Feb. 5, 1957 J. V. DAVIS 2,780,229

WORK-HANDLING APPARATUS FOR TREATING HOLLOW ARTICLES

Filed Feb. 16, 1953

4 Sheets-Sheet 1

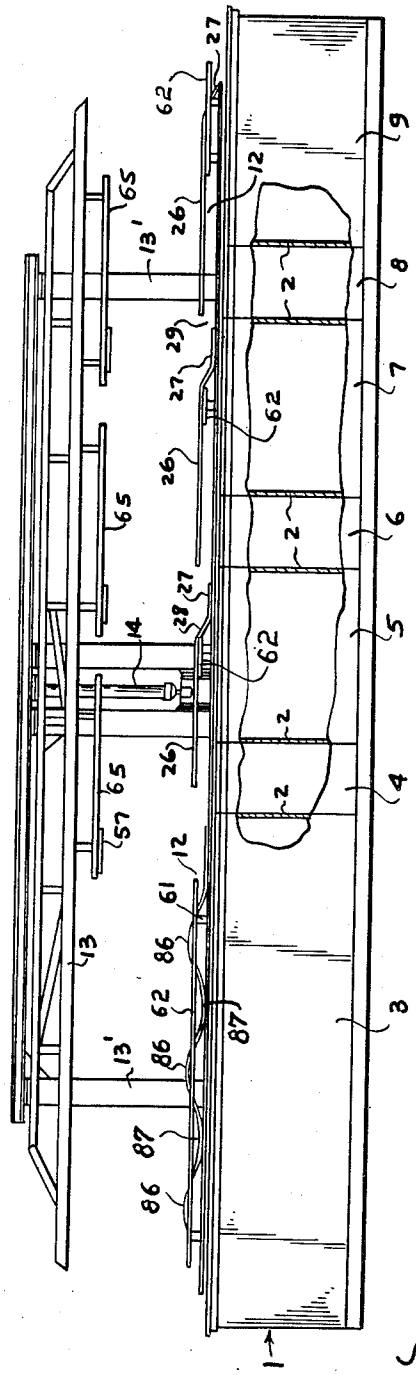


Fig. 1

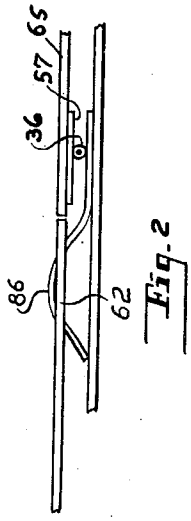


