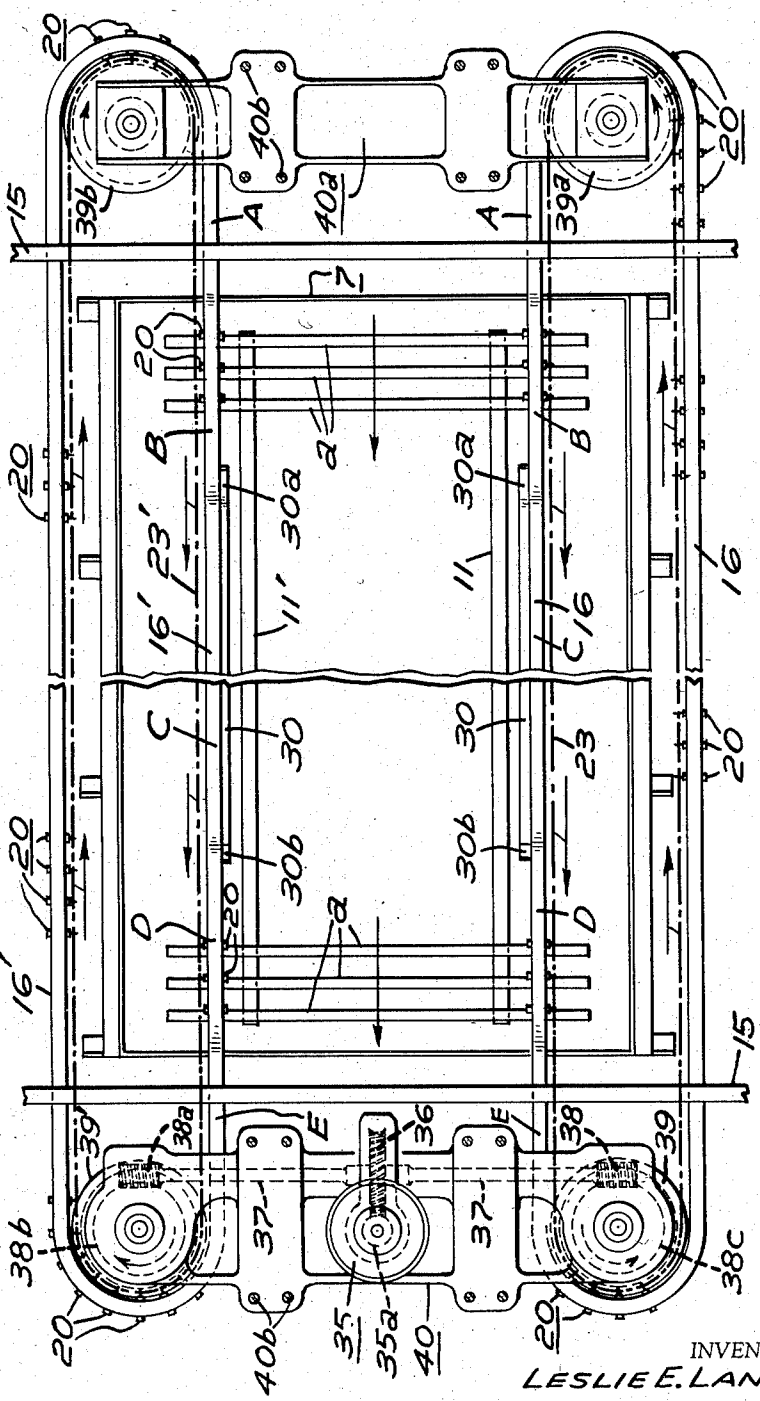
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ELECTROTREATING APPARATUS AND PROCESS

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FIG. 6



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United States Patent Office 2,887,447 Patented May 19, 1959

2,887,447

ELECTROTREATING APPARATUS AND PROCESS

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Application October 18, 1956, Serial No. 616,873

10 Claims. (Cl. 204—198)

This invention pertains to the field of electrolytic processing of articles or work pieces, such as tubes, rods, and similar shapes. It is particularly applicable to the treatment of articles or work pieces that may have a considerable length and that may be pushed or rolled along a support or guide means.

The invention deals with improved apparatus for providing better accuracy and quality of electrolytic treatment and particularly, of electrolytic plating of shapes, such as tube pipe or rod members. It deals particularly with the need for a more positive and effective type of control of and power transmission for the advancement of work articles within the treating bath or during the treating operation, as contrasted to conveying movement into and out of the treating bath or in a path or cycle outside of the bath.

