March 13, 1962 C. W. CHILL 3,024,794

AUXILIARY WORK TRANSFER MECHANISM FOR PLATING MACHINES

Filed May 19, 1959 5 Sheets-Sheet 1

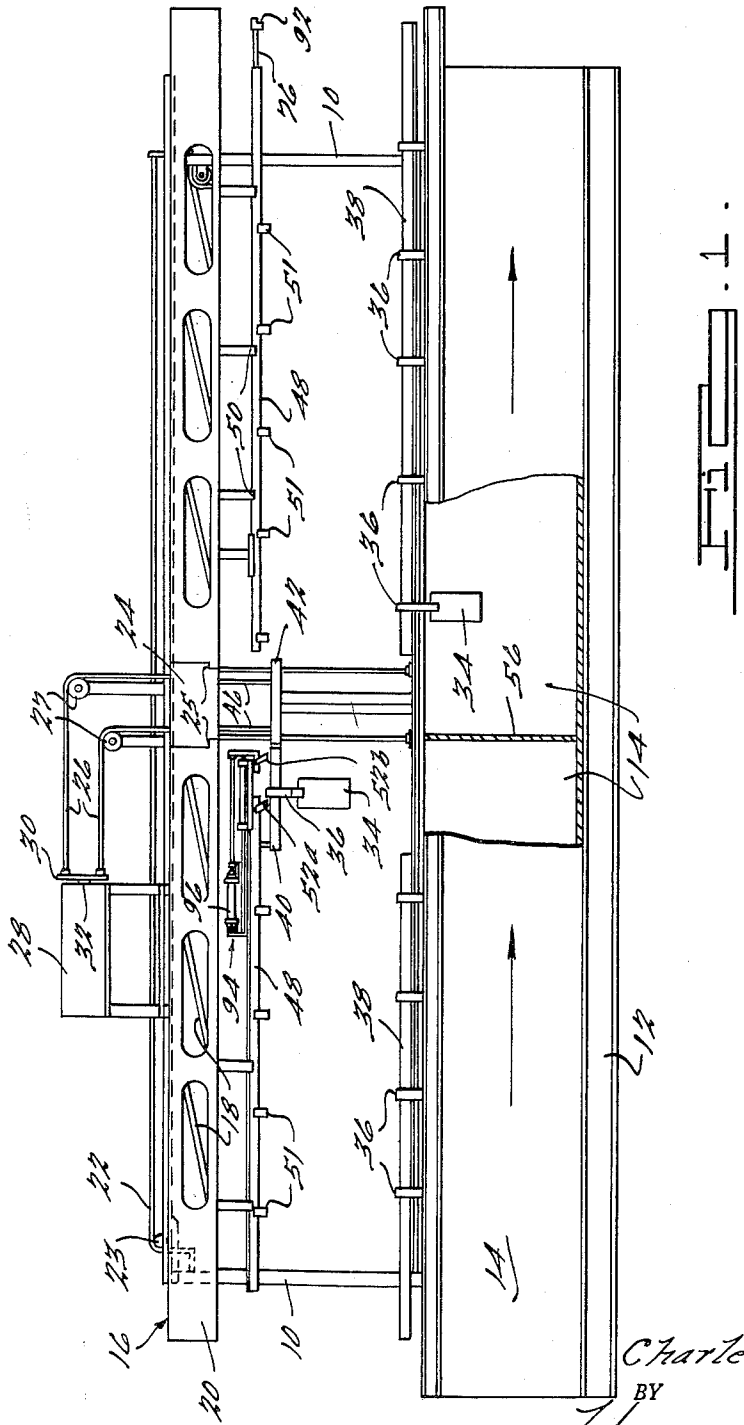


FIG. 1.

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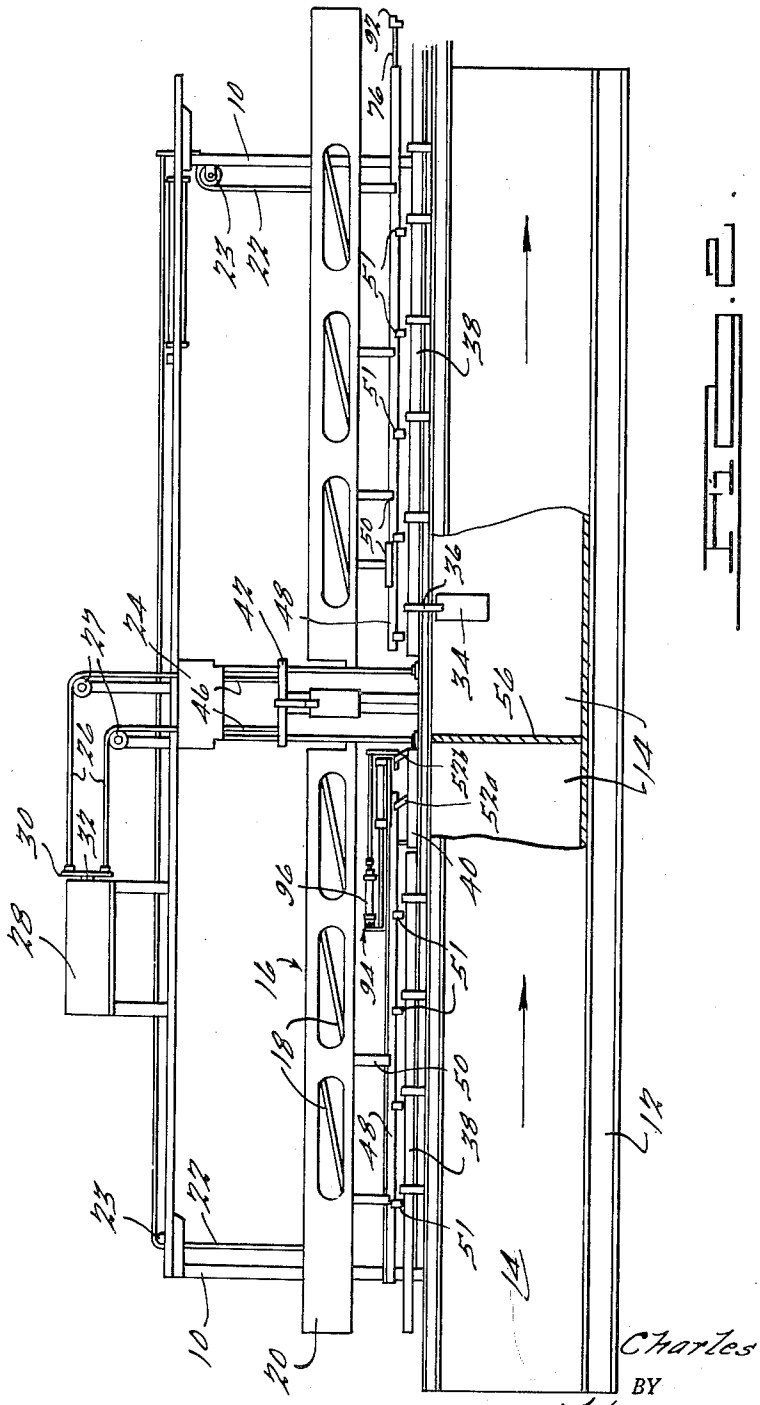


