

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 1

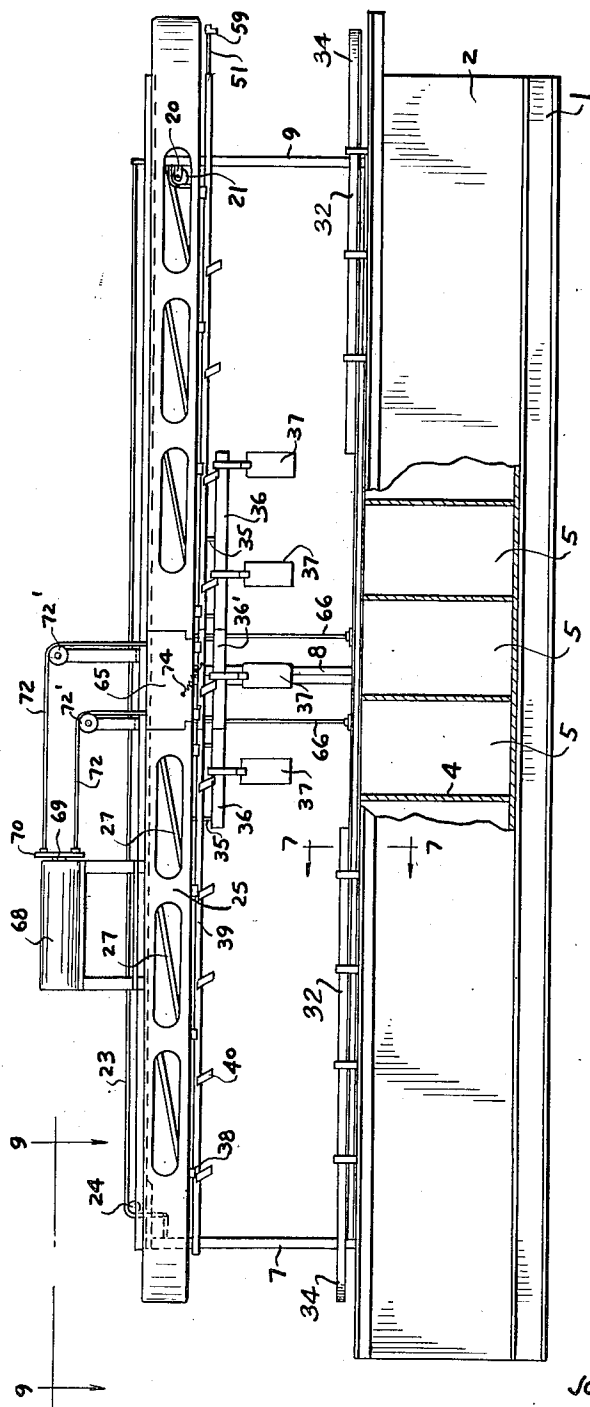


Fig. 1

INVENTOR.
JOHN V. DAVIS.

BY
Samuel Weisman
ATTORNEY.

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 2

FIG. 2.