Fig. 2

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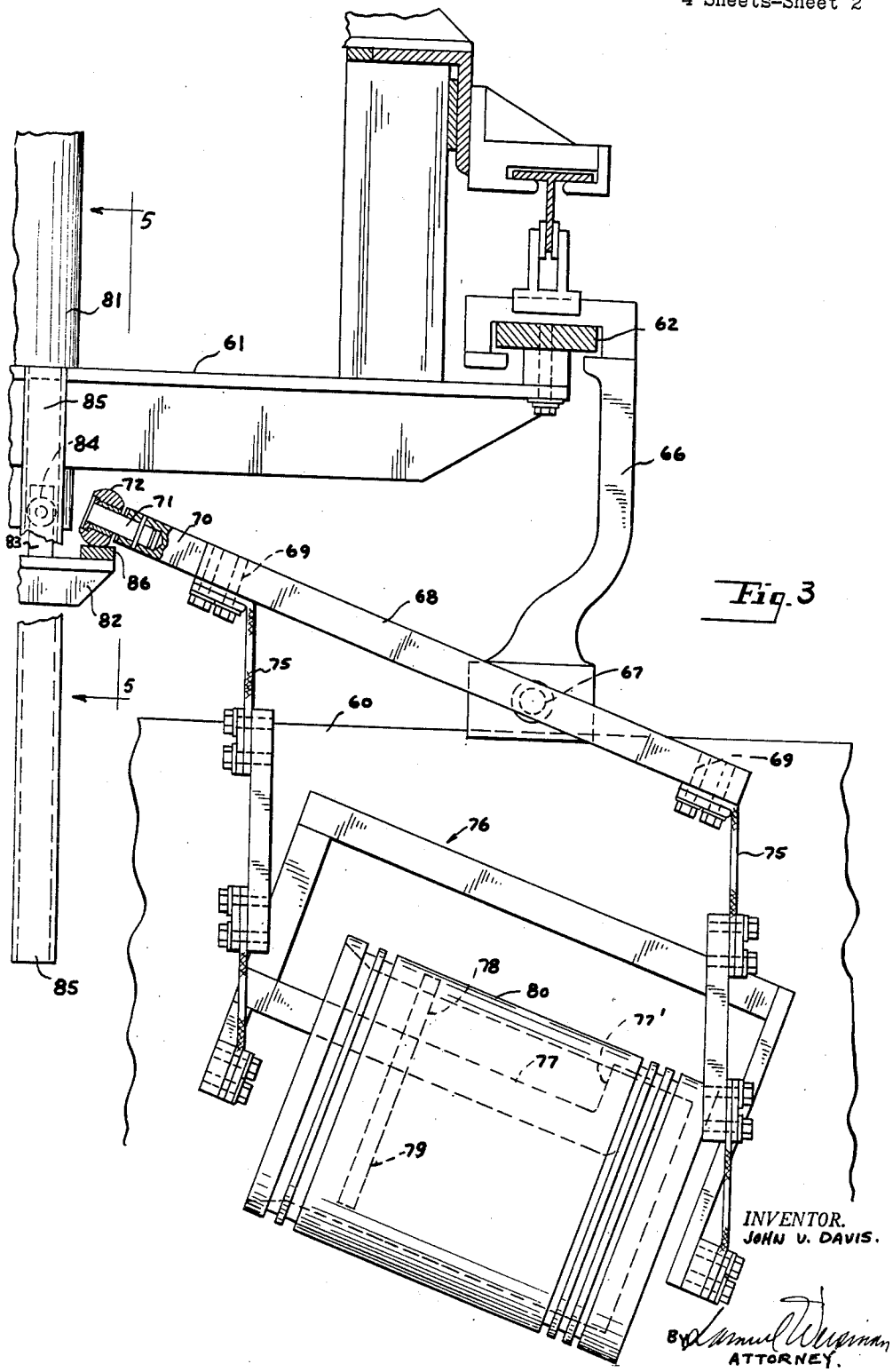


Fig. 3

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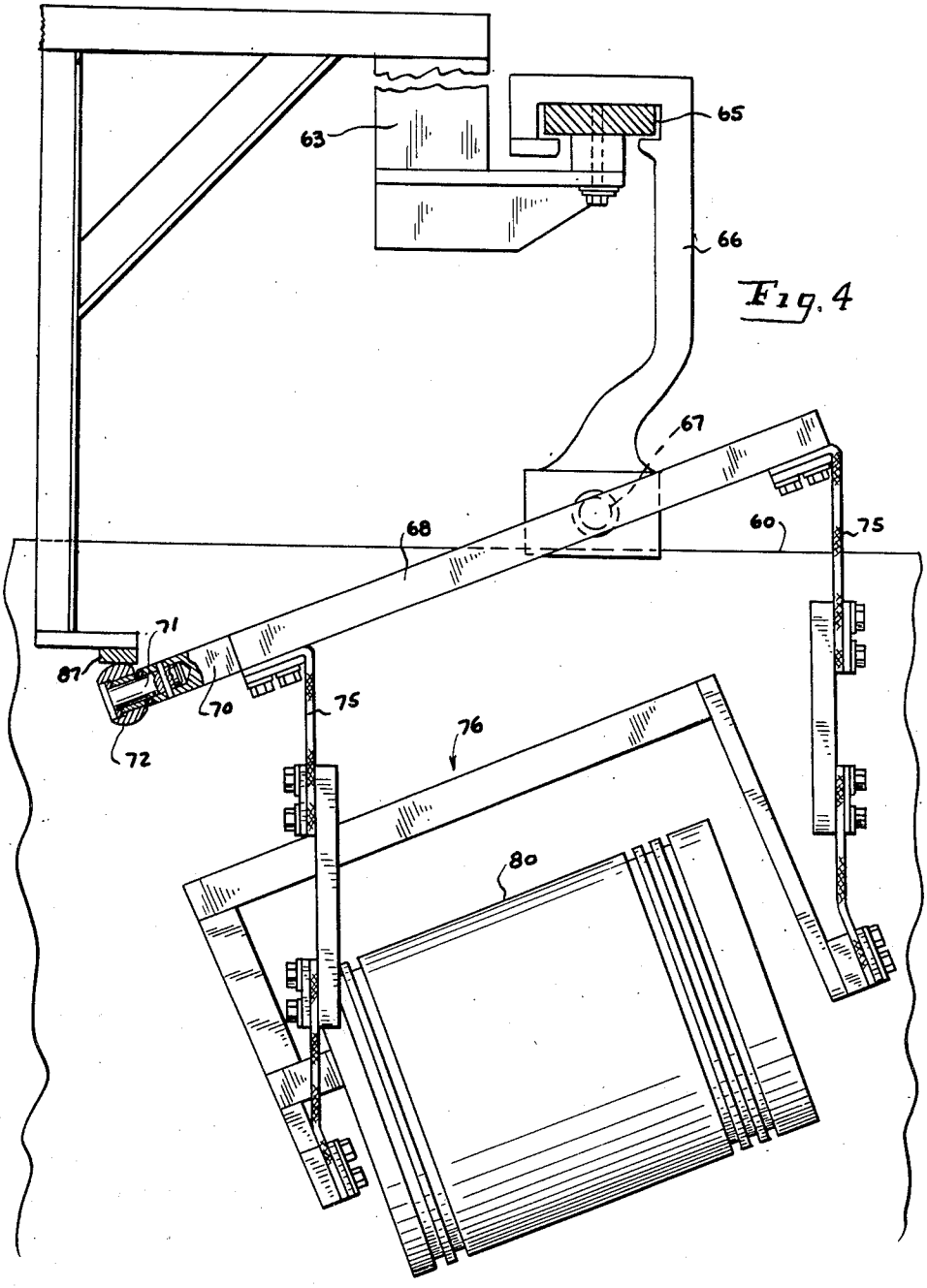