Fig. 2

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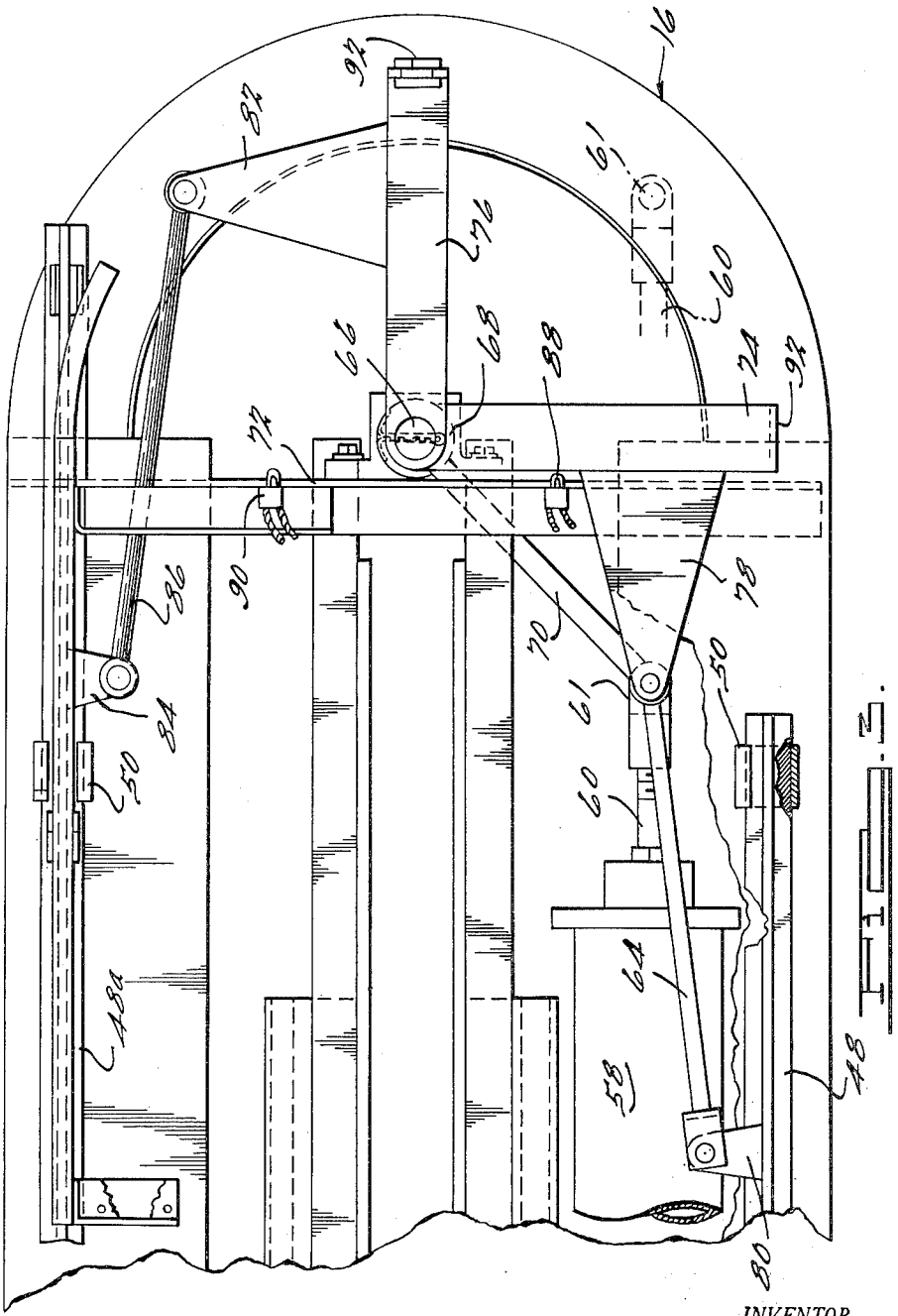


FIG. 3.

