Jan. 22, 1963 J. A. LISOWSKI ETAL 3,074,417

WORK PROCESSING APPARATUS

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FIG.2.

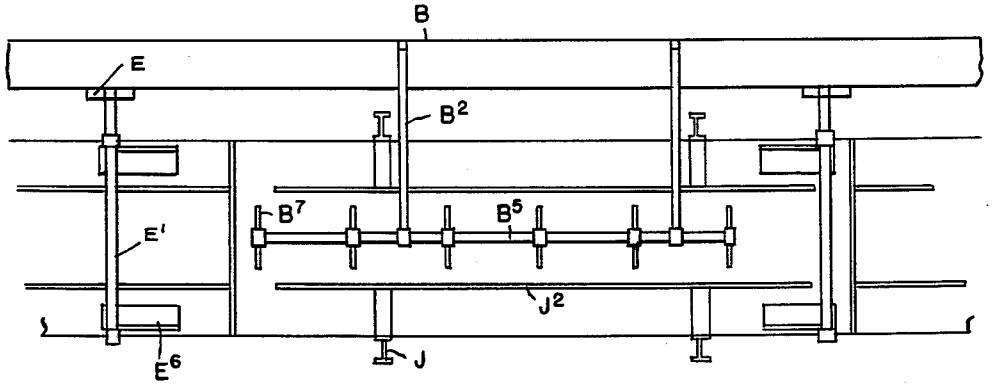
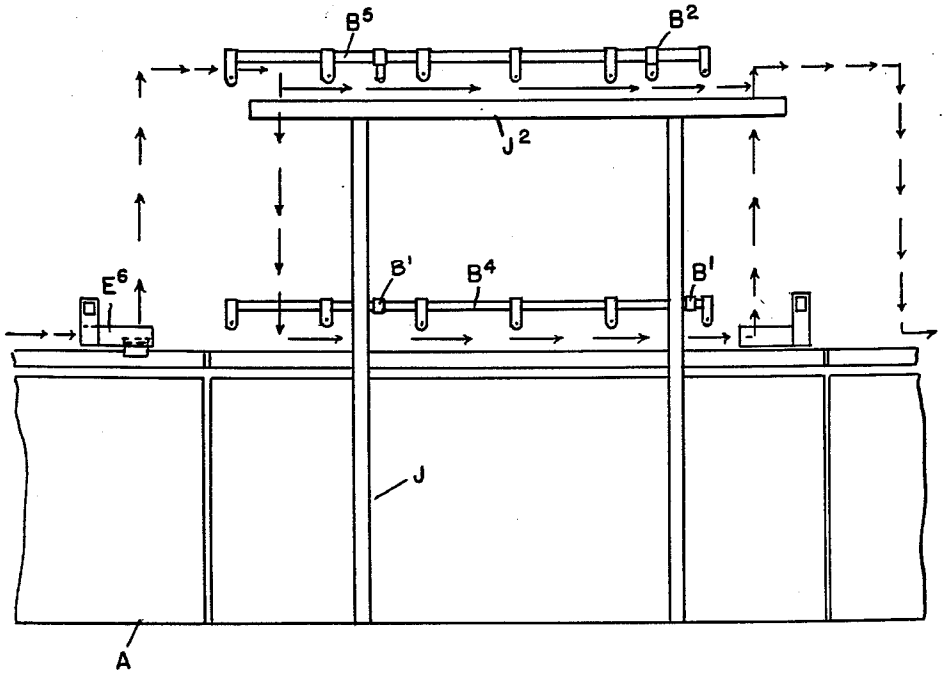


FIG.1.



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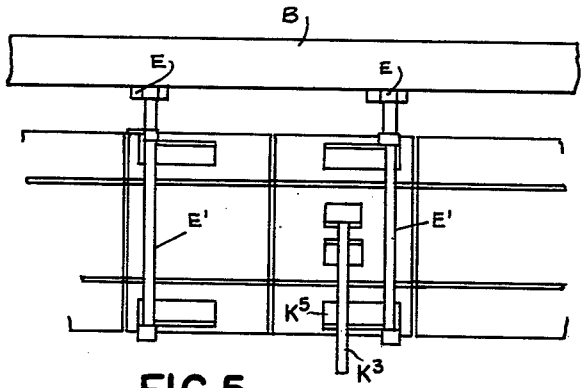


FIG.5.