I have found that a problem of poor or insufficient control of the electrolytic operation is presented where work articles or pieces to be treated are guided to and delivered on a rail support or guide, and then pushed on the support along the length of the treating tank. It should be noted that work articles may be moved along a declining plane into a treatment level of the bath, moved along the treatment level of the bath by periodic pushes against them, and then raised out of the treatment level on a rising or inclining plane. In such an installation, the strength of the conveyor or chain has to be increased considerably above that necessary for straight conveyance. Also, the chain has to be continually tightened to take up stretch and to avoid loose action of the pushers during the conveyor travel.

I found that a considerable amount of energy has to be exerted by the pushers to hold back and push forward work articles at inclined entry and exist ends of a treating or plating level of a tank or treating bath. In addition, I have found that there is considerable amount of wear and tear, since the weight of the articles to be treated acts through a lever force multiplication on the conveyor device or chain from which pushers are fastened or suspended. Since articles are carried at the extreme lower end of the pusher or set of pushers, the lever action is so great when the articles are pushed along that considerable twist on the chain or conveyor lengths is caused, particularly during movement of the hangers into, along, and out of a suitable treating level of the tank or container.

Although hangers may be so hung or swung as to provide an equal spacing along the conveyor or chain, and although work articles may be suspended in a relatively fixed position within lower hook ends of hangers suspended from the conveyor or chain, the advantage of these features are lost when the articles are introduced into the bath to rest on a guide or support rail system and are moved therealong while being treated, cleaned or plated. As a result, work articles may, as swing-pushed, accelerate, decelerate, and momentarily stop during their movement or roll on a guide rail

structure. The hangers tend to pivot about their upper ends on the conveyor when resistance is encountered.

Summarized briefly, it has been my experience that present day practices in an installation of the type above described, in addition to increasing structural requirements and thus cost and maintenance, also have an adverse effect on the efficiency or practicability of the treating or plating operation. Particularly in a plating operation, it will be appreciated by those skilled in the art that a uniform application of coating, as between articles, and along the extent of each article, and at a constant rate is important. Masking and shading are to be avoided, and a maximum efficiency of electrical conductivity is desirable. Thus, I set out to solve the problem presented and have been able to do so by employing a new and improved structure or procedure to produce a better treated article or product and at less expense.

An object of my invention has thus been to solve the problem presented and in a practical manner;

Another object of my invention has been to provide a steady type of movement of work articles such as that the articles of a series or group are maintained in substantially the same spaced relationship during their treatment and are moved with a maximum of efficiency and with a minimum of power;

A further object of my invention has been to devise a pusher type of electrolytic treatment construction for work articles or shapes which maintains the articles in a relatively one-timed or steady-positioned relationship with respect to an energy supply conductor or bus bar on which they are moved along the treating bath;

A still further object has been to develop an improved system or apparatus for handling and advancing work articles or shapes through a treatment bath;

These and other objects of my invention will appear to those skilled in the art from the illustrated embodiments thereof.

In the drawings,

Figure 1 is a longitudinal or side sectional view in elevation along a treating line or system and its bath and conveyor means to illustrate an important phase of my invention;

Figure 2 is a transverse or end view in elevation on the same scale as Figure 1 and taken along the line II—II of Figure 1;

Figure 3 is a greatly enlarged fragmental view in elevation illustrating the construction of hanger means employed in the system or apparatus of Figures 1 and 2;

Figure 4 is an end or transverse view in elevation on the enlarged scale of Figure 3, taken at right angles to Figure 1, and showing details of the construction and mounting of hanger members employed in the apparatus of Figures 1 and 2;

Figure 5 is a view similar to Figure 4, but taken along the line V—V at right angles thereto, parallel to Figure 1, and on the same scale as Figure 4;

Figure 6 is a top plan view on a greatly reduced scale illustrating apparatus of my invention, as employed in a complete system or continuous conveying construction, for moving articles to be treated (plated or cleaned) in synchronism, and in a positive and steady timed relationship, into, along, and out of a treatment bath or tank.