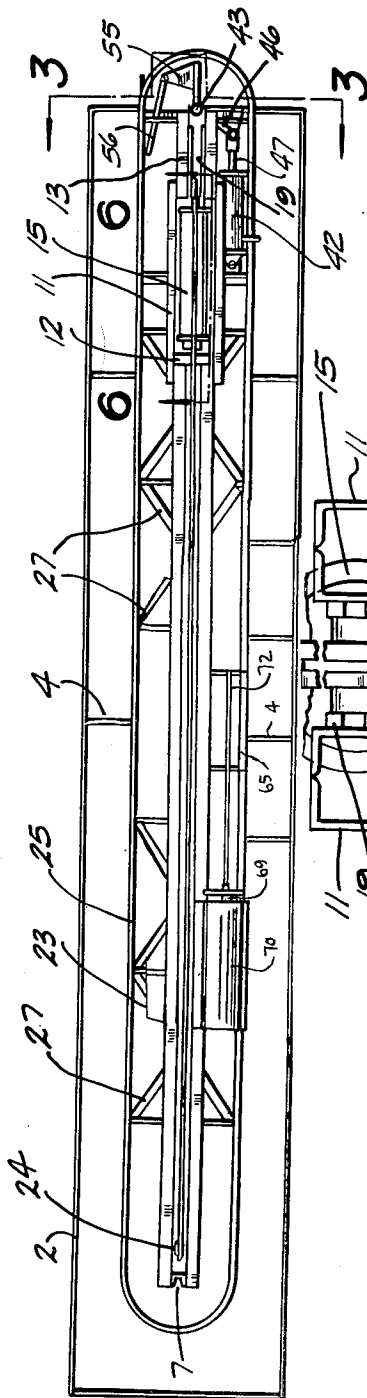
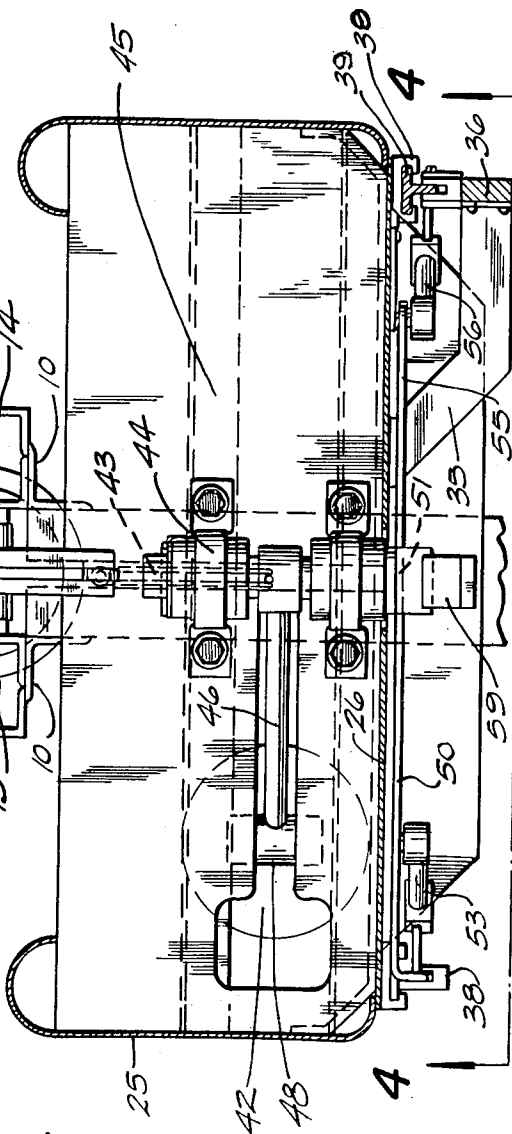


FIG. 3.



INVENTOR.
JOHN V. DAVIS
BY
Samuel Weissman
ATTORNEY.

April 8, 1952

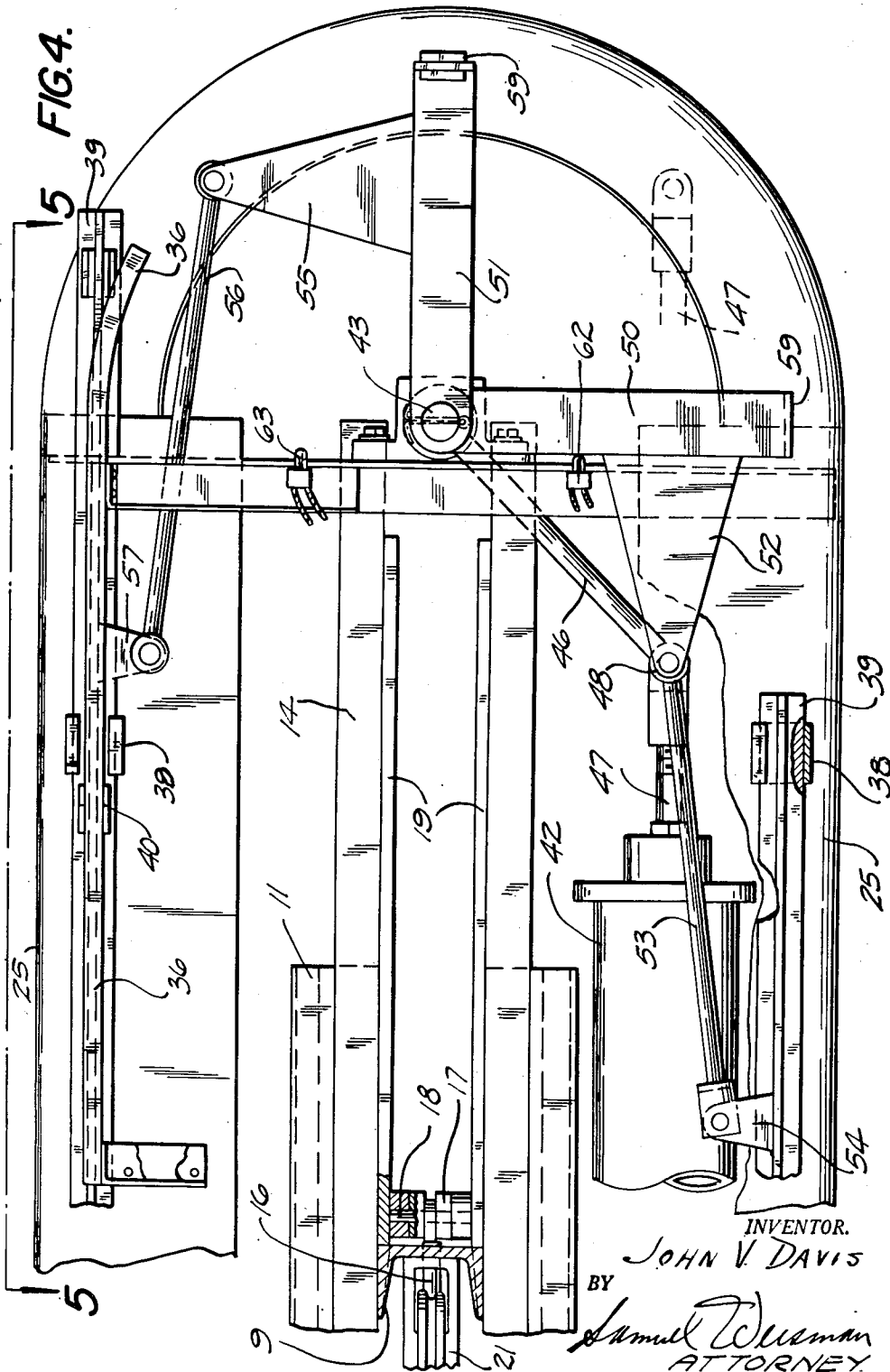
J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 3