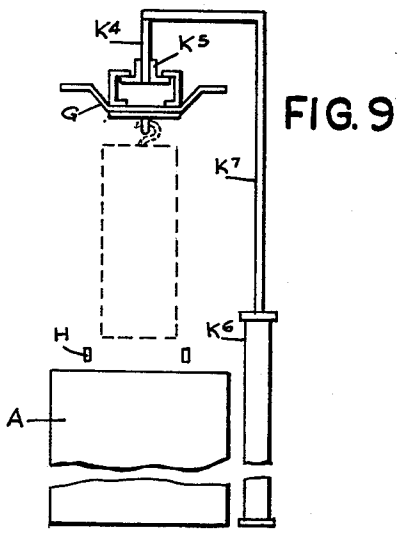
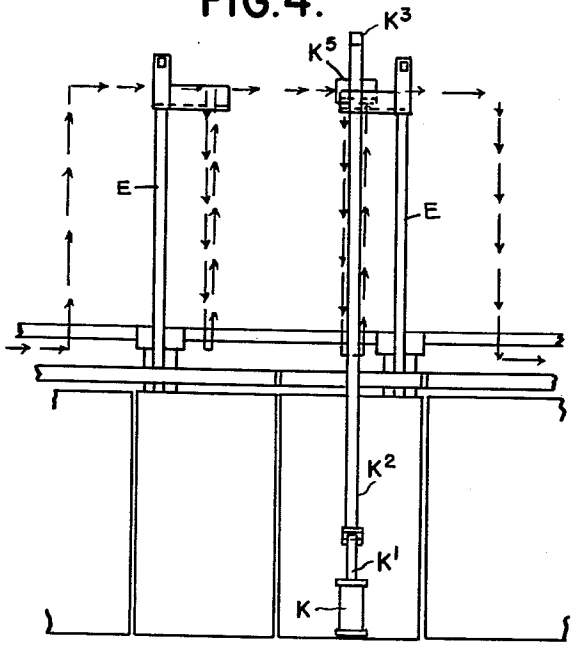


FIG. 9

FIG.4.



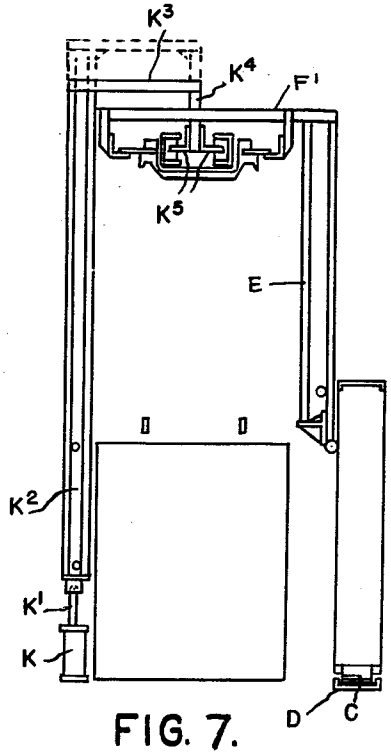


FIG. 7.