In carrying out my invention, I employ a guide, support or conductor rail structure **11** and **11'** along a lower or bottom level of a treating bath or tank **7** to supply current to work articles *a* and to support them as they are moved along and actively treated within the bath. The articles *a* are, as shown particularly in Figure 2, definitely controlled as to their rate, timing and spac-

ing of movement through the bath, and as to their transverse and longitudinal alignment during such movement. In addition, work articles or shapes are moved between upper and lower electrode stages or levels in a constantly-maintained uniformity of spaced relationship therebetween.

The tank or bath 7 (see Figure 2), is along its length, provided with a centrally-disposed, longitudinally-extending, and downwardly-offset collector chute 7*a* that at its central area provides a deep, central channel portion 7*b* of maximum depth within the tank. The channel portion 7*b* minimizes adverse effects caused by used-up materials, sludge, etc., or in general, by dropped electrode material, so that they do not interfere with an effective and efficient electrolytic action upon above-positioned and moving work articles or shapes.

For normal movement, the shapes *a* are hung or supported from or within a hook or crook of a lower end portion 25*a* of hanger means that preferably consists of at least a pair of transversely spaced-apart hanger members or arms 25 and 25'. The hanger means is suspended near its upper end from an overhead conveyor means or chain 23 for continuous, spaced movement therewith. The hook or article-retaining portion 25*a* carries work articles with a minimum of energy requirements about the conveying system and until or just before the articles are to be treated. As shown in Figure 1, an article *a* is released from its retained position within the hook portions 25*a* by lowering the hangers 25 and 25' downwardly after the article has been moved to position over or above rails 11 and 11'. At this time, the article is no longer positively positioned or held in position with respect to the hangers 25 and 25' which now become pushers.

By changing the type of support for the hangers 25 and 25' during their movement along the treatment tank 7, I have found that stress and strain on the conveyor or chain system is minimized. Actually during this period, less energy or power is consumed than if a swing type support was continued throughout the bath. In carrying out this idea, I add a spaced type of guide-support for the hangers during their period of movement within the bath and particularly, during the period after they have been lowered to an article-releasing position and before they have been raised to an article-withdrawing position. I have been able to provide an effective, positive-retaining, power-requirement-minimizing, and swing-preventing type of support whose frictional losses are minimized and are well below requirements. Actually, in spite of the use of additional points of support, the power requirements are well within normal factors of safety for a driving conveyor or chain that has no dipping, pushing and raising functions. In addition, wear and tear on the chain or conveyor is minimized at its point of connection to the hanger means.

Swing or pivot action is prevented during the article-pushing or treating portion of the cycle of operation. Periodic free-rolling of the article, bumping of the article back and forth between hangers, and advancement of the article out of contact or ahead of its appropriate hanger means is prevented. This gives a maximum efficiency of conduction of electric current during the critical phase of the conveying operation, minimizes damage to the article and to its coating which is being applied, eliminates excessive wear and tear on the hangers and through them on the conveyor means. It actually retains the work article without requiring its confinement within a finger hook portion of the hanger means. I thus eliminate the masking effect of an other than a minimum point contact by avoiding the use of turned-around supporting hooks or fingers, and while avoiding lack of control of article movement, increased power requirements, etc.

Referring particularly to Figures 1, 2 and 6, I have shown a system or apparatus that is adapted to operate in a continuous cycle and that employs the electrolytic

treating bath, tank or container 7. This container which may be of metal construction, is shown mounted on longitudinally-extending I-beam supports 6 and a suitable foundation 5. As disclosed particularly in Figures 1 and 2, I also employ conveyor means having transversely spaced-apart, longitudinally-extending side rails or conveyor members 16 and 16' of the same general I-beam construction. The conveyor rail members 16 and 16' (constituting a pair) are shown carried on and electrically connected to a lower electrode shelf, platform support or plate member construction 10.

Referring particularly to Figures 1 and 2, the container 7 has centrally, transversely-downwardly or inwardly-declining, bottom or side chute portions 7*a* which cooperate to define a common, longitudinally-extending, central, collector channel or bottom portion 7*b*. Thus, portions 7*a* provide a guide chute and portion 7*b* provides a collector chute for spent, broken-off or used material to prevent it from interfering with or decreasing the efficiency of operation of electrodes.

A bottom electrode level, plane or layer 10*a* is carried on the lower shelf, platform or conductor plate member construction 10. As shown particularly in Figure 2, the shelf 10 is supported in a spaced relationship above the bottom portions 7*a* by non-conductive or dielectric support and spacer columns or members 9 that are mounted or secured in position therebetween. The columns 9 have a longitudinally and transversely spaced relationship with each other along the length of the tank 7.