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AUXILIARY WORK TRANSFER MECHANISM FOR PLATING MACHINES

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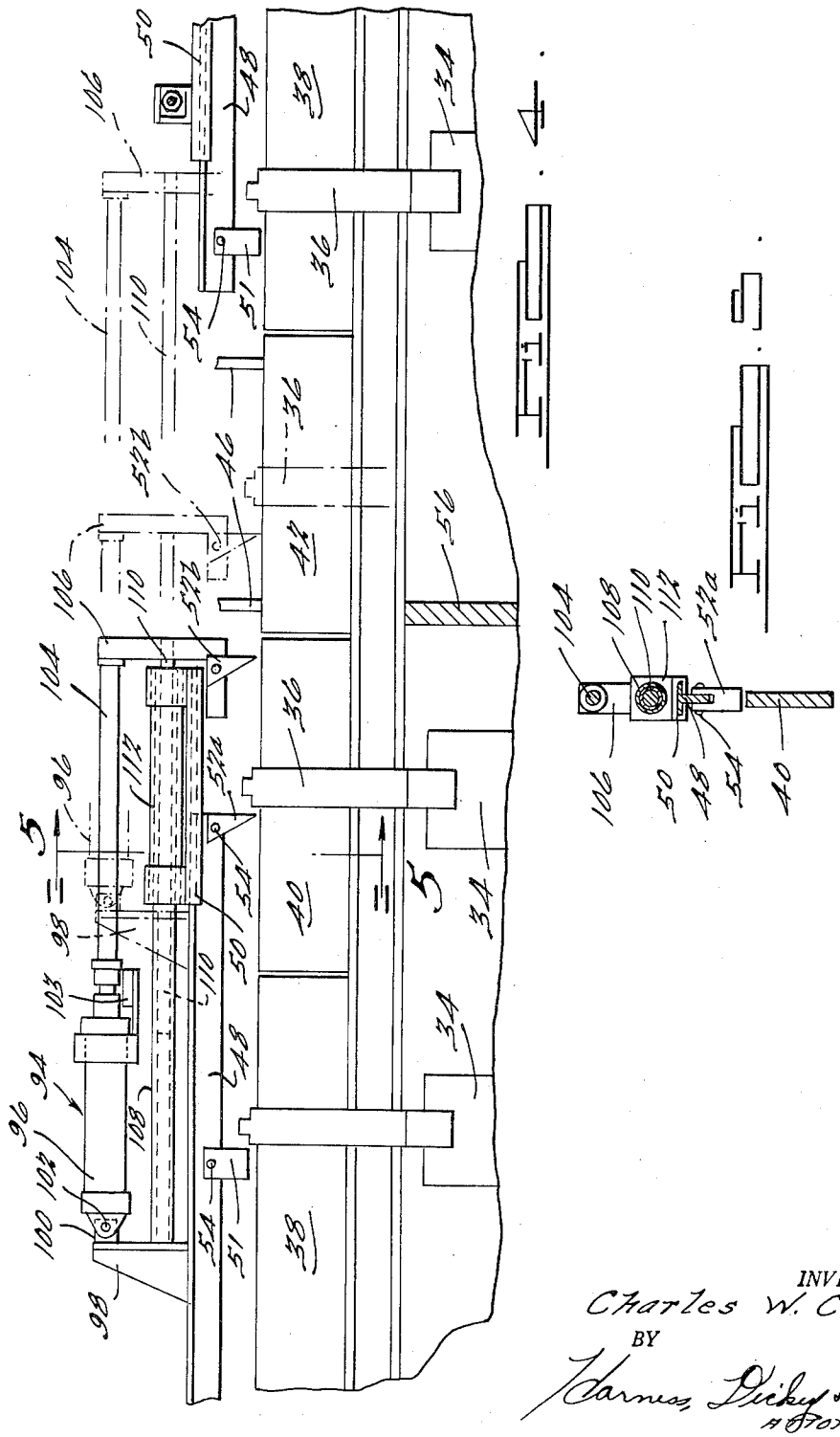


FIG. 4.

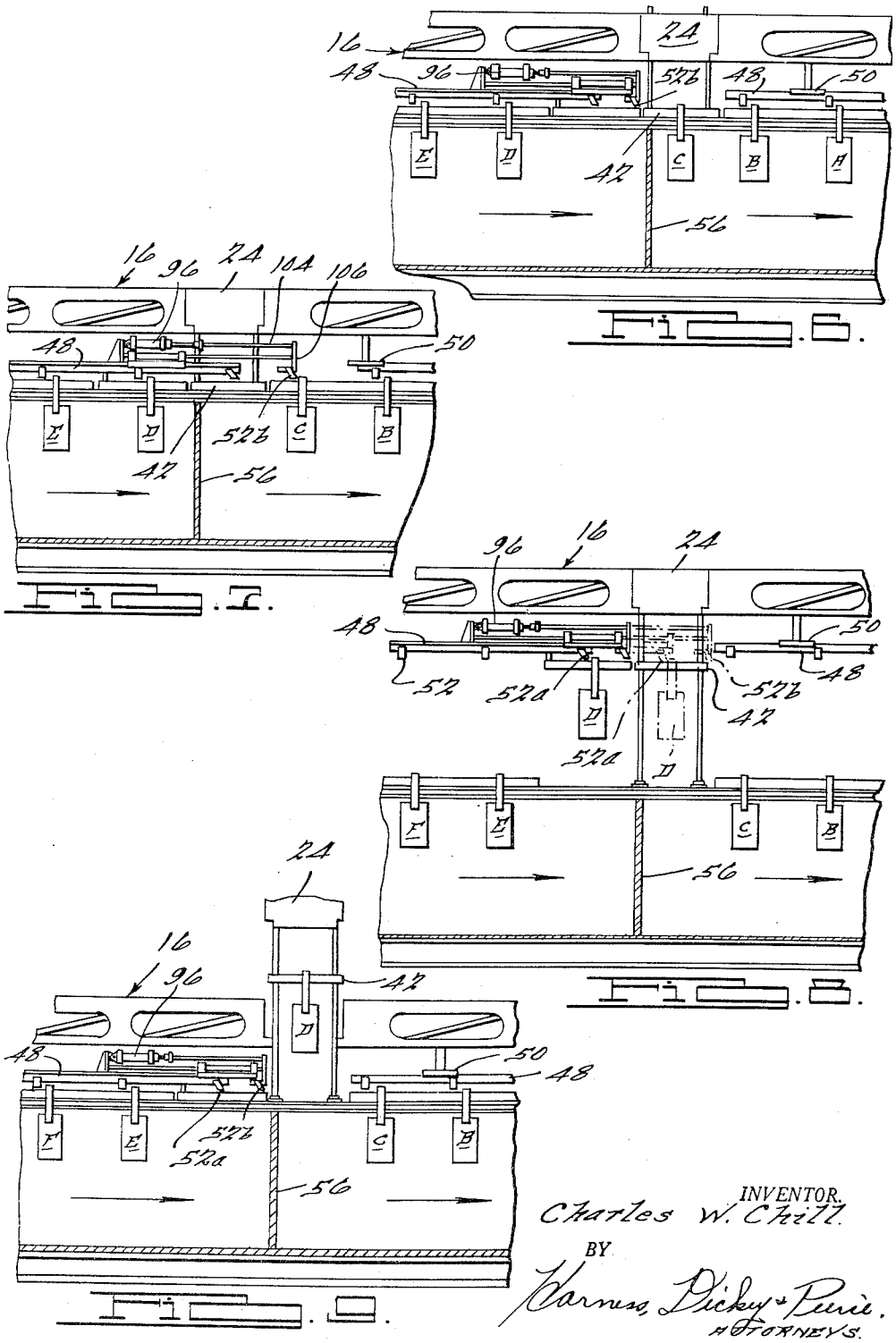
FIG. 5.