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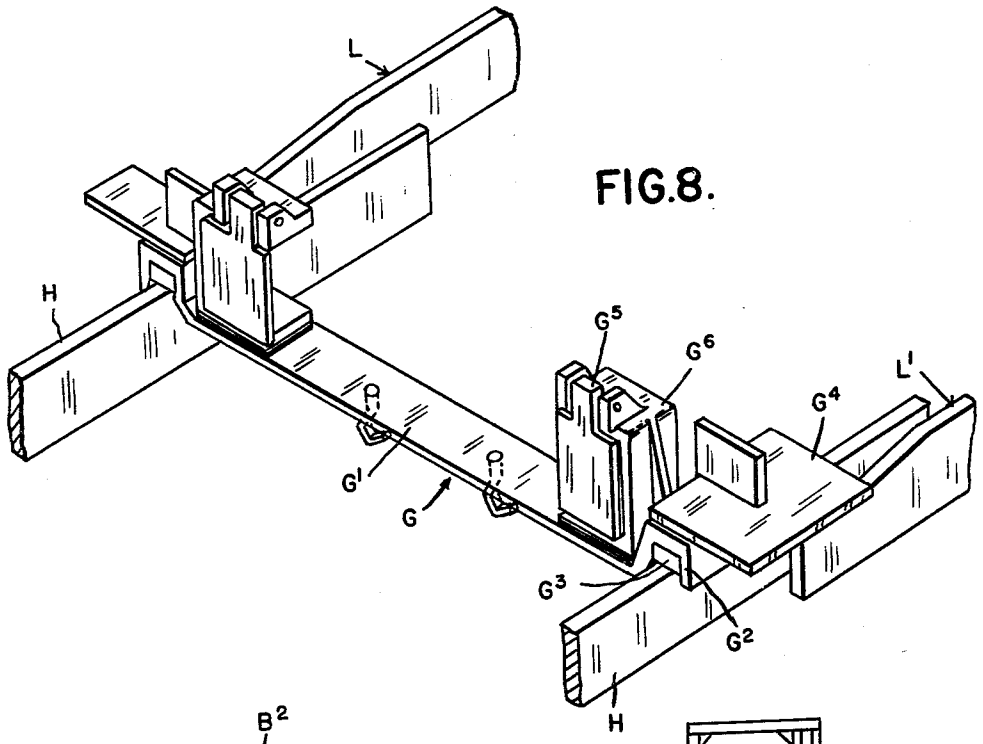


FIG.8.

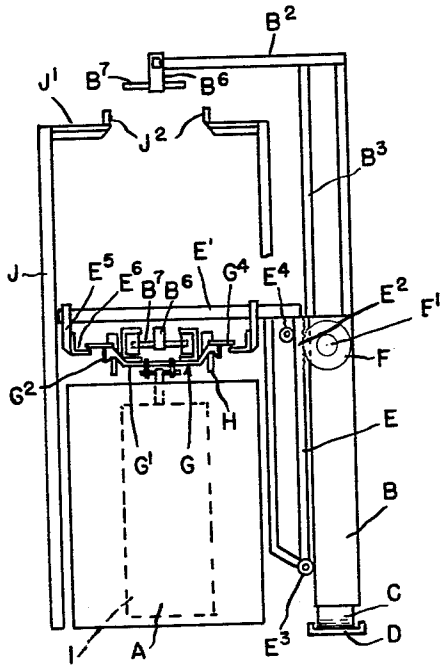


FIG.3.

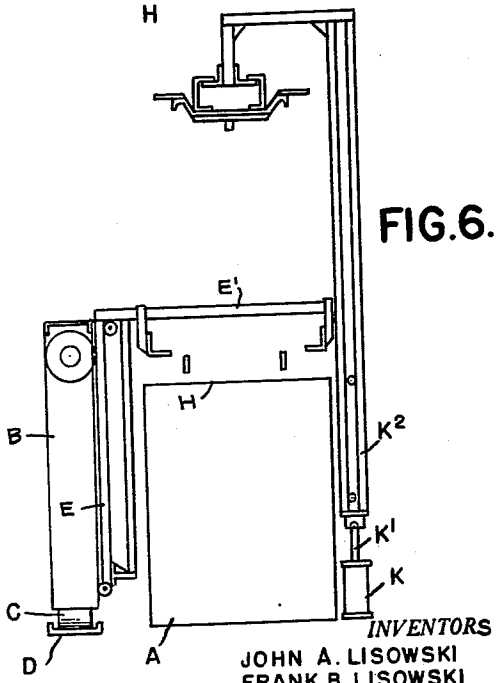


FIG.6.

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3,074,417

WORK PROCESSING APPARATUS

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17 Claims. (Cl. 134—76)

The invention relates to work processing apparatus of that type in which individual work units are intermittently advanced to successive stations, at each of which some step of a processing may be performed. However, all of the steps may not be required for the processing of certain work, so that it is desirable to provide advancement means for the work units which will by-pass certain stations.

It is the object of the invention to obtain a construction of this general type, more particularly designed for use in electroplating or other processes in which the work is immersed in treatment fluids held in tanks or containers at the several stations. It is a further object to obtain a construction in which the work units are suspended from individual carriers which are advanced in steps and which are elevated to lift the work above the tanks during transfer from one to another. It is a further object to provide means for holding the work thus elevated during certain portions of its step by step advancement to by-pass certain of the tanks. Still further it is an object to provide means for limiting the time of immersion of the work in certain treatment fluids to less than the interval of immersion in other fluids. With these objects in view the invention consists in various features of construction as hereinafter set forth.