A second, upper level, plane or layer of electrodes 13*a* is carried in an upwardly-spaced relationship with respect to the lower electrodes 10*a* by an upper shelf, platform or conductor plate member construction 13. Outer side electrodes 13*b* and 13'*b* are carried by side strips 13*c* and 13'*c*, so that there is no interference with the movement of hanger means 25—25'. At the same time, side strip or alignment members 31 and 31' serve as end limit or guide means for work articles *a* that are being moved and treated along the rails 11 and 11'. That is, to further increase the efficiency of the electrotreating or plating operation, I have provided the pair of transversely spaced-apart and longitudinally-extending side guide rails, strips or assemblies 31 and 31'. This guide pair has a transverse spacing that is slightly greater than the length of the work articles *a* that are being processed. The side guide rails 31 and 31' provide a substantially enclosed treating area with the upper and lower levels of electrode assemblies 13*a* and 10*a*, such that a high efficiency of electrolytic action is effected along the full extent of the articles as well as at their ends. The side guide members or rails 31 and 31' may be secured directly to end walls of the tank 7 to extend along its full length between its opposite end walls.

Negative electric current may be supplied by a suitable direct current generator through leads 12 and 12' (see Figure 2), to the rails 11 and 11' and thus, to articles *a* that are being moved along the upper rim or flange portions of the rails. As seen particularly in Figures 1 and 2, the rails 11 and 11' are shown mounted on a substantially horizontal plane to project upwardly in a transversely-spaced relationship with each other. The rails provide a common guide means for rolling movement of work articles *a* therealong during the treating operation. Current of like potential may be supplied to the upper level consisting of conductor plate 13 and electrodes 13*a*, 13*b* and 13'*b* and to the lower level consisting of conductor plate 10 and electrodes 10*a*, by positive connections 14 and 14'. It will be noted that the rails 11 and 11' are insulated from the plate or table 10 by non-conductive or dielectric base portions (see Figure 2).

Referring to Figures 4 and 5, I have shown hanger means comprising a pair of transversely-spaced-apart and longitudinally-aligned, upright or vertical hanger or depending arm members 25 and 25'. I have employed prime suffixes to indicate parts on the opposite side of

the structure which correspond in construction, mounting and operation to parts having the same numerals on the other side thereof. Overhead rails **16** and **16'** (see Figures 2 and 6) are of the same length and have the same number of depending arms **25** and **25'**, respectively, since one guides its arms counterclockwise in a loop and the other guides its arms clockwise in a loop outwardly from the bath **7** (looking downwardly on the assembly).

As shown in Figures 2, 4 and 5, each hanger member **25** (or **25'**) is carried in a suspended relationship by a roller mounting from overhead track, guide or rail member **16** (or **16'**). It will be noted that each member **16** and **16'** is welded or riveted to structural cross members **15**. A U-shaped mounting, hanger bracket or yoke **20** is swingably secured at its lower bifurcated end or leg portion by bolt and pin assembly **24** to the hanger or swing arm **25**. The arm **25**, as shown, has an upwardly-turned or hook-shaped foot or lower end finger portion **25***a* to receive and retain the article *a* during movement of the article (see positions A and E) outside of the tank **7**, downwardly into (see B) and upwardly out of the tank (see D) or, in other words, to, into, out of, and from an article-treating position within the tank. Each work piece *a* may be lowered into a receiving position within a pair of finger portions **25***a* ahead of A and the finished or treated work piece *a* may be lifted out or removed from the finger portions beyond E.

As shown in Figure 4, the mounting bracket **20** may be enlarged and bifurcated at its upper end part to provide two opposed arm portions which, at their upper and spread-apart end portions, carry pin shaft **18**. Each pin shaft **18** is adjustably and rotatably secured in position by means of a nut **19** that is threaded on its outer end portion **18***b*. It will also be noted that the outer end portion **18***b* has a screw head to facilitate adjustment between it and the nut **19**. At its inner end **18***a*, the pin shaft **18** rotatably carries or mounts a tapered rider roller **17**. In this manner, a pair of opposed rollers **17** are provided (see Figures 4 and 5) which rotate on pins **18** and which are adapted to fit in the spacing between upper and lower flanges of the guide rail member **16** (or **16'**) and to ride along the sloped surfaces of the bottom flange on opposite sides of the web of the member of I-beam shape.