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AUXILIARY WORK TRANSFER MECHANISM FOR PLATING MACHINES

Filed May 19, 1959 5 Sheets-Sheet 5



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United States Patent Office 3,024,794 Patented Mar. 13, 1962

3,024,794
AUXILIARY WORK TRANSFER MECHANISM FOR PLATING MACHINES

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Filed May 19, 1959, Ser. No. 814,327
11 Claims. (Cl. 134—77)

This invention relates to improvements in work conveying apparatus used in electroplating operations of the general character disclosed in United States Patents 2,591,681 of April 8, 1952, and Re. 24,072 of October 11, 1955, originally 2,650,600 of September 1, 1953, both of which are assigned to the same assignee of the present invention.

In machines of this type a plurality of workpieces are suspended from a rail and conveyed thereon around a circuit usually having two straight side sections connected at one or both of their ends by an arcuate turn-around section. An oscillating pusher-type transfer mechanism intermittently moves the workpieces along said circuitous rail through a series of tanks and the workpieces are periodically lifted in order that they may be transferred over the partitions separating adjoining tanks. The workpiece lifting means is comprised of an elevator chassis having an outer periphery substantially coextensive with the circuitous path of travel of the workpieces and movable in a vertical direction between a raised position and a lowered position. Sections of the workpiece supporting rail are secured to the chassis, whereby workpieces suspended therefrom are lifted and lowered as the chassis is raised and lowered. Portions of the elevator chassis may be adapted so as to be vertically movable independently of the elevator chassis. By means of this provision, the immersion period of the workpieces in any selected tank or tanks may be reduced by either maintaining the independently movable portion of the chassis in an elevated position until sometime after the balance of the chassis has been lowered or by raising the independently movable chassis section prior to the time the chassis is raised. Moreover, rail sections fixed in the elevated position can be provided whereby workpieces suspended therefrom completely skip a treating step.

The transfer mechanism generally employed to convey the workpieces along the supporting rail through successive tanks is comprised of a pusher bar or rod slidably attached to the chassis and mounted along each straight side section of the machine and a pair of radially extending pusher arms rotatably mounted substantially at the center of curvature of the arcuate turn-around end section. Incorporation of an independently operative chassis section or fixed elevated rail section at an appropriate point along the straight side portion of the machine necessitates an interruption of the pusher bar to enable the elevator chassis to be raised and lowered without obstruction by the independently movable or fixed elevated rail sections. In order to maintain continuity of the transfer of workpieces along the supporting rail, it is necessary that an auxiliary pusher type transfer mechanism be incorporated to transfer workpieces on the independently movable and fixed elevated rail sections.

It is accordingly an object of this invention to provide an improved auxiliary work transfer mechanism for transferring workpieces along those rail sections of a plating machine that are independently movable of the chassis or are fixed in an elevated position.

Another object of this invention is to provide an improved auxiliary work transfer mechanism of compact design and durable operation that can be easily and simply integrated with the operating sequence of the machine and principal transfer mechanism.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a side elevation view of a plating machine embodying this invention and wherein the machine is shown with the elevator chassis in the raised position;

FIGURE 2 is a side elevation view of the same machine shown in FIGURE 1 wherein the chassis is in the lowered position and the delayed immersion section is in the raised position;

FIGURE 3 is a fragmentary inverted plan view of the end portion of the elevator chassis;

FIGURE 4 is a fragmentary side elevation view of the plating machine showing in particular the delayed immersion work transfer mechanism;

FIGURE 5 is a transverse vertical sectional view of the delayed immersion work transfer mechanism shown in FIGURE 4 and taken along line 5—5 thereof; and

FIGURES 6 through 9 are fragmentary schematic elevation views sequentially showing the operating cycle of the machine and work transfer mechanism.

Referring now in detail to the drawings and as may be best seen in FIGURES 1 and 2, a typical plating machine having embodied therein the present invention comprises a central frame of upright columns **10** mounted on a base **12** and surrounded by a system of tanks **14** comprising two parallel rows of partitioned compartments. An elevator chassis **16** is mounted for vertical movement on columns **10**, said chassis comprising a framework of structural members **18** enclosed in an outer casing **20** of sheet steel. The elevator chassis **16** is suspended on columns **10** by cables **22** co-acting with rotatably mounted rollers **23**. The elevator cables **22** are actuated by a double-acting hydraulic cylinder as shown and described in the above-mentioned patents to which reference is made for a description of various details of the machine embodying the present invention.

The plating machine as shown in FIGURES 1 and 2 has one delayed immersion section **24** adapted to be lowered independently of the elevator chassis **16** and having suitable interfitting provisions **25** along its sides, whereby the delayed immersion section **24** is engaged by the elevator chassis **16** and simultaneously raised when the elevator chassis **16** is raised. Although only one such independently movable unit is shown in the drawings, several delayed immersion units may be provided in order to effect a similar delayed operation at other selected locations along the circuitous path of travel of the workpieces. Any suitable means may be employed for lowering the delayed immersion section **24** independently of the elevator chassis **16**, such as a vertically disposed direct-acting hydraulic piston and cylinder assembly or, as shown in the drawings, a cable system similar to that employed for raising and lowering the elevator chassis **16**. As shown in the drawings, a double-acting hydraulic cylinder **28**, having a cross-head **30** securely attached to the end of piston rod **32** actuates cables **26** acting over sheaves **27** thereby controlling the descent of the delayed immersion section **24** in a manner as shown and described in greater detail in aforementioned United States Patent No. 2,591,681. It will be appreciated that the means for lowering the independently movable section can also be utilized for raising the section independently of the chassis and in which event provisions **25** would not be necessary.