In the accompanying drawings:

FIG. 1 is a side elevation of a portion of the apparatus including a number of tanks indicating the means for by-passing one or more of said tanks.

FIG. 2 is a plan view of FIG. 1.

FIG. 3 is an end elevation thereof.

FIGS. 4, 5 and 6 are views similar, respectively, to FIGS. 1, 2 and 3, illustrating a modified construction.

FIG. 7 is a view similar to FIG. 6, showing parts in different positions of adjustment.

FIG. 8 is a perspective view illustrating another feature of the invention.

FIG. 9 is a view similar to FIG. 7 showing another modification.

As shown in FIGS. 1 and 2, A are tanks arranged in a straight line series, preferably in two rows with a small space therebetween. The mechanism for advancing the work includes a carriage B arranged between the rows and extending substantially the full length thereof, being supported by rollers C on a track D. The carriage consists of a skeleton frame of a height somewhat more than that of the tanks and has mounted thereon opposite each of the tanks an elevator E having a cantilever arm E' extending from its upper end over the tank. This elevator includes a rack bar E^2 in mesh with the gear wheel F which is on a shaft F' extending substantially the length of the carriage. There is also a roller E^3 at the lower end of the rack for travelling over a vertical upright of the carriage frame and a roller E^4 near the upper end bearing against the rear side of rack bar. Thus, when the shaft F' is rotated in one direction it will simultaneously move upward all of the elevators E on one side of the carriage and adjacent to one row of tanks while rotation of the shaft in the opposite direction will lower the elevators. On the opposite side of the carriage are elevators adjacent to the second row of tanks, and as the rack bars of these elevators are operated by the same gear wheels that operate the first mentioned elevators, it is obvious that

while the elevators for one row are moving upward, those of the other row would be simultaneously moving downward. The individual work units to be plated or otherwise treated are suspended from individual carriers G (best illustrated in FIG. 8). Each carrier includes a transversely extending bar G' which at its opposite end rest upon rails H extending longitudinally over each tank. The ends of the cross bars have inverted U-shaped portions G^2 which embrace the rails with bearing members G^3 resting thereon. The work units I are suspended from hooks depending from the cross bar G' so as to be immersed in the fluid within the tank when the carrier is supported on the rails. If the fluid within the tank is a plating bath, one or both of the rails H will be electrified to form a cathode connection. Extending outward beyond the portions G^2 are plates G^4 which perform a function later to be described. Between the portions G^2 are arranged latch dogs G^5 pivoted at their upper ends to U-shaped members G^6 mounted on the cross bar G'. These dogs are capable of swinging outward from the members G^6 but when in vertical position are restrained from swinging in the opposite direction. The carriers G are advanced step by step along the rails H or other supporting rails by members mounted on cantilever arms extending laterally from the carriage B. A pair of these arms B' spaced from each other extend in a plane substantially at the level of the upper end of the carriage. Another pair of arms B^2 are at a higher level and supported on uprights B^3 extending upward from the carriage. Each pair of arms supports centrally over the tanks a longitudinally extending bar, and these bars B^4 and B^5 each having depending therefrom inverted T-shaped members including stem portions B^6 and head portions B^7. The arrangement is such that when the carriers G are supported at the corresponding level the T-heads on one of the bars B^4 and B^5 will pass through the U-shaped portions G^6 and displace the dogs G^5 when the carriage B is travelling in one direction, while during movement of the carriage in the opposite direction the heads B^7 engaging said dogs will move the carrier G with the carriage. By this construction the carriers G will be advanced step by step along the rails H or other supports later to be described. The spacing of the inverted T-heads is such that after the carrier G has been advanced along its rails by one of said heads engaging the dogs G^5, it will be in a position for the next advanced head to pass through the U-shaped embers G^6 in the reverse movement of the carriage. This will swing the dogs G^5 out of the path of the head so that when again travelling in a forward direction said dogs will be engaged by the head to advance the carrier another step. The cantilever arm E' of each of the elevators E has depending therefrom a pair of spaced members E^5, certain of which have in turn attached to their lower ends a member E^6 of angle cross section extending longitudinally therefrom. When the carriage is at one end of its reciprocating movement the members E^6 will extend beneath the plates G^4 of a carrier G so that when the elevator moves upward it will lift the carrier with it and hold it in such position while the carriage moves forward. This will elevate the suspended work unit so as to clear the upper ends of the tanks when passing from one tank to another, and in the subsequent lowering of the elevator, the work will be immersed in the next tank of the series. In this way the work units will be transferred from one tank to another and in the intervals between movements of the elevators said units will be advanced step by step along their supporting rails, as previously described. If, however, it is desired to by-pass a tank, the carrier raised by the elevator will be held at the upper