Fig. 4

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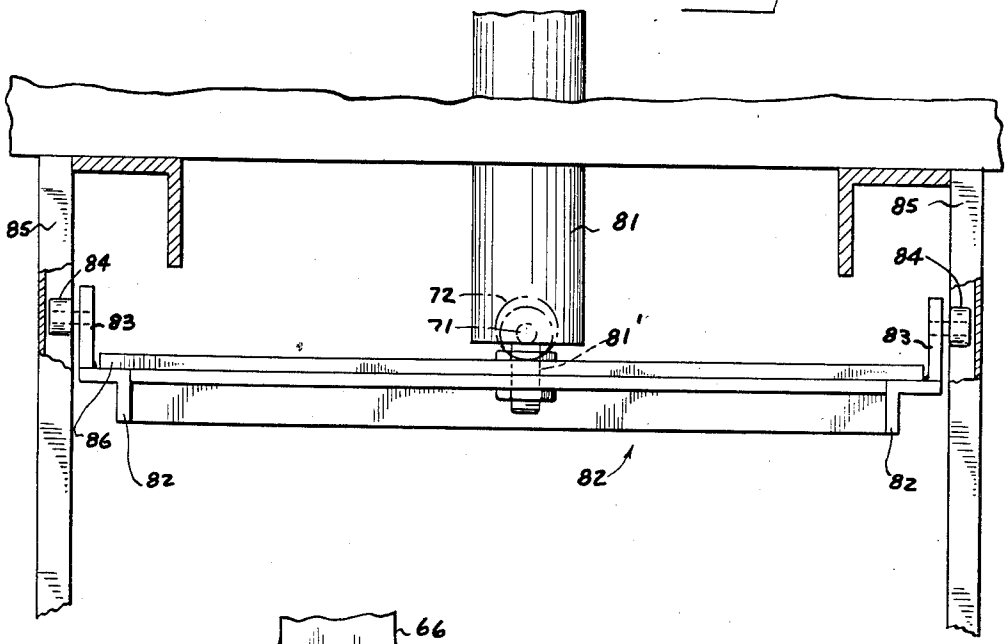
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Feb. 5, 1957 J. V. DAVIS 2,780,229

