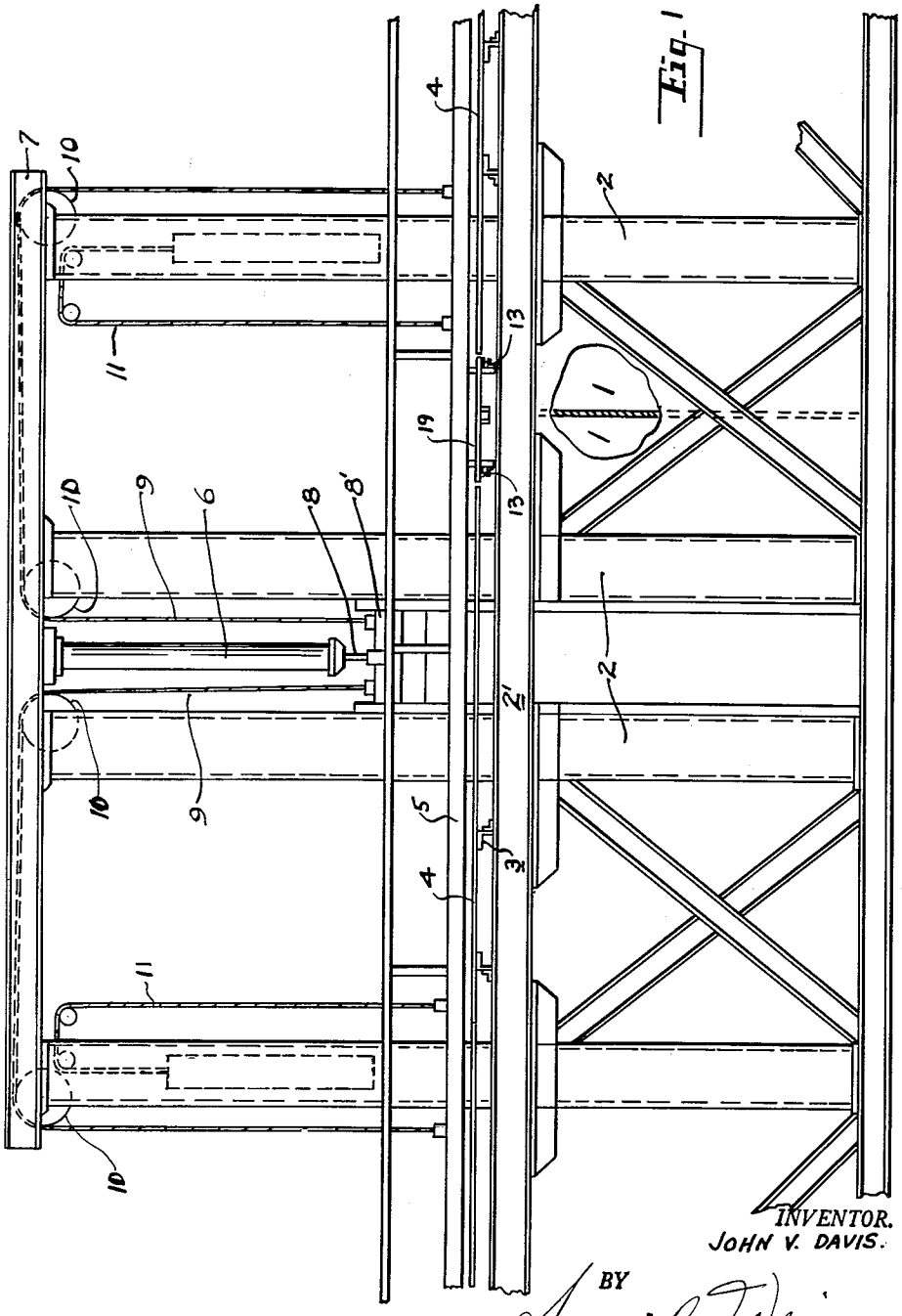
April 10, 1956 J. V. DAVIS 2,741,252

WORK TREATING APPARATUS WITH TILTING WORK-SUPPORTING RAIL

Original Filed Dec. 4, 1952 4 Sheets-Sheet 1

Fig. 1