April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 4

FIG. 6.

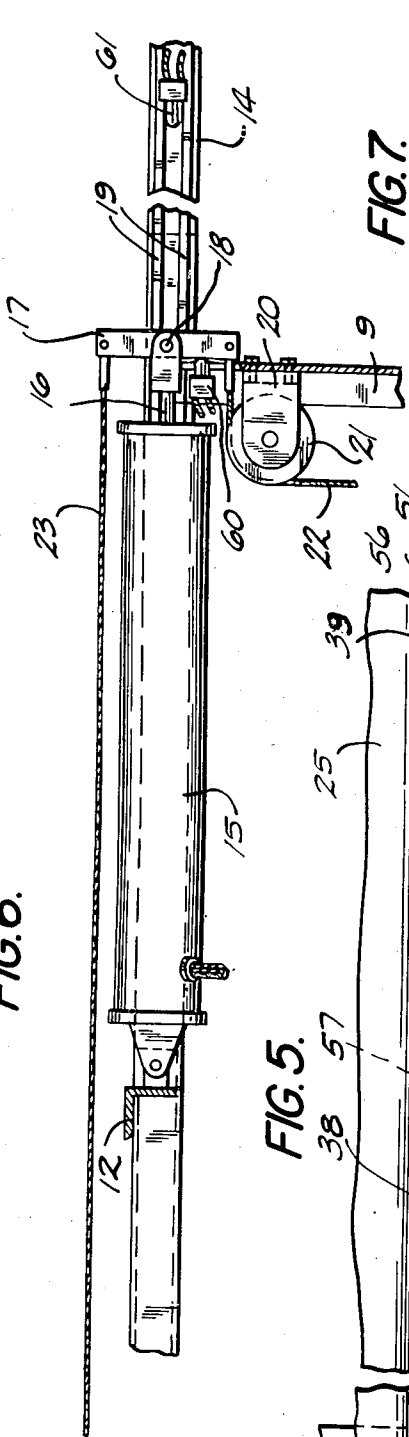


FIG. 5.