Each hanger **25** (or **25'**) is driven by an integral or one-piece, somewhat ♀-shaped (see Figures 4 and 5) special link part **23***a* (or **23'***a*) of a hoist type of chain **23** that permits movement in any direction. The link **23***a* has a projecting pin portion that is mounted with a slip fit to project through a central body portion of yoke **20**. The pin portion is retained in position by opposed spacer washers and a cotter pin **23***b* (see Figure 4).

As shown particularly in Figures 4, 5 and 6, chain or conveyor means **23** and **23'** are each of continuous construction, the former being driven or actuated counterclockwise and the latter being driven or actuated clockwise. I have provided housings or frames **40** and **40***a* at opposite ends of the construction that may be mounted or secured on suitable frame or overhead beams by bolts **40**b. One end (the left of Figure 6) housing **40** carries an electric drive motor **35**. Worm **35***a* is fixed to the shaft of motor **35** to drive worm gear **36**, cross shaft **37**, end worms **38** and **38***a*, worm gears **38***b* and **38***c*, and driving wheels **39** and **39'**. Each wheel **39** and **39'** has pockets to receive or grip its respective chain **23** and **23'** and are termed "rag" wheels. The other end housing **40** carries a pair of idler wheels **39***a* and **39***b* that may be of the same rag type of **39** and **39'** or of a plain grooved type. It will be noted that the drive wheels **39** and **39'** grip the chains **23** and **23'** through about one half their circumferences instead of providing an engagement of only one or two links at a time.

To maintain the hanger **25** with a positively-supported, straight-arm or non-pivoting, moving-carrier suspension, support or substantially rigid length during a portion of its movement, I have shown a secondary, lower roller guide and rider assembly that is mounted in a spaced relationship below the mounting provided by the rollers **17**. The lower roller assembly employs a horizontal, longitudinally-extending, guide or channel member **30** which is secured to an overhead support structure depending from the members **15**. A lateral support arm or cross piece **26** is secured, as by welding, to project outwardly and sidewise of the hanger **25** (or **25'**). Spaced-apart guide and position support rollers **28** are rotatably mounted adjacent opposite ends of the lateral support arm **26** on pin shafts **27** by bolt and washer assemblies **29**. As shown, the rollers **28** are adapted to roll along the inside of upper and lower flanges of the channel member **30** while the articles *a* rest upon and are being carried or positively pushed along the conductor rails **19** and **19'**.

As shown particularly in Figure 1 of the drawings, the work articles *a* are advanced along a normal higher level (see A and E) of the conveyor when they are being moved to and from the treatment bath **7**. The articles *a* are lowered into (see B) and raised out of (see D) the bath or a treating position or level (see C); it will be noted that the hanger arms **25** (and **25'**) are free to swing during these periods to maintain a vertically-aligned positioning while they are being moved along inclined portions of the track or rail members **16** (and **16'**). When the hanger means, as shown in Figure 1, has almost reached the end of its downward travel of step B, it enters between outwardly-spread-apart or Y-shaped guide flange portions **30***a* of the channel **30** and in step C, proceeds along such portions into full, non-tilting, guided alignment with the channel member **30**, see also Figures 4 and 5.

During step C, the hanger means **25** and **25'** is, in effect, positively held against any pivot or swing action at its roller suspension **17**, twist at its connection to drive or conveyor chain **23** or swing as to the work pieces *a*, by spaced-apart upper and lower guide rollers **17** and **28** and by the dual supporting nature of the lower guide rollers **28**. In other words, each arm **25** (or **25'**) acts as a fully integral member and also what amounts to a three-way, position-retaining, movement-guide action is attained. As a result and, as shown in Figure 1, the articles *a* retain a line-abutting position against the hanger arms **25** and **25'** and do not get ahead of, roll ahead of, or tend to lag behind such arms during the continuous movement of a series progression of work articles into, through and out of the bath **7**.

At its opposite end, the guide channel **30** has spread-apart flange portions **30***b* which facilitate the exit of the two-way suspension support provided by the lateral support arm or cross piece **26** and its assembly or pair of rollers **28**.

The hanger arms **25** and **25'** may be made of a dielectric or insulating material, such as a plastic or a laminated glass fiber construction of suitable strength. However, if as shown in Figure 3, it is desirable to employ metal hanger members **25** and **25'**, then I contemplate providing them with an insulating, dielectric, protective, closure sleeve **25***b*.