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WORK TREATING APPARATUS WITH TILTING WORK-SUPPORTING RAIL

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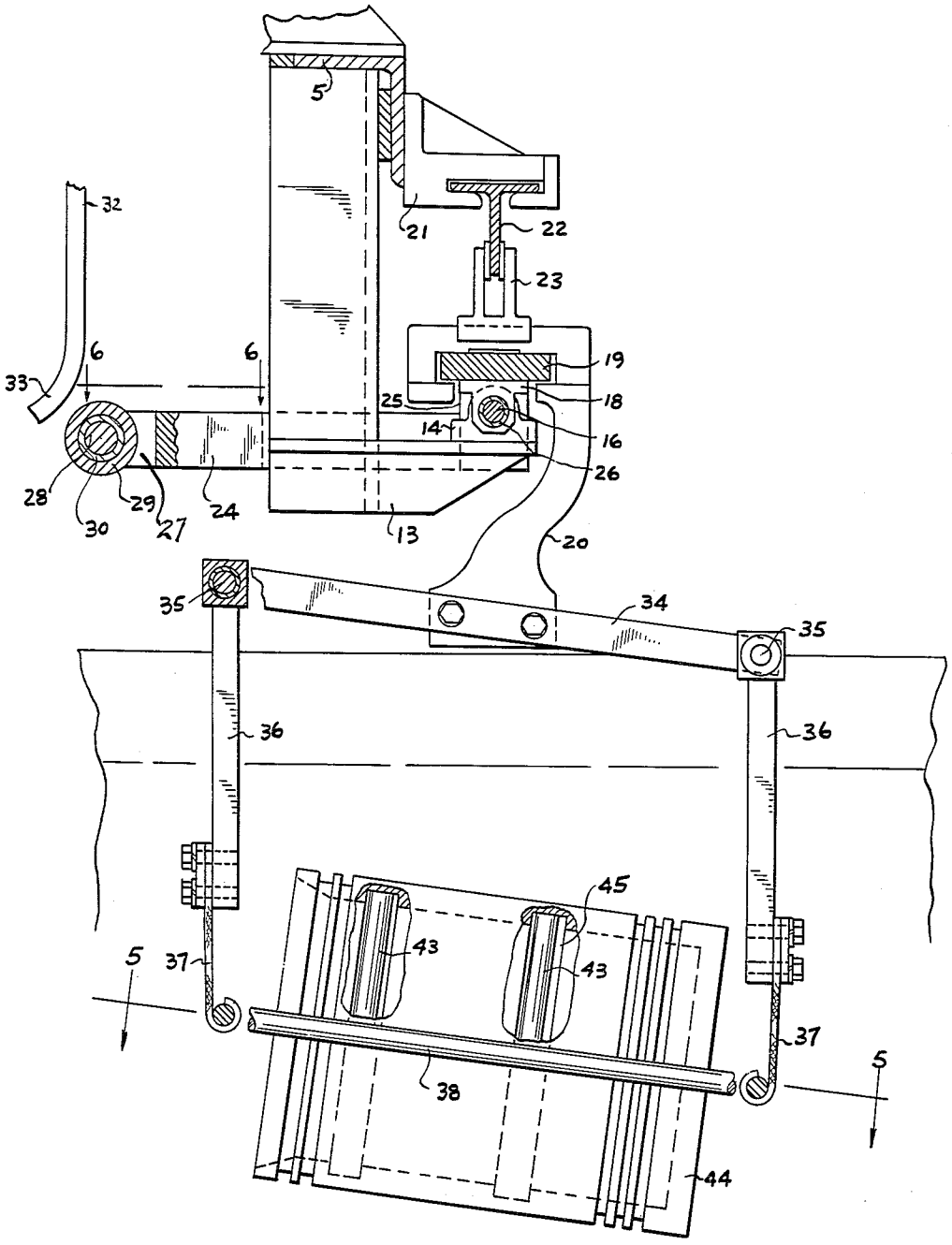