level during subsequent advancement by the following construction:

J are columns arranged in pairs upon opposite sides of a tank to be by-passed, extending upward above said tank and having at their upper ends inwardly extending arms J' which support longitudinally extending rails J^2.

These rails are in a position corresponding to the rails H but at the high level. They do not interfere with the upward or downward movement of the elevator and the members E^6 thereof, but the latter when the elevator is in position for beginning its downward movement will support the carrier G above the rail J^2. Consequently the carrier will be deposited on said rails and will be advanced step by step therealong by the members B^7 of the bar B^5. At the opposite ends of the rails J^2 the elevator has its members E^6 extending in the opposite direction so that during its upward movement it will lift the carrier from off the rails J^2 and advance it to a position where it is free to be lowered onto the rails H. The columns J and rails J^2 supported thereby may be temporarily positioned in connection with any tank which it is desired to by-pass and when not needed may be removed. An alternative construction is illustrated in FIGS. 5 to 7, inclusive, in which in place of the elevated rails J^2, the carrier is supported in its elevated position by other means after the elevator is lowered. This supporting means includes a cylinder K at the base of the structure and a piston therein having its piston rod K' extending upward therefrom. Connected to and extending upward from the piston K' is a column member K^2 having at its upper end a cantilever arm K^3 with a depending portion K^4 and a pair of angle bars K^5 attached to its lower end. This forms an inverted T structure which in one position of the carriage and elevator will be within the U-shaped members G^6 of the carrier. Consequently the carrier will be held in this elevated position so that the work will not be lowered with the elevator to be engaged with the processing means. In the next step the carrier will be lifted and advanced by the elevator to the next station. At any time when it is desired not to by-pass this station pressure fluid introduced into the cylinder K will raise the piston K', column K^2, and connecting parts, so as to remove the same from the path of the carrier.

As a further modification of this construction FIG. 9 the cylinder K^6 and piston rod K^7 may be made of suitable length so that the suspended carrier G may be lowered thereby to immerse the work unit in the fluid within the tank and raised again out of the fluid. This will be useful where the immersion in the fluid is only for a brief interval instead of the period determined by successive operations of the elevators E.

In the plating process it is sometimes advantageous to oscillate the work in the plating fluid. To accomplish this the supporting rails H may be oscillated by suitable means (not shown) but this might interfere with the progressive advancement of the carrier G therealong. We have, as shown in FIGURE 8 provided additional supporting rails L onto which the carriers are moved at the end of movement of the carriage. These rails have inclined ramp portions L' which lift the plates G^4 out of contact with the rails H so that the latter rails may be oscillated without disturbance of the carrier.

What we claim as our invention is:

1. In work processing apparatus including a series of tanks for treating agents, a reciprocatory carriage at one side of said series and extending to overlap all of said tanks, individual work suspension carriers, rails above said tanks on which said carriers rest with the work immersed in the tank, means on said carriage for advancing said carriers along said rails step by step in successive reciprocations, elevators on said carriage having cantilever arms extending over said tanks and located to lift said carriers and suspended work for clearance in passing from one tank to another and redepositing on a rail of the latter; means for by-passing a tank comprising an elevated support thereabove with which a work carrier is registered by the forward movement of an elevator from a preceding tank and on which it is supported during downward movement of said elevator.

2. The construction as in claim 1 in which said elevated support is out of the path of said elevators to avoid interference therewith.

3. The construction as in claim 2 in which said elevated support comprises a pair of spaced parallel rails, the advancing means for the carrier being located between said rails and the raising and lowering means therefor on the elevator cantilever arm being outside of said rails so as to avoid interference with each other.