Figure 1 discloses that each work piece *a* is positively held within the hook finger or end portions **25***a* of the hangers **25** and **25'** until these hangers have moved into a position such that their lower ends project into the bath below the rails **11** and **11'**. When the ends of the hangers are further lowered, then the work pieces rest upon or become fully supported on the pair of rails **11** and **11'**. The rails **11** and **11'** thus constitute cathode bars or a contact table along which the work articles are moved and between end-positioned, sidewise-extending, side guide strips **31** and **31'**.

An important factor in reaching a solution to the prob-

lem rested in the discovery that a positive, stable, and non-swinging type of guide suspension or support means could be advantageously provided for the hangers during the period of their movement into, through or along, and out of a treating level in the tank. I determined that this could be done without the necessity for eliminating a somewhat free-swinging type of suspension during straight conveying portions of a cycle of movement of the work articles. I also determined, contrary to what would be expected, that actual power requirements during the treating portion of the cycle of operation are less than about 50% of those which arise in employing freely-suspended pushers, and that this is true in spite of the fact that there is, of course, some increase of friction by reason of the employment of secondary guide or stabilizing means for the hangers during such portion of their movement.

I found that I have not only been able to greatly reduce wear and tear on the pushers and other mechanism, but that I can employ a much lighter weight of conveyor chain and a smaller horsepower of actuating motor than heretofore required for a so-called swing type of hanger suspension. During the article-treating portion of my operation, cycle or system, the hangers or push arms are maintained in a positive and rigid relationship while being moved along an above-positioned primary track and a below-positioned secondary track by what amounts to a three-point roller suspension, and independently of connections to the driving chain or mechanism.

Thus, in accordance with my invention, I obtain the advantages of a free swinging type of hanger construction from the standpoint of major movement or travel of work articles along the conveyor system, outside of the treating bath. This assures a minimum of frictional losses and power requirements outside of bath and, at the same time, eliminates the disadvantageous results of such a system during the period of travel of the articles through the treating bath.

In accordance with my invention, the work articles or shapes *a* are positively moved along a treating path at an appropriate bottom level of the bath (see C) and also, out of and into a swung or suspended position as to the hanger means or more particularly, as to the hook end portions thereof. That is, during step C, the hanger means is positively and non-swingably supported during its movement to push the articles *a* at a uniform speed with a uniform spacing therebetween, and without damage to them as they are being treated.

What I claim is:

1. In apparatus for electrically treating and advancing work articles in series progression longitudinally along and within a treating solution of a treating tank between upper and lower electrodes, a longitudinally-extending contact and support assembly for the work articles operatively positioned between the upper and lower electrodes longitudinally along the tank to define an article treating level within the treating solution of the tank and receive and guide work articles therealong, conveying means along the tank operatively positioned thereabove, swing support means along said conveying means, work supporting hangers vertically-pivotally suspended by said swing support means, said conveyor means being operatively connected to said hangers to move them in a suspended relation into and along the tank, said swing support means having portions guiding said hangers in a longitudinally-swingable relationship of the tank into the tank and into an article-releasing position with respect to said contact and support assembly to position the work articles thereon at an entry end portion of the tank, guide means along the tank cooperating with said swingable support means and operatively associated with said hangers during their movement along said contact and support assembly to positively restrain them from swinging longitudinally of the tank and positively push the work articles along said contact and support assembly when said hangers are moved by said conveyor means longitudinally along the tank; said guide means comprising, a flanged guide member positioned longitudinally along and above the tank, and a pair of laterally-opposed guide rollers carried by said hangers and operatively engaging between flanges of said guide member.

2. In apparatus for electrically treating and advancing work articles in series progression longitudinally along and within a treating solution of a treating tank between upper and lower electrodes, a longitudinally-extending contact and support assembly for the work articles operatively positioned between the upper and lower electrodes longitudinally along the tank to define an article treating level within the treating solution of the tank and receive and guide work articles therealong, conveying means along the tank operatively positioned thereabove, swing support means along said conveying means, work supporting hangers vertically-pivotally suspended by said swing support means, said conveyor means being operatively connected to said hangers to move them in a suspended relation into and along the tank, said swing support means having portions guiding said hangers in a longitudinally-swingable relationship of the tank into the tank and into an article-releasing position with respect to said contact and support assembly to position the work articles thereon at an entry end portion of the tank, guide means along the tank cooperating with said swingable support means and operatively associated with said hangers during their movement along said contact and support assembly to positively restrain them from swinging longitudinally of the tank and positively push the work articles along said contact and support assembly when said hangers are moved by said conveyor means longitudinally along the tank; said guide means comprising, a guide channel along the tank having entry and exit end portions adjacent entry and exit end portions of the tank, a lateral portion extending longitudinally of the tank and carried by each of said hangers, and a pair of rollers carried at opposite ends of said lateral portion and operatively engaging between the flanges of and within said channel.