Workpieces **34** suspended from slidably mounted work hangers or carriers **36** are propelled along fixed rail sections **38**, vertically movable rail sections **40** and vertically movable delayed immersion rail section **42** in response

to the work transfer mechanism and in the direction indicated by the arrows. Fixed rail sections 38 are securely attached by suitable brackets to the central frame and disposed directly above the top of tanks 14 in a manner as shown in FIGURES 1 and 2. Vertically movable rail section 40 is secured by suitable brackets 46 to the underside of elevator chassis 16 whereby workpieces suspended therefrom are raised from the tanks 14 as the elevator chassis 16 is raised to the elevated position. In a similar manner, vertically movable delayed immersion rail section 42 is rigidly secured by means of brackets 46 to the understructure of delayed immersion chassis section 24. When the elevator chassis 16 and the delayed immersion section 24 are in the lowered position, the vertically movable rail sections 40 and 42 and the straight and arcuate fixed rail sections 38 are aligned to form a continuous rail around the machine to which current may be supplied in any manner well known in the art.

The primary workpiece transfer mechanism is comprised of pusher bars 48, 48*a* mounted for reciprocating movement along the straight side portions of the machine and above the rail section. The pusher bars 48, 48*a* are of a T-shaped cross-section and are slidably mounted in shoes 50 rigidly affixed to the underside of the elevator chassis. Fixed pushers 51 and pivoted pushers 52*a* are attached to pusher bars 48, 48*a* and are adapted to engage hangers 36 suspended from the rail section. The pushers 52*a* are constructed to pivot only on being retracted and are provided wherever a pusher must travel across a work carrier in being retracted. A suitable stop incorporated in each such pusher and adapted to engage the pusher bar on the pushing movement will hold the pusher from pivoting at this time. Both the fixed and pivoted pushers are adjustable lengthwise on the pusher bars 48, 48*a* by positioning their supporting pins 54 in appropriate apertures disposed along said pusher bars.

The pusher bars 48, 48*a* are actuated from a fluid operated cylinder 58 mounted on the chassis 16 adjacent to and longitudinally of the pusher bar 48, as shown in FIGURE 3. At each end of the chassis 16 is mounted a vertical shaft 66 concentrically with the adjacent curved rail section and passing through the bottom of the chassis. Each shaft is held in suitable bearings 68, rigidly secured to a cross member 72 of the chassis. The shaft 66 nearer the cylinder 58 has a link 70 secured to and pivotally connected with the end of piston rod 60 by a suitable swivel 61. The transverse member 72 to which bearings 68 are secured is formed with an opening to permit passage of the link 70 and piston rod 60 there through.

Beneath the bottom of the chassis the shaft 66 carries a pair of fixed arms 74, 76 at a right angle to each other. From the arm 74, a lug 78 extends toward the cylinder 58 and by means of link bar 64 is joined to an ear 80 rigidly attached to adjacent pusher bar 48, said link bar 64 being pivotally connected to lug 78 and ear 80. Similarly, lug 82 extending from pivot arm 76 is pivotally connected to ear 84 secured to pusher bar 48*a* by means of link bar 86. As the piston rod 60 moves outwardly during the forward stroke, link bar 70 rotates shaft 66 and arms 74 and 76 through an angle of 90° simultaneously pulling and pushing pusher bars 48 and 48*a*, respectively. Limit switch 88 engageable by arm 74 when in its full retracted position and limit switch 90 engageable by arm 76 when in its fully rotated position provide for timed control of cylinder 58 in proper sequence with other operative elements. The closed end of the cylinder 58 is pivotally mounted to accommodate the arcuate movements of the swivel 61 at the end of the piston rod 60. The free ends of arms 74 and 76 are provided with pushers 92 that engage work carriers 36 on arcuate rail 38 and propel the work ninety degrees along said rail for each ninety degree movement of the shaft 66 when the chassis is in the lowered position. At the other end of the chassis the oscillating movement imparted to pusher bars 48, 48*a* is transmitted to a pair of fixed arms similar to 74, 76 by means of suitable linkage, as described in detail in the aforementioned patents. It will also be appreciated by those skilled in the art that separate actuating cylinders may be employed at each end of the elevator chassis with one cylinder being attached to only one of the pusher bars 48, 48*a* and in such event link bar 86 is unnecessary.

As heretofore mentioned, pushers 51 and 52A are adjustable lengthwise on the pusher bars 48, 48*a* by positioning their supporting pins 54 in appropriate apertures disposed along said pusher bars. When the pusher bars are in their fully retracted position, the pushers 51, 52*a* are normally spaced about two inches behind the work carriers 36 to avoid clashing therewith when the chassis is lowered. If it be assumed, for example, that the reciprocating transfer stroke of the pusher bars is about 25 inches, the pushers mounted thereon with a 2 inch rearward overlap with respect to the work carriers will advance the workpieces linearly a distance of about 23 inches during each transfer stroke. Unequal travel of selected workpieces can be achieved by unequal spacing of the pushers, so that the rearward overlap of the pushers with respect to the work carriers is greater than the normal 2 inches.