Fig. 2

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WORK TREATING APPARATUS WITH TILTING WORK-SUPPORTING RAIL

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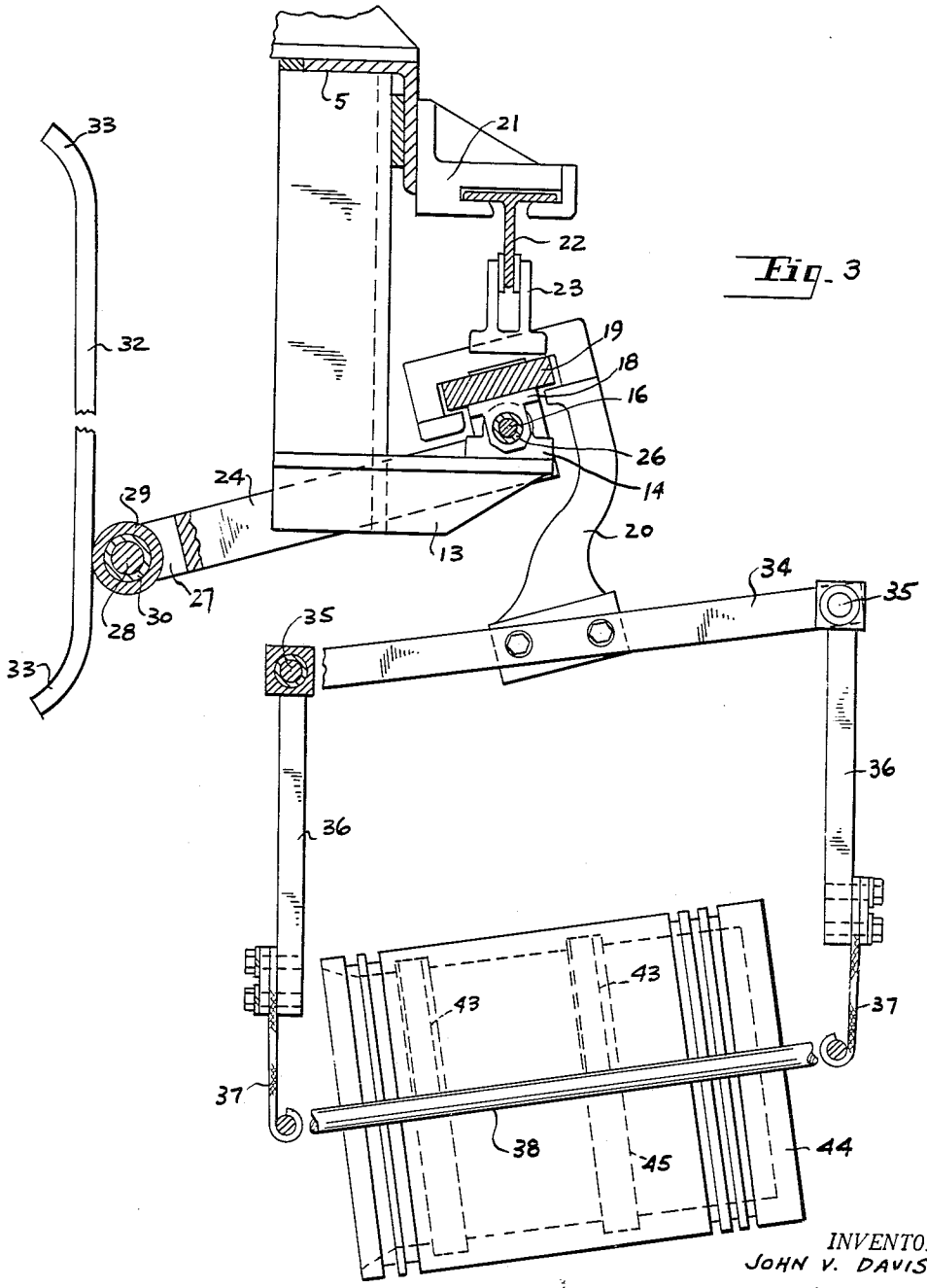