3. In apparatus for electrically treating and advancing a series of transversely-projecting work articles in a longitudinal direction along and within a longitudinal tank having a treating solution therein, the combination of a series of vertically-extending article-advancing hangers, means swingably supporting said hangers from their upper end portions for swinging movement longitudinally of the tank; actuating means operatively positioned along and above the tank to move said hangers into, along, and out of the tank; rail means longitudinally along the tank and within the treatment solution level thereof to supply electric current to work articles positioned thereon, said hangers having lower end portions to hold the work articles in a suspended relationship during their movement into and out of the tank and to position the work articles on said rail means and move them therealong within the treatment solution of the tank, guide means vertically-downwardly spaced with respect to said swingable supporting means and extending longitudinally along the tank between positions adjacent entry and exit end portions thereof, said hangers having portions cooperating with said guide means to positively hold them against longitudinal swinging movement with respect to the tank during their movement along said rail means, so that said hangers will positively push the work articles along said rail means during advancing movement of the work articles within the treatment solution, said guide means terminating adjacent the entry and exist end portions of the tank, so that said hangers will be free to swing longitudinally of the tank during their movement into and out of the tank, said guide means having portions adjacent the entry and exit end portions of the tank to restrain said hangers from swinging longitudinally of the tank, while they are moved by said conveyor means in cooperation with said swingable support means into and

out of a cooperative relationship with said roll means.

4. Apparatus as defined in claim 3 wherein, said swingable support means has means cooperating with said actuating means for lowering said hangers into a cooperating relationship with said rail means at the entry end portion of the tank and position the work pieces on said rail means, to maintain the work pieces in position on said rail means along the tank, and at the exit end portion of the tank, to raise said hangers upwardly for lifting the work pieces off said rail means and out of the tank.

5. Apparatus as defined in claim 3 wherein, said actuating means has a pair of continuous chains operatively mounted for movement along opposite sides of the tank and said hangers are carried in transverse alignment by said chains to define a series of hanger pairs along the tank.

6. Apparatus as defined in claim 5 wherein, said chains are of a hoist type, and rag wheels operatively engage said chains for a substantial portion of the peripheries of said rag wheels to activate said chains.

7. In apparatus for electrically treating and advancing a series of transversely-projecting work articles in a longitudinal direction along and within a longitudinal tank having a treating solution therein, the combination of a series of vertically-extending article-advancing hangers, means swingably supporting said hangers from their upper end portions for swinging movement longitudinally of the tank; actuating means operatively positioned along and above the tank to move said hangers into, along, and out of the tank; rail means longitudinally along the tank and within the treatment solution level thereof to supply electric current to work articles positioned thereon, said hangers having lower end portions to hold the work articles in a suspended relationship during their movement into and out of the tank and to position the work articles on said rail means and move them therealong within the treatment solution of the tank, guide means vertically-downwardly spaced with respect to said swingable supporting means and extending longitudinally along the tank between positions adjacent entry and exit end portions thereof, said hangers having portions cooperating with said guide means to positively hold them against longitudinal swinging movement with respect to the tank during their movement along said rail means, so that said hangers will positively push the work articles along said rail means during advancing movement of the work articles within the treatment soluiton, said guide means terminating adjacent the entry and exit end portions of the tank, so that said hangers will be free to swing longitudinally of the tank during their movement into and out of the tank; said swingable support means having means cooperating with said conveyor means for lowering said hangers into a cooperating relationship with said rail means at the entry end portion of the tank and position the work pieces on said rail means, to maintain the work pieces in position on said rail means along the tank, and at the exit end portion of the tank, to raise said hangers upwardly for lifting the work pieces off said rail means and out of the tank; and the lower end portions of said hanger being of upwardly-open hook shape to carry the work articles in a suspended relation therein adjacent entry and exit portions of the tank.