To enable the vertical movement of the elevator chassis 16 with respect to an independently movable chassis section or a chassis section fixed in an elevated position, it is necessary to provide gaps in the pusher bars 48, 48*a* to prevent interference of the pusher bars with such independently movable and fixed rail sections. As shown in FIGURE 2, the provision of a gap in pusher bar 48 enables the elevator chassis 16 to be lowered without interfering with rail section 42 secured to the delayed immersion section 24. Moreover, the provision of a gap in pusher bar 48 enables the delayed immersion section 24 to be subsequently lowered without obstruction or interference with the elevator chassis 16 which is in the lowered position. Continuity of the transfer of workpieces through successive treating tanks is maintained by an auxiliary work transfer mechanism 94 secured to and mounted above the pusher bar 48 immediately adjacent to the gap in said pusher bar, as shown in FIGURES 1, 2 and 4. In the specific application shown, it is the function of the auxiliary work transfer mechanism 94 to transfer workpieces suspended from delayed immersion rail section 42 to adjacent fixed rail section 38 when the chassis 16 and delayed section 24 are in the lowered position. The auxiliary work transfer mechanism is of a rigid, compact design and adaptable for integrated operation with the principal work transfer mechanism and the other operating sequences of the machine. As shown in the drawings and particularly FIGURE 4, the auxiliary work transfer mechanism 94 is comprised of a double-acting, fluid-actuated cylinder 96 mounted with its longitudinal axis disposed above and substantially parallel to pusher bar 48. Upstanding bracket 98 is rigidly secured to the top surface of pusher bar 48 and is provided with an ear 100 to which the closed end of cylinder 96 is pivotally connected by means of pin 102. The forward end of piston rod 104 is secured to an L-shaped bracket or crosshead 106, which has a pusher 52*b* pivotally mounted on the lower portion thereof. The pivotally mounted cylinder 96 is maintained in a substantially horizontal position by means of a telescoping tube guide comprised of an outer tube 108 rigidly secured at one of its ends to upstanding bracket 98 and an inner telescoping tube 110 which is slidably mounted within outer tube 108 and having its exposed end securely attached to crosshead 106. The outer tube 108 is slidably supported by supporting bracket 112 mounted on and secured to shoe 50, which, in turn, is rigidly secured to the structure of elevator chassis 16 by a suitable bracket. The relative vertical disposition and alignment of the piston rod 104, supporting bracket 112, outer and inner telescoping tubes 108 and 110, respectively, and pusher bar 48 are illus-

tarted in FIGURE 5. A drip tray 103 disposed below the open end of cylinder 96 intercepts any fluid that may leak from the cylinder preventing its contamination of the treating tanks below. The pusher bars 48 and auxiliary work transfer mechanism 94 is shown in its fully retracted position in FIGURE 4. In that position, sufficient clearance is provided between the ends of delayed immersion rail section 42 and the end of cross-head 106 on one side and the end of pusher bar 48 on the other side that said said rail section 42 and chassis 16 are vertically movable relative to each other without interfering with said work transfer mechanism.

In operation, the auxiliary work transfer mechanism 96 combines the reciprocating motion of the pusher bar 48 with the forward thrust of piston rod 104 to engage a workpiece suspended from about the midpoint of delayed immersion rail 42 and transfer it to the next treating station on the adjacent fixed rail 38. The forward stroke of piston rod 104 is of a length so that the rearward overlap between the workpiece carrier 36 on rail 42 and pusher 52*b* is reduced to about 2 to about 3 inches. The actual transfer of a workpiece is achieved through the reciprocating travel of the pusher bar 48. The cylinder 96 may be actuated first, followed by the reciprocating thrust of pusher bar 48 or both of these events may occur simultaneously. Hydraulic fluid under pressure may be supplied to cylinder 96 by a separate fluid source or by branch lines connected to the principal transfer cylinder 58. A positive fluid pressure is maintained on the transfer cylinders 96 and 58, particularly when in the retracted positions, to prevent the pusher bars 48, 48*a* and cross-head 106 from drifting from that position. As heretofore mentioned, the auxiliary pusher mechanism embodied in the machine illustrated in the drawings is effective to transfer workpieces only when the elevator chassis 16 and the delayed immersion section 24 are in the lowered position. Accordingly, suitable control means may be provided, if desired, whereby the cylinder 96 is not actuated when the delayed immersion section 24 and chassis 16 are in the raised position. The partially and fully extended positions of cross-head 106 are shown in phantom in FIGURE 4. In addition, the relative position of upstanding bracket 98 and cylinder 96 are also shown in phantom at the forward-most point of travel of the pusher bar 48. During the reciprocating travel of the pusher bar 48, cylinder 96 and the auxiliary work transfer mechanism 94 are maintained in alignment by outer tube 108 slidably supported in supporting bracket 112. In addition, inner tube 110 slidably mounted within outer tube 108 maintains appropriate alignment during the outward and inward thrust of piston rod 104. It will be noted that the shoes 50 at each side of the independently movable rail section 42 are of a length sufficient to provide continuous support for end sections of pusher bar 48 during their entire travel stroke and disposed so as to minimize the magnitude of unsupported over-hang end portions thereof.

It will, of course, be appreciated by those skilled in the art that modifications to the auxiliary pusher mechanism 94 are feasible without departing from the spirit of this invention. For example, the auxiliary work transfer mechanism may be mounted on the pusher bar 48 to the right-hand side of the independently movable rail 42 as viewed in FIGURES 1, 2 and 4, so that pusher 52*b* would be effective in pulling rather than pushing work carrier 36 along rail 42. In this arrangement, it would be necessary to first actuate cylinder 96 to position pusher 52*b* behind the work carrier before the pusher bar 48 was actuated. Moreover, the auxiliary work transfer mechanism could be mounted in a fixed position independently of the pusher bar 48 by means of suitable brackets secured to the central frame and in alignment with rail 42 when in the lowered position. This arrangement would require cylinder 96 to have a stroke equal to the combined linear displacement of pusher bar 48 and the rearward overlap between pusher 52*b* and the work carrier 36 positioned on the independently movable rail 42. In this way, the transfer of a work carrier from the rail 42 to the next adjacent position of fixed rail 38 would be achieved entirely by the reciprocating stroke of cylinder 96. Still another modification would include the substitution of equivalent mechanical or electrically actuated means for hydraulic cylinder 96.

The pusher bars 48, 48*a* are operative in both the raised and lowered positions of the elevator chassis 16, the pusher 52*a* in a raised position being effective to move the work carrier 36 suspended on vertically movable rail section 40 to delay rail section 42 so that consecutive workpieces are passed over tank partition wall 56. In the lowered chassis position, the pushers 51 and 52*b* are effective to advance all of the workpieces on the aligned rail sections 38, 40 and 42.