Fig. 3

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WORK TREATING APPARATUS WITH TILTING WORK-SUPPORTING RAIL

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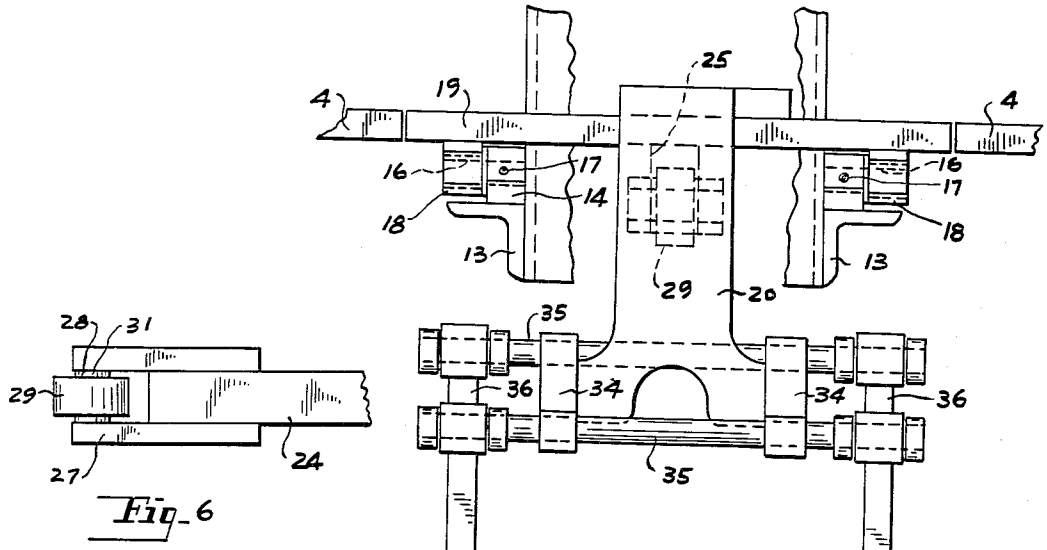



Fig. 6

Fig. 4

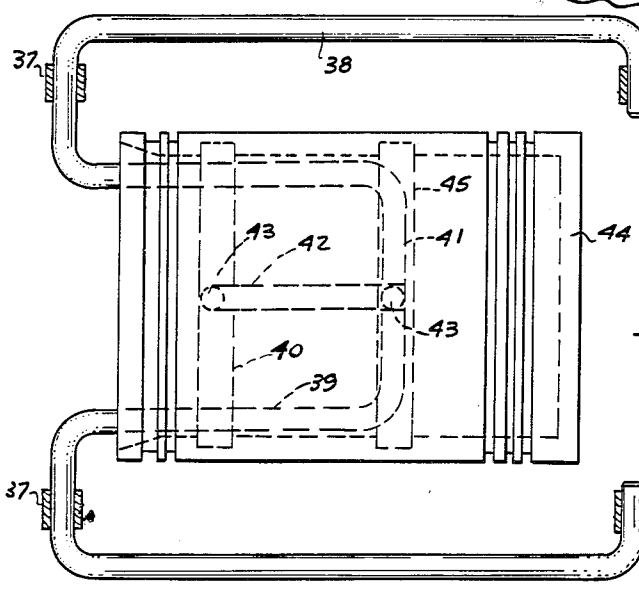



Fig. 5

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United States Patent Office 2,741,252 Patented Apr. 10, 1956



2,741,252

# WORK TREATING APPARATUS WITH TILTING WORK-SUPPORTING RAIL

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Continuation of abandoned application Serial No. 324,095, December 4, 1952. This application February 11, 1954, Serial No. 409,568

12 Claims. (Cl. 134—76)

This application is a continuation of my abandoned co-pending application Serial No. 324,095, filed December 4, 1952, allowed October 8, 1953.

The present invention pertains to a novel work-immersing apparatus and particularly to a plating machine as herein disclosed, although not necessarily limited thereto.

The machine is of the character in which the work, suspended from hooks, is moved through a series of tanks or baths. Segments of the rail are separate and vertically movable in order to lift a piece of work from one tank to the next as already known in the prior art and disclosed in several patents issued to me.