WORK-HANDLING APPARATUS FOR TREATING HOLLOW ARTICLES

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Fig. 5



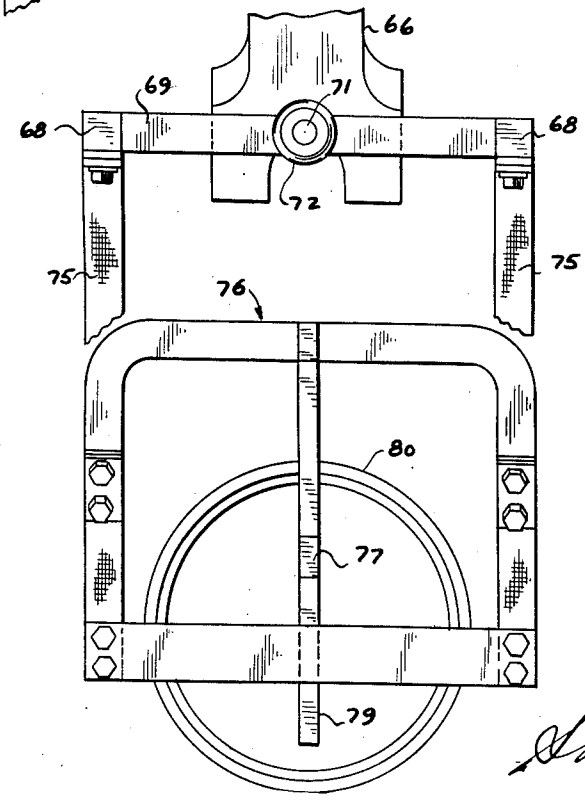


Fig. 6

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2,780,229

WORK-HANDLING APPARATUS FOR TREATING HOLLOW ARTICLES

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Application February 16, 1953, Serial No. 337,048

6 Claims. (Cl. 134—76)

The present invention pertains to a novel work-handling apparatus and particularly to a plating machine including a series of tanks.

In plating the interior of hollow articles having one open end, it is desirable to immerse the artcile mouth upward to avoid trapping of gases formed within the articles. When an article is lifted in transfering from one tank to the next, it should be turned mouth downward in order to drain before alining with the next tank which contains a different solution. The principal object of this invention is to provide means to maintain these two positions as desired.

The machine is of the type in which a work hook is moved along a rail. To accomplish the stated object of the invention, a work carrier is pivotally mounted on the hook and is preferably so mounted that the work piece supported thereby swings into a mouth downward position by gravity. An extension from the carrier rides on a cam designed to tilt the carrier so that the work piece therein is mouth upward. This cam is operative in the described manner when the work piece is immersed.

When the hook is lifted out of the cam for transfer, the work piece will take a mouth downward, emptying position by force of gravity. However, a supplemental means for maintaining this position during transfer may be provided.

In one form of the invention the cam means is a vertically movable strip timed in its movement to hold the work carrier in the upwardly tilted position or permit it to take the downward tilted position, as required in the operation of the apparatus.

In another embodiment, the cam is stationary and has two different levels for the two positions.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings in which

Figure 1 is a side elevation of a plating apparatus equipped with the invention, with the chassis raised;

Figure 2 is a detail side elevation with the chassis lowered;

Figure 3 is a cross section of a plating apparatus, showing a form of work support and tilting means, in plating position;

Figure 4 is a similar view in transfer position;

Figure 5 is a section on the line 5—5 of Figure 3, and Figure 6 is an end view of the work support.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

In Figure 1 is shown schematically a plating tank structure 1 divided by partitions 2 to form a series of consecutive tanks 3, 4, 5, 6, 7, 8 and 9. The tanks are of various lengths and may be varied in number according to the character and number of operations performed on the work. The old features of Figure 1 which will now be described briefly are shown in greater detail in U. S. Patent No. 2,591,682, of April 8, 1952. A

cathode rail 62 is supported over the top of the tanks by transverse arm 61. The rail is interrupted at 12 at the transverse areas or where the work is to be lifted over a partition 2. For this lifting movement a vertically movable chassis 13 is guided on vertical posts 13' and is propelled from a fluid cylinder 14 with suitable connecting parts and counterweights as disclosed in the aforementioned patent. The purpose of the chassis is to carry transverse rail segments 65 adapted to enter the spaces 12 and to take work from the fixed rail sections 62, after which the work is elevated with the chassis 13 and rail segments 15 to be transferred over the partitions 2. The means for propelling the work on the rail parts 62 and 65 is also familiar in the art and shown in the aforementioned disclosures.

Each work carrier assembly is associated with a hook 66 slidable on the rails, and only one such assembly need be described. A bar 68 is pivoted across the shank on an axis parallel to the rails, and a support rod 75 is suspended from each end thereof.