8. In apparatus for electrolytically-treating and advancing a series of work articles in a transversely-horizontally-extending relationship progressively into, along, and out of a longitudinal tank having a treating solution therein; a continuous conveyor operatively positioned longitudinally along and above the tank, a series of vertically-depending hangers, means swingably connecting said hangers to said conveyor means for swinging movement longitudinally of the tank; said conveyor means having higher level portions above entry and exit end portions of the tank, having downwardly-declining connecting portions adjacent the entry and exit end portions of the tank, and having a lower level portion longitudinally along the tank, for moving said hangers in a downwardly longitudinally-swingable relation of and into the tank adjacent its entry end portion, for moving them along the tank at the lower level, and for moving them upwardly out of the tank adjacent its exit end portion; supporting means longitudinally along the tank within the treatment solution level thereof to receive and support the work articles in a transverse relationship thereon for longitudinal movement therealong, said hangers having upwardly-open article-carrying portions at their lower end portions to deliver the work articles on said supporting means adjacent the entry end portion of the tank and to receive the work articles from said supporting means adjacent the exit end portion of the tank, restraining means longitudinally along the tank and thereabove in a vertically-downwardly spaced relationship with said conveyor means and cooperating with said hangers during the movement of said conveyor means along its lower level to positively restrain swinging movement of said hangers longitudinally of the tank during their movement along said support means for positively pushing the work articles therealong within the treatment solution of the tank; said restraining means comprising, a cross member rigidly secured to each of said hangers, roller means operatively positioned at opposite ends of said cross member, and a channel-shaped member positioned longitudinally along the tank and receiving said rollers therein for movement therealong in a closely adjacent relation with respect to its flange portions.

9. In apparatus for electrically treating and advancing work articles in series progression longitudinally along and within a treating solution of a treating tank between upper and lower electrodes, a longitudinally-extending contact and support assembly for the work articles operatively positioned between the upper and lower electrodes longitudinally along the tank to define an article treating level within the treating solution of the tank and receive and guide work articles therealong, conveying means along the tank operatively positioned thereabove, swing support means along said conveying means, work-supporting hangers vertically-pivotally suspended by said swing support means, said conveyor means being operatively connected to said hangers to move them in a suspended relation into and along the tank, said swing support means having portions guiding said hangers in a longitudinally-swingable relationship of the tank into the tank and into an article-releasing position with respect to said contact and support assembly to position the work articles thereon at an entry end portion of the tank, guide means having flange means along the tank between positions adjacent the entry and exit portions of the tank, said hangers having means to move into and engage said flange means adjacent the entry end portion of the tank and retain said hangers in a positive swing-locked relationship during their movement along the tank, so that said hangers will positively push the work articles along said contact and support assembly when said hangers are moved by said conveyor means longitudinally along the tank to the extent of said flange means.

10. In apparatus for electrically treating and advancing a series of transversely-projecting work articles in a longitudinal direction along and within a longitudinal tank having a treating solution therein, the combination of a series of vertically-extending article-advancing hangers, means swingably supporting said hangers from their upper end portions for swinging movement longitudinally of the tank; actuating means operatively positioned along and above the tank to move said hangers into, along, and out of the tank; rail means longitudinally along the tank and within the treatment solution level thereof to supply electric current to work articles positioned therein, said hangers having lower end portions to hold the work articles in a suspended relationship during their movement into and out of the tank and to position the work

articles on said rail means and move them therealong within the treating solution of the tank; guide means verically-downwardly spaced with respect to said swingable support means and having portions positioned adjacent entry and exit end portions of the tank to restrain said hangers from swinging longitudinally of the tank, while they are moved by said conveyor means in cooperation with said swingable support means into and out of a cooperative relationship with said rail means, said hangers having portions cooperating with said guide means to positively hold them against longitudinal swinging movement with respect to the tank during their movement along said rail means, so that said hangers will positively push the work articles along said rail means during advancing movement of the work articles within the treatment solution, and said guide means terminating adjacent the entry and exit end portions of the tank, so that said hangers will be free to swing longitudinally of the tank during their movement into and out of the tank.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,887,447

May 19, 1959

Leslie E. Lancy

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 48, for "exist" read -- exit --; line 65, for "advantage" read -- advantages --; column 9, line 1, for "roll" read -- rail --; column 11, line 3, for "verically" read -- vertically --.

Signed and sealed this 1st day of September 1959.

(SEAL)
Attest:

KARL H. AXLINE
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ROBERT C. WATSON
Commissioner of Patents