Hollow work pieces, such as shells or pistons, should be emptied of liquid before being moved from one tank to another. This would be no problem if the pieces were normally suspended mouth downward, but this position would lead to difficulties in plating, and in fact it is preferred that the pieces be suspended level or mouth upward in the liquid.

The principal object of the invention is to provide a work-carrying rail with means for tilting the rail and the work carried thereby on a pivotal axis lengthwise of the rail. This movement causes the work to agitate the solution at least until the work emerges from the solution.

Another object of this invention is to provide a mechanism whereby the pieces may be initially suspended in the described desired position and subsequently tilted for emptying in the transfer operation, in a machine having vertically movable rail segments as set forth above. Another object is to provide such mechanism that operates simultaneously with or is dependent on the transfer operation.

In the accomplishment of these objects, the rail is flat or otherwise of a character that does not permit the work-carrying hook to rotate thereon. Each vertically movable rail segment has a pivotal mounting on its support which in turn is carried by a vertically actuated chassis disclosed in the prior art referred to above. The movable rail segment is fixed to one end of a lever arm, the other end of which carries a roller adapted to engage a vertical cam while the segment moves vertically. Such a cam is provided at both terminal positions of a transfer movement lengthwise of the rail. Each cam is in the path of the vertically moving roller and therefore swings the lever arm and tilts the connected rail segment about the pivotal axis of the latter. Since the work-carrying hook is non-rotatable on the rail segment, it is also tilted, carrying with it the suspended hollow work piece which is so positioned that the tilting movement brings its mouth downward for emptying.

When the roller reaches the upper end of the cam, it is relieved of cam pressure, whereupon the rail segment returns to its normal or level position, permitting movement of the hook on the elevated rail segment. Although the assembly is again tilted while riding down the cam, the lower end of the lever is so constructed as to



permit a return to level or normal position when the work piece becomes immersed.

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 machine constructed according to the invention;

Figure 2 is a vertical cross section showing the vertically movable rail in its lower position;

Figure 3 is a similar section showing the same rail partly elevated and tilted;

Figure 4 is a detail vertical elevation at right angles to Figure 2;

Figure 5 is a section on the line 5—5 of Figure 2, and

Figure 6 is a detail plan view on the line 6—6 of Figure 2.

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

The apparatus includes a series of contiguous tanks 1 and a number of columns 2 at intervals along the sides of the series for supporting accessory mechanism as will presently be shown. Horizontal frame members 2' are supported by the columns, and arms or cantilevers 3 extend from one of the bars to support fixed rail segments 4. These segments are interrupted by movable rail segments by which the work, suspended from the rail, is lifted in transferring from one tank to another.

In order to accomplish the lifting movement, a chassis 5 is guided vertically along the columns 2 or other suitable guiding structure, as already known in the art. The chassis may be actuated, for example, from a hydraulic cylinder 6 suspended from a top frame member 7 on the columns and having therein a piston with a downwardly extending piston rod 8. A crosshead 8' on the piston rod is joined to the chassis 5 by chains or cables 9 passing over pulleys 10 mounted on the frame structure. Counterweighting devices 11 may be added. For each movable rail segment, a suitable number of rail supports 13 are suspended from the chassis 5 and are generally similar to the arms 3 but not fixed to the columns 2. Only one assembly between an arm 13 and the corresponding movable rail segment need be described, since these assemblies are merely repeated if more than one arm 13 is employed for a given movable rail segment.

Each of the opposed supports 13 carries a pillow block 14, and the two blocks are alined lengthwise of the machine. A pivot shaft 16 extends from each block 14 and is secured therein by a pin 17. Another pillow block 18 is rotatably mounted on the extending portion of each shaft 16 and extends somewhat higher than the adjacent block 14 as shown in Figure 4. The movable rail segment 19 is secured upon the two blocks 18 and is adapted to aline with the adjacent fixed segment or segments to form a continuous rail when the chassis 5 is in its lower position, as shown in Figure 1.