Over each tank are mounted transverse supporting arms 61 carrying a cam track consisting preferably of flat stock and having at least one high portion and one low portion at each end. At the tank 3, for example, the cam track is undulating, consisting of a number of high points 86 and intervening low points 87. The next track has a horizontal high portion 26 lying over the tank 4 and extending partially over the tank 5, with a low horizontal portion 27 near the end of the tank 5 where the work is to be lifted out of this tank. The portions 26, 27 are connected by a sloping portion 28. There is no change of cam structure over the tank 4, inasmuch as the work is merely dipped therein while suspended from the overhead transfer rail segment. The cam sections may be separated at 29 where no cam action occurs, as will presently appear. The cam structure 26—28 may be repeated, and each cam section terminates in a low portion 10 or 27 in the area where the work is to be lifted for transfer.

It is desirable, in fact essential, to empty the work pieces before they are transferred to the next tank containing a different solution. For this reason, each cam track has a low section 27 near the transfer point as already indicated. The undulating action at the cam 86, 87 over the longer tank 3 is desirable for rinsing.

When a carrier assembly is initially lifted by a transfer rail segment 15, it is weighted by liquid to remain mouth downward until the pieces are emptied. However, to insure this position notwithstanding shifting of weight by discharge of liquid, the follower 36 on a low end portion 27 will ride under an upper cam or hold-down 57 as shown in Figure 2. This member holds the basket's mouth downward during the lift and the emptying, after which the hook is shifted along the segment 15 by the means previously mentioned. Since the work pieces are now empty, it is material that they swing to the mouth upward position.

In the detailed embodiment shown in Figures 3–6, the top of the tank or series of tanks is indicated by the numeral 60, and the general tank and rail structure corresponds to that shown in Figure 1. Transverse supports 61 carry the fixed and spaced work rail sections 62, and the vertically movable chassis 63 (Figure 4) carries the movable rail segments 65 adapted to fit in the spaces between the sections 62 as in Figure 1. The work hook 66 suspended from any part of the rail structure is representative of a series of such hooks moved by known means through the several tanks and lifted from tank to tank on the corresponding segments 65 as previously set forth.

The carrier structure includes a pivot shaft 67 journaled at its midpoint in the lower end of the hook 66. Parallel arms 68 are secured to the ends of the shaft 67 at points

between the ends of the arms. The ends of opposite arms are joined by bars 69 to form a rectangular frame. From the midpoint of one of the bars 69, an arm 70 is extended outward and receives a coaxial stub shaft 71 on which is journaled a roller or follower 72.

Flexible conducting members 75 are suspended from the four corners of the rectangle formed by the members 68, 69 and carry at their lower ends a frame structure designated generally by the numeral 76. A hooked arm 77 extends into the frame structure from one end thereof and crosswise of the shaft 67. The finger carries upwardly and downwardly extending lugs 78, 79 respectively to engage or position a piece of work mounted on the finger 77. This piece of work is an open-ended part such as a piston 80 inserted in the frame and over the member 77 so that its hooked end 77' and the finger 78 engage internal grooves in the piston to prevent it from sliding.

The roller 72 in this case rides on strips or bars which are designated as cams, and so to be understood in the claims, in the sense that they constitute a means for raising and lowering the roller. Vertical cylinders 81 are carried by the fixed structure at suitable intervals, and the piston rod 81' of each such cylinder carries a vertical U-shaped frame 82 lying in a plane parallel to the direction of the work rail 62. The uprights 83 of the frame carry rollers 84 riding in fixed guide channels 85. The top of the frame carries the cam strip 86 on which the roller 72 rests.

The center of gravity of the mounted work piece 80 is between the open end thereof and perpendicular from the pivot shaft 67. Thus, the frame 76 and the arms 68 tend to tilt in the direction that brings the mouth of the work piece downward. The preferred plating position, however, is mouth upward, and the cam member 86 is positioned to bring the roller 72 and the open end of the work piece upward while the work is moving along the tank. At the beginning of the dwell interval, that is, when the movement of the work along the rail is stopped and the work is shifted to a vertically movable segment 65 for transfer, a suitable timed mechanism operates on the cylinder 81 to bring the frame 82 and cam member 86 downward. The work piece 80 then assumes the mouth downward position.

As the work hook 66 first rides on the movable segment 65 while the chassis is still down, the roller 72 rides under an upper cam strip 87 carried by the chassis. The member 87 maintains the work piece 80 in the mouth downward position in a positive manner, against a possible shift of the center of gravity as the liquid pours out of the work piece during the ascent of the chassis 63. Since the segment 65 and work hook 66 rise with the chassis, it will be understood that the cam member 87 maintains the same relative position to the roller 72 in this movement. The roller 72 may ride off the cam 87 when transfer commences shortly after the rail segment 65 reaches its uppermost position. By this time the work piece has emptied, having been held mouth downward by the cam 87 during the entire upward movement of the chassis 63.