4. The construction as in claim 3 in which the advancing means includes a cantilever arm on said carriage projecting over said station, a member depending from said arm centrally of said carriers, a pivoted latch dog on each carrier in the path of said depending member, being displaced thereby when the carriage moves in one direction and coupling said carrier to said member when the carriage moves in the opposite direction.

5. The construction as in claim 4 in which each carrier has a spaced pair of said latch dogs mounted thereon, and said depending member is of inverted T-shape, the head portion of which travels through a path intercepted by said dogs.

6. The construction as in claim 4 having spaced angle members depending from said elevator cantilever arm to be engageable beneath opposite end portions of one of said carriers in one position of said carriage, whereby said carrier may be raised and lowered by said elevator.

7. The construction as in claim 5 in which said depending member has a bar attached thereto extending longitudinally of the carriage and a series of T-heads spaced along said bar for successively engaging said latch dogs to advance the carrier step by step.

8. The construction as in claim 5 in which said carrier includes a bar extending across and supported upon said spaced rails, said bar having mounted thereon a pair of latch dogs adjacent to and inside of said rails for operation by said depending member and projections from said bar outside said rails for engagement with said spaced angle members.

9. The construction as in claim 8 in which said carrier bar has inverted U-bends therein slidably engaging said spaced rails and U-shaped members mounted sidewise on said bar adjacent to and inside of said bends and with their openings facing each other, said latch dogs being hinged at their upper ends to the upper portions of the last mentioned members and seated against the lower portion thereof, being free to swing outward and to be returned to their seats by gravity.

10. The construction as in claim 3 in which the upper rails are supported by columns at a side of the station and cantilever arms at the upper ends of said columns extending over the station and on which said rails are mounted.

11. Work processing apparatus including a reciprocating carriage, individual work suspension carriers intermittently advanced step by step by said carriage in one direction of its movement, an oscillating rail on which said carriers are supported during such advancement with the suspended work in operative relation to processing means, and a stationary rail on which each carrier is deposited at the end of each step of its advancement and on which it is supported during the return movement of said carriage.

12. The construction as in claim 1 in which said elevated support includes a rail corresponding to the lower rail on said tank and means for advancing said carriers step by step along the upper rail corresponding to the advancement means for carriers on the rail below.

13. In work processing apparatus including a series of tanks for treating agents, a reciprocatory carriage at one side of said series and extending to overlap all of said tanks, individual work suspension carriers, rails above said tanks on which said carriers rest with the work immersed in the tank, means on said carriage for advancing said carriers along said rails step by step in successive reciprocations, elevators on said carriage having cantilever arms extending over said tanks and located to lift said carriers and suspended work for clearance in passing from one tank to another and redepositing on a rail of the latter; means for by-passing a tank comprising an elevated support thereabove with which a work carrier is registered by the forward movement of an elevator from a preceding tank and on which it is supported during downward movement of said elevator, said elevated support including a column at a side of the station, a cantilever arm at the upper end of said column extending over the station and to which said elevated support is directly connected, and means for raising said column to remove said elevated support when not required from the path of said carriers.

14. The construction as in claim 13 in which said means for raising said column is a fluid actuated cylinder and piston motor.

15. The construction as in claim 14 in which said cylinder is of sufficient length to lower said supporting means with said carrier thereon so as to engage the suspended work with the processing means at the station.

16. Work processing apparatus including a series of tanks for treating agents, a reciprocatory carriage at one side of said series and extending to overlap all of said tanks, individual work suspension carriers, oscillating rails above said tanks on which said carriers rest with the work immersed in the tank, means on said carriage for

advancing said carriers along said oscillating rails step by step in successive reciprocations, additional stationary supporting rails on which each carrier is deposited at the end of the advancement of the work through said tank, and elevators on said carriage having cantilever arms extending over said tanks and located to lift said carriers and suspended work for clearance in passing from one tank to another, said elevators redepositing said carriers on rails above the successive tank.

17. The construction as in claim 16 in which said additional supporting rails are arranged above the level of said oscillating rails for a distance corresponding to the end only of said advancement through the tank, and are also provided with ramps rising from a point below the level of said oscillating rails.

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