Work hooks 20 are slidably keyed on and suspended from the several rail segments at selected intervals as known in the art. The hooks carry the work immersed in the tanks and are moved along the rail segments by familiar means. For example, a horizontal track 21 is secured to the chassis 5 and carries a T-shaped pusher bar 22. Pushers 23 are pivotally attached to the bars 22 and engage the hooks at one side. The bars 22 are oscillated by suitable mechanism, such as that shown in my United States Patent No. 2,591,682, of April 8, 1952, whereby the hooks are moved along the rail segments.

To the lower surface of each movable rail segment 19 is secured a pivot arm 24 by suitable means such as a welded block 25. The pivot arm causes the segment 19 to pivot or tilt on the alined shafts 16, as will be shown,

To accommodate this movement, a bushing **26** surrounds each pivot shaft within the corresponding pillow block **18**. The free end of the arm **24** is forked at **27** to carry a shaft **28** on which is mounted a roller **29** with an interposed bushing **30**. Washers **31** are mounted on the shaft **28** at the ends of the roller. The arm **24** extends in the same direction as the supporting arms **13**, leaving the other side clear for movement of the hook **20**.

At the transfer position, where the movable rail segment **19** is to be lifted with the chassis **5**, the supporting structure **2, 7** carries a vertical cam **32** having its ends **33** bent outward. On the initial shifting movement, the roller **29** engages the lower end **33** and then rides on the main vertical portion of the cam, causing the pivot arm **24** to swing and thereby tilt the segment **19** as shown in Figure 3. The hook **20** on the segment **19** tilts therewith, and the purpose of this movement is to agitate the tank solution initially and to drain a hollow work piece suspended from the hook, as will now be described.

To the sides of the hook **20**, at the lower ends, are fastened a pair of cross bars **34** lying transversely of the tanks, with a pair of shafts **35** passed through the ends of both arms. From each end of each shaft is pivotally suspended a hanger **36**, and from the lower end of each hanger is suspended a flexible connector **37** such as wire braid.

A modified U-shaped bar frame **38** has its sides supported by the four connectors **37**, as shown in Figure 5. From end to end the frame lies crosswise of the tank, with one end somewhat higher than the other. The modification of the U-shape consists in the formation of a U-bend **39** from the intermediate side that joins the outer sides of the frame. A cross bar **40** is welded between the parallel sides of the bend **39** in parallel relation to the third side **41**. A bracing rod **42** is welded between the parts **40** and **41**, a radial support rod **43** extends from the ends of the member **42**.

The hollow work piece is here illustrated by a piston or shell **44** slipped over the intermediate bent portion **39** of the frame and held by the support rods that extend into internal grooves **45** in the member **44**.

The normal or immersed position of the work piece **44** is shown in Figure 2, wherein the work piece slopes downward from its open end. The described tilting action empties the work piece while being transferred from one tank to another, inasmuch as the work piece is tilted to bring its open end downward before passing to the next tank.

The upper end **33** of the cam **32**, being also directed away from the rail segment **19**, relieves the roller **29** of cam pressure when disengaged by the roller **29**. The arm **24** and segment **19** thereby return to their normal or untilted position, wherein the work-advancing means **21—23** carried by the chassis **5** is capable of advancing the hook **20** as known in the art or as disclosed in the aforementioned patents.

The axis of the work support **38—43** lies transversely of the tank or of the pivot shafts **16**. The work piece **44** lies on the same axis so that its open end faces laterally rather than directly upward. The amplitude of oscillation of the rail **19** is relatively short and is such that the load-supporting end of the hook **20**, along the member **34**, lies at all times below the rail **19** as may be seen in Figures 2 and 3. There is no inversion of the work support but rather a reversal of the inclination thereof with respect to the horizontal while remaining at all times below the rail **19**.

With the work piece tilted upward toward the mouth as Figure 2, gas will collect in the upper closed corner of the piece during plating. The gas will flow along the top line of the work piece and out through the top of the mouth. Replacement by liquid will occur through the lower portion of the open mouth, thereby creating a definite flow path rather than a random turbulence as would be the case if the mouth were facing straight up or straight down. The described flow path of liquid causes a smooth, beneficial purging action.