By the time the chassis descends again, the cam 86 has been adjusted by timed operation of the cylinder 81 to bring the work piece to the mouth upward position. However, at one or more of the tanks, it may be desired to have the work piece immersed in the mouth downward position for rinsing or removing sludge, or otherwise where no electrolytic action is performed. In such cases the cam 86 is permitted to fall away by timed operation of the cylinder 81, and the work piece takes the described position by gravity.

In the embodiment shown in Figure 6, the carrier is an articulated parallelogram structure suspended from the hook 66. The lower transverse side of the parallelogram may be regarded as imaginary or may be read on the structure 76. In either case there is articulation at all vertices of the parallelogram since the suspended

members 75 in this case are flexible braid and constitute the vertical sides.

The advantage of the parallelogram action is a rocking of the work without substantial horizontal sway. If such sway were present as in prior devices, it would be necessary to make the tanks wider. The sway would be considerably wider at the bottom that at the top. As a practical matter in any case, it would not be feasible to rock the vertically suspended work across the width of a tank of practical proportions.

Although specific embodiments of the invention have been illustrated and described, it will be understood that various alterations in the details of construction will be made without departing from the scope of the invention as indicated by the appended claims.

What I claim is:

1. In a work-handling apparatus, a tank, a rail over said tank, a work carrier hook suspended from and slidable on said rail for supporting work in said tank, an articulated parallelogram work carrier structure suspended from said hook, said structure including an arm pivoted between its ends to said hook and having two side members depending from said arm at opposite sides of its pivot point, and means for imparting vertical movement to one of said depending members, whereby said structure is rocked on a horizontal axis without substantial horizontal sway.

2. In a work-handling apparatus, a series of tanks, a rail over said tanks, a work carrier hook suspended from and slidable on said rail for supporting work in said tanks, a work carrier pivotally mounted on said hook, an arm extending from said carrier transversely of said rail, vertically acting cam means along said rail and bearing vertically on said arm to hold said carrier in an upwardly tilted position, a vertically movable chassis over said tanks, a rail segment carried by said chassis and receivable in a gap in said rail over the abutting ends of two consecutive tanks, and a cam member carried by said chassis and positioned to bear downward on said arm to hold said carrier in a downwardly tilted position during upward movement of the chassis.

3. In a work-handling apparatus, a series of tanks, a rail over said tanks, a hook suspended from and slidable on said rail, a work carrier including an arm pivotally attached to said hook and extending transversely of said rail, a frame suspended from said arm for supporting work in said tanks, an extension from said arm, and vertically acting cam means along said rail and bearing vertically on said extension to hold said frame in an upwardly tilted position.

4. In a work-handling apparatus, a series of tanks, a rail over said tanks, a hook suspended from and slidable on said rail, a work carrier including an arm pivotally attached to said hook and extending transversely of said rail, a frame suspended from said arm for supporting work in said tanks, an extension from said arm, vertically acting cam means along said rail and bearing vertically on said extension and means for vertically adjusting said cam means to hold said frame in corresponding tilted positions.

5. In a work-handling apparatus, a series of tanks, a rail over said tanks, a hook suspended from and slidable on said rail, a work carrier including an arm pivotally attached to said hook and extending transversely of said rail, a frame suspended from said arm for supporting work in said tanks, an extension from said arm, vertically acting cam means along said rail and bearing vertically on said extension to hold said frame in an upwardly tilted position, a vertically movable chassis over said tanks, a rail segment carried by said chassis and receivable in a gap in said rail over the abutting ends of two consecutive tanks, and a cam member carried by said chassis and positioned to bear downward on said extension to hold said carried in a downwardly tilted position during upward movement of the chassis.

6. In a work-handling apparatus, a series of tanks, a

rail over said tanks, a hook suspended from and slidable on said rail, a work carrier including an arm pivotally attached to said hook and extending transversely of said rail, a frame suspended from said arm for supporting work in said tanks. an extension from said arm, vertically acting cam means along said rail and bearing vertically on said extension, means for vertically adjusting said cam means to hold said frame in corresponding tilted positions, a vertically movable chassis over said tanks, a rail segment carried by said chassis and receivable in a gap in said rail over the abutting ends of two consecutive tanks, and a cam member carried by said chassis and positioned to bear downward on said extension to

hold said carrier in a downwardly tilted position during upward movement of the chassis.

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