A typical timed operating cycle of the machine embodying this invention is sequentially illustrated in FIGURES 6 through 9. Let it be assumed that the elevator chassis and delayed immersion section are in the lowered position and the work transfer mechanism is fully retracted preparatory to a forward stroke, as shown in FIGURE 6. At the appropriate timing sequence, pusher bar cylinder is actuated causing the workpieces A, B, D and E engaged by pushers 51 to advance along the supporting rail. Simultaneously, auxiliary work transfer cylinder 96 is actuated and the forward travel of piston rod 104 and cross-head 106 combined with the reciprocating travel of pusher bar 48, cause pusher 52*b* to transfer workpiece C to the next station, formerly occupied by B, as shown in FIGURE 7. On completion of the forward travel of the work transfer mechanism, the elevator chassis and delayed immersion section are raised, withdrawing workpiece D from the tank, as shown in FIGURE 8. During the upward travel of the elevator chassis and delayed immersion section, the work transfer mechanisms are withdrawn to their fully retracted positions. The work transfer mechanism is again actuated, whereby pusher 52*a* engages workpiece D and transfers it over tank partition 56 to delayed immersion rail section 42, as shown in phantom in FIGURE 8. It will be noted that the auxiliary cylinder 96 need not be actuated in the elevated position since pusher 52*b* does not engage any workpiece during the forward travel of the pusher bar. After the pusher bar has been completely retracted, providing unobstructed vertical clearance, the elevator chassis is lowered while workpiece D is maintained in an elevated position by delayed immersion section 24, as shown in FIGURE 9. Upon the expiration of a predetermined delay period, the delayed immersion section is lowered in position and in alignment with elevator chassis 16, as shown in FIGURE 6 preparatory to beginning another timing cycle.

The specific timing sequence and cycle described is applicable to the particular treating sequence shown, that is, the withdrawal of a workpiece from the last station of a multiple station tank, transferring it over an intervening tank partition and providing for a delayed immersion or set-down at the first station of a succeeding multiple station tank. It will, of course, be appreciated by those skilled in the art that the auxiliary work transfer mechanism herein described is equally applicable to transferring workpieces off single station rail sections which may be either fixed in an elevated position providing a skip operation or a vertically movable early pickup rail section located at the last station of a multiple station tank. For example, if, instead of a delayed immersion treatment as heretofore described, it were preferred to completely omit or skip immersion of a selected workpiece at a particular treating station, the delayed immersion section could be fixedly maintained in an elevated position or replaced by an elevated fixed rail section at the particular treating station. The transfer of workpieces on and off such fixed elevated rail section would take place only when the elevator chassis was in the raised

position. Accordingly, the auxiliary work transfer mechanism would be operative only in the elevated position to transfer workpieces from the fixed rail. It would, of course, be necessary to provide a vertically movable rail section similar to section **40** contiguous to the fixed rail to receive workpieces transferred from the elevated fixed rail section. Similarly, an early pickup rail section located at the last station of a multiple station tank would require an auxiliary work transfer mechanism to transfer workpieces suspended therefrom when in an elevated position to a vertically movable rail section attached to the elevator chassis immediately contiguous thereto. As in the case of the elevated fixed rail section, the auxiliary work transfer mechanism would be actuated only when the elevator chassis was in the raised position.

Plating machines provided with more than one delayed immersion section, early pickup section, fixed elevated rail section, or combinations thereof disposed along a straight side section thereof, require supplementary actuating means for the intervening pusher bar sections and synchronized with the reciprocating stroke of the primary work transfer cylinder **58**. This can be achieved either by providing a separate actuating cylinder synchronized to reciprocate with actuating cylinder **58** or through suitable equalizing linkage connected with a driven pusher bar section. Adjacent to each single station independently movable or fixed elevated rail section, an auxiliary work transfer mechanism as herein described is provided to transfer the workpieces suspended therefrom off said rail section to the next adjacent treating station. Each of said auxiliary work transfer units may be provided with a set of safety limit switches to communicate to the central control system the fully extended and fully retracted positions of said unit. In this manner, the safety limit switches would supplement limit switches **88** and **90** of the principal work transfer mechanism, and prevent independently movable rail sections and the chassis to be raised or lowered unless the work transfer mechanisms are in the appropriate position so as to prevent clashing or interference therebetween.

While it will be apparent that the preferred embodiments herein illustrated are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixed supported over the receptacles, at least one independently movable rail section adapted to fit in the space between the said spaced rail sections, the improvement comprising discontinuous reciprocating first pusher means movable independently of said independently movable rail section adapted to engage work carriers on said spaced rail sections and said independently movable rail section, and an auxiliary pusher mechanism on said first pusher means and disposed adjacent to said independently movable rail section, said auxiliary pusher mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail section, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail section longitudinally along said independently movable rail section and for a distance of at least a portion of the length of said independently movable rail section.

2. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, at least one independently movable rail section adapted to fit in the space between the said spaced rail sections, the improvement comprising discontinuous reciprocating first pusher means movable independently of said independently movable rail section adapted to engage work carriers on said spaced rail sections and said independently movable rail section, and an auxiliary pusher mechanism mounted on said first pusher means and disposed adjacent to said independently movable rail section, said auxiliary pusher mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail section, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail section longitudinally along said independently movable rail section and for a distance greater than the length of said independently movable rail section whereby a work carrier positioned thereon is transferred to the adjacent portion of said spaced rail section.

3. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, at least one independently movable rail section adapted to fit in the space between the said spaced rail sections, the improvement comprising discontinuous reciprocating first pusher means movable independently of said independently movable rail section adapted to engage work carriers on said spaced rail sections and said independently movable rail section, and an auxiliary pusher mechanism mounted on and reciprocable by said first pusher means and disposed adjacent to said independently movable rail section, said auxiliary pusher mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail section, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail section longitudinally along said independently movable rail section and for a distance less than the length of said independently movable rail section, said auxiliary pusher mechanism functioning in conjunction with said reciprocating first pusher means to transfer a work carrier positioned on said independently movable rail section to the adjacent portion of said spaced rail section upon the advancing stroke of said reciprocating first pusher means.

4. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, the improvement comprising discontinuous reciprocating first pusher means carried by the chassis and adapted to engage work carriers on said spaced rail sections and said movable rails and an auxiliary pusher mechanism carried by the chassis and disposed adjacent to said independently movable rail, said mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail longitudinally along said independently movable rail and for a distance of at least a portion of the length of said independently movable rail.

5. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, the improvement comprising discontinuous reciprocating first pusher means carried by the chassis and adapted to engage work carriers on said spaced rail

sections and said movable rails and an auxiliary pusher mechanism carried by the chassis and disposed adjacent to said independently movable rail, said mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail longitudinally along said independently movable rail and for a distance greater than the length of said independently movable rail whereby a work carrier positioned thereon is transferred to the adjacent portion of said spaced rail section.

6. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, the improvement comprising discontinuous reciprocating first pusher means carried by the chassis and adapted to engage work carriers on said spaced rail sections and said movable rails and an auxiliary pusher mechanism carried by the chassis and disposed adjacent to said independently movable rail, said auxiliary pusher mechanism comprising a second pusher means adapted to engage work carriers on said independently movable rail, means for reciprocating said second pusher means from a position spaced longitudinally from said independently movable rail longitudinally along said independently movable rail and for a distance less than the length of said independently movable rail, said auxiliary pusher mechanism functioning in conjunction with said reciprocating first pusher means to transfer a work carrier positioned on said independently movable rail to the adjacent portion of said spaced rail section upon the advancing stroke of said reciprocating first pusher means.

7. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, slidably mounted pusher bars carried by the chassis, means for reciprocating the pusher bars, pushers carried by the pusher bars and adapted to engage work carriers on said spaced rail sections and said movable rails, the improvement comprising an auxiliary pusher mechanism carried by the chassis and disposed adjacent to the independently movable rail, said mechanism comprising a reversible actuating means mounted on one of said pusher bars, a pusher connected to said means and adapted to engage work carriers on said independently movable rail, said pusher reciprocated by said reversible actuating means and said one of said pusher bars for a distance greater than the length of said independently movable rail whereby a work carrier positioned thereon is transferred to the adjacent portion of said spaced rail section.

8. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, slidably mounted pusher bars carried by the chassis, means for reciprocating the pusher bars, pushers carried by the pusher bars and adapted to engage work carriers on said spaced rail sections and said movable rails, the improvement comprising an auxiliary pusher mechanism carried by the chassis and disposed adjacent to the independently movable rail, said mechanism comprising a reversible acting hydraulic cylinder mounted on one of said pusher bars in substantially parallel spaced alignment therewith, a piston rod cooperating with said cylinder and actuable thereby, pusher means associated with said rod and adapted to engage work carriers positioned on the independently movable rail, said pusher means movable from a retracted position spaced longitudinally from said independently movable rail along said independently movable rail and for a distance greater than the length of said independently movable rail, said hydraulic cylinder functioning in conjunction with the advancing stroke of one of said pusher bars whereby said pusher means is effective to transfer a work carrier positioned on said independently movable rail to the adjacent portion of said spaced rail section when in alignment therewith.

9. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, slidably mounted pusher bars carried by the chassis, means for reciprocating the pusher bars, pushers carried by the pusher bars and adapted to engage work carriers on said spaced rail sections and said movable rails, the improvement comprising an auxiliary pusher mechanism carried by the chassis and disposed adjacent to the independently movable rail, said mechanism comprising a reversible acting hydraulic cylinder mounted on one of said pusher bars in substantially parallel spaced alignment therewith, a piston rod cooperating with said cylinder and actuable thereby, pusher means associated with said rod and adapted to engage work carriers positioned on the independently movable rail, said pusher means movable from a retracted position spaced longitudinally from said independently movable rail along said independently movable rail and for a distance greater than the length of said independently movable rail, said hydraulic cylinder functioning in conjunction with the advancing stroke of one of said pusher bars whereby said pusher means is effective to transfer a work carrier positioned on said independently movable rail to the adjacent portion of said movable rail when in alignment therewith.

10. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles and a chassis section movable independently of said chassis, a movable rail carried by the chassis, an independently movable rail carried by the chassis section, said movable and said independently movable rails adapted to fit in the spaces of the said spaced rail sections, means for moving the chassis section independently of the chassis, slidably mounted pusher bars carried by the chassis, means for reciprocating the pusher bars, pushers carried by the pusher bars and adapted to engage work carriers on said spaced rail sections and said movable rails, the improvement comprising an auxiliary pusher mechanism carried by the chassis and disposed adjacent to the independently movable rail, said mechanism comprising a reversible acting hydraulic cylinder, a member secured to one of said pusher bars and supporting the closed end of said cylinder, a piston rod cooperating with

said cylinder and actuable thereby, a pusher pivotally connected to said rod and adapted to engage work carriers positioned on the independently movable rail, said pusher movable from a retracted position spaced longitudinally from said independently movable rail along said independently movable rail and for a distance greater than the length of said independently movable rail, means for slidably supporting said pusher during the longitudinal movement thereof, said hydraulic cylinder functioning in conjunction with the advancing stroke of one of said pusher bars whereby said pusher is effective to transfer a work carrier positioned on said independently movable rail to the adjacent portion of said spaced rail section when in alignment therewith, said auxiliary pusher mechanism when said pusher is in the retracted position providing unobstructed vertical clearance whereby said chassis and said chassis section can be moved relative to each other.

11. In a conveying apparatus for conveying articles through a series of treating receptacles including an aligned series of spaced rail sections fixedly supported over the receptacles, a chassis movably mounted over the receptacles having a section thereof fixedly supported in the elevated position, movable rail sections carried by the chassis, a fixedly elevated rail carried by the chassis section and adapted to fit in the space between said movable rail sections when the chassis is in the elevated position, slidably mounted pusher bars carried by the chassis, means for reciprocating the pusher bars, pushers carried by the pusher bars and adapted to engage workpieces on said spaced rail and said movable rail sections, the improvement comprising an auxiliary pusher mechanism carried by the chassis and disposed adjacent to the fixedly elevated rail, said mechanism comprising a reversible acting hydraulic cylinder mounted on one of said pusher bars in substantially parallel spaced alignment therewith, a piston rod cooperating with said cylinder and actuable thereby, a pusher means associated with said rod and adapted to engage work carriers positioned on the fixedly elevated rail, said pusher means movable from a retracted position spaced longitudinally from said fixedly elevated rail along said fixedly elevated rail and for a distance greater than the length of said fixedly elevated rail, said hydraulic cylinder functioning in conjunction with the advancing stroke of said one of said pusher bars whereby said pusher means is effective to transfer a work carrier positioned on said fixedly elevated rail to the adjacent portion of said movable rail when the chassis is in the raised position.

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