Although a specific embodiment of the invention has 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-treating apparatus, a support, a horizontal rail pivotally mounted on said support on a horizontal longitudinal axis, a tank below said rail and positioned lengthwise thereof, a work-carrying hook suspended from said rail and slidably keyed thereon against release from the rail in any direction transverse of the rail, load-carrying means on said suspended hook and extending into the tank, means for oscillating said rail on said pivotal axis in a short arc of such amplitude as to maintain the lower end of said hook below said rail in all positions of the rail, and means for advancing said hook on said rail.

2. In a work-treating apparatus, a support, a horizontal rail pivotally mounted on said support on a horizontal longitudinal axis, a tank below said rail and positioned lengthwise thereof, a work-carrying hook suspended from said rail and slidably keyed thereon against release from the rail in any direction transverse of the rail, load-carrying means on said suspending hook and extending into the tank, an arm connected to said rail and extending transversely therefrom, means for oscillating said arm about said pivotal axis in a short arc of such amplitude as to maintain the lower end of said hook below said rail in all positions of the rail, and means for advancing said hook on said rail.

3. In a work-immersing apparatus, a work rail, a vertically movable segment in said rail, means for moving said segment, means rendered operative by the first means for tilting said segment as the segment is elevated and returning the segment to its original position as the segment is lowered, a work-carrying hook slidably mounted on said rail to tilt with said segment, and means for advancing said hook on said rail.

4. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a lever arm fastened to said segment and extending transversely thereof, means rendered operative by the first means for tilting said segment as the segment is elevated and returning the segment to its original position as the segment is lowered, whereby to tilt said hook.

5. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a lever arm fastened to said segment and extending transversely thereof, a vertical cam engageable by the free end of said arm during vertical movement of said segment and constructed to tilt said arm as said segment is elevated, whereby to tilt said segment and hook.

6. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a lever arm fastened to said segment and extending transversely thereof, a vertical cam obstructing the vertical path of the free end of said arm, the lower end of said cam being curved away from said segment, whereby to direct the free end of said arm to the main

portion of the cam and thereby tilt said segment and hook.

7. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a lever arm fastened to said segment and extending transversely thereof, a vertical cam obstructing the vertical path of the free end of said arm, both ends of said cam being curved away from said segment, whereby the lower end directs the free end of said arm to the main portion of the cam and thereby tilts said segment and hook, and the upper end relieves the arm of cam pressure.

8. In a work-immersing apparatus, a work rail, a vertically movable segment in said rail, means for moving said segment, means rendered operative by the first means for tilting said segment as the segment is elevated and returning the segment to its original position as the segment is lowered, a work-carrying hook slidably mounted on said rail to tilt with said segment, and means for advancing said hook on said rail, and a frame rigidly suspended from said hook, said frame having projecting portions adapted to support open-ended work pieces.

9. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a frame rigidly suspended from said hook, said frame having projecting portions adapted to support open-ended work pieces, a lever arm fastened to said segment and extending transversely thereof, means rendered operative by the first means for tilting said segment as the segment is elevated and returning the segment to its original position as the segment is lowered, whereby to tilt said hook.



10. In a work-immersing apparatus, a work rail, a vertically movable support, a rail segment pivotally mounted on said support on an axis lengthwise of the segment, means for moving said support, a work-carrying hook slidably mounted on said rail and non-rotatable relatively thereto, means for advancing said hook on said rail, a frame rigidly suspended from said hook, said frame having projecting portions adapted to support open-ended work pieces, a lever arm fastened to said segment and extending transversely thereof, a vertical cam engageable by the free end of said arm during vertical movement of said segment and constructed to tilt said arm as said segment is elevated, whereby to tilt said segment and hook.

11. In a work-treating apparatus as set forth in claim 1, said load-carrying means lying transversely of said rail, whereby to support a work piece transversely of said rail, said last named means having a work-supporting axis transverse of said rail and disposed to lie respectively at opposite inclinations to the horizontal at the limits of oscillation of said rail.

12. In a work-treating apparatus as set forth in claim 2, said load-carrying means lying transversely of said rail, whereby to support a work piece transversely of said rail, said last named means having a work-supporting axis transverse of said rail and disposed to lie respectively at opposite inclinations to the horizontal at the limits of oscillation of said rail.

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