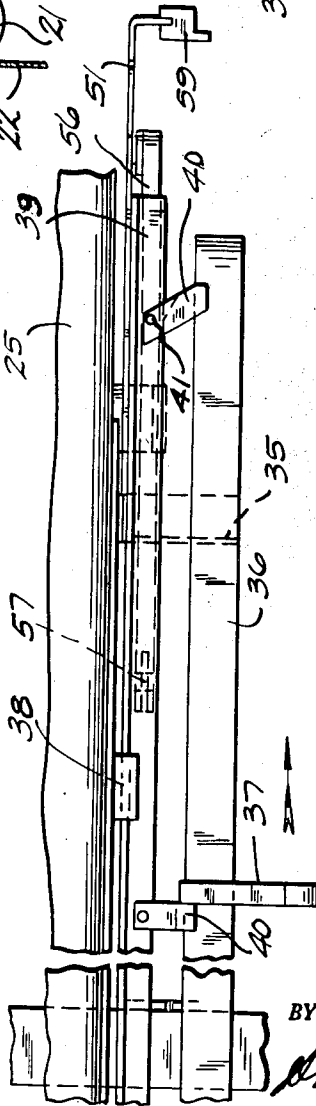
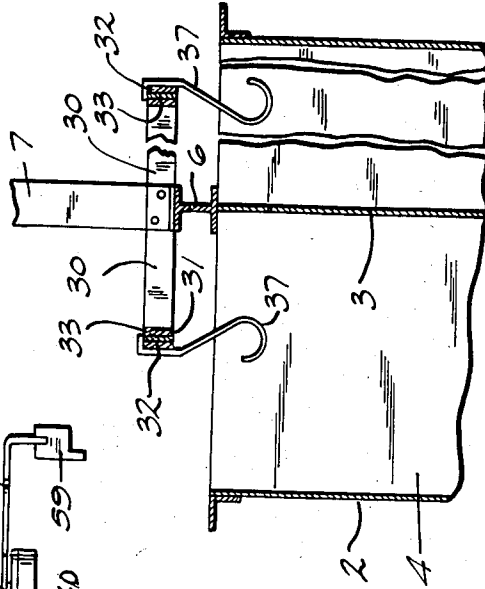


FIG. 7.



INVENTOR.
JOHN V. DAVIS

BY

Samuel Weisman
ATTORNEY.

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 5

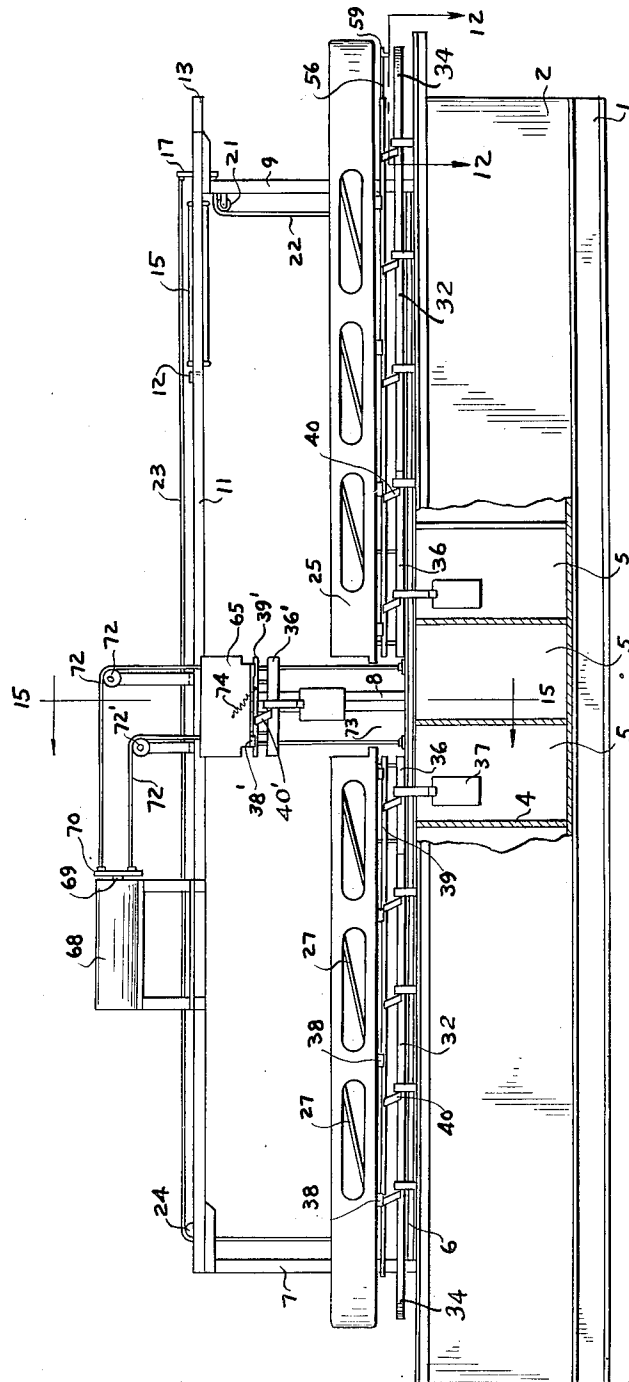


Fig. 8

INVENTOR.

JOHN V. DAVIS.

BY

Samuel W. W. W.
ATTORNEY.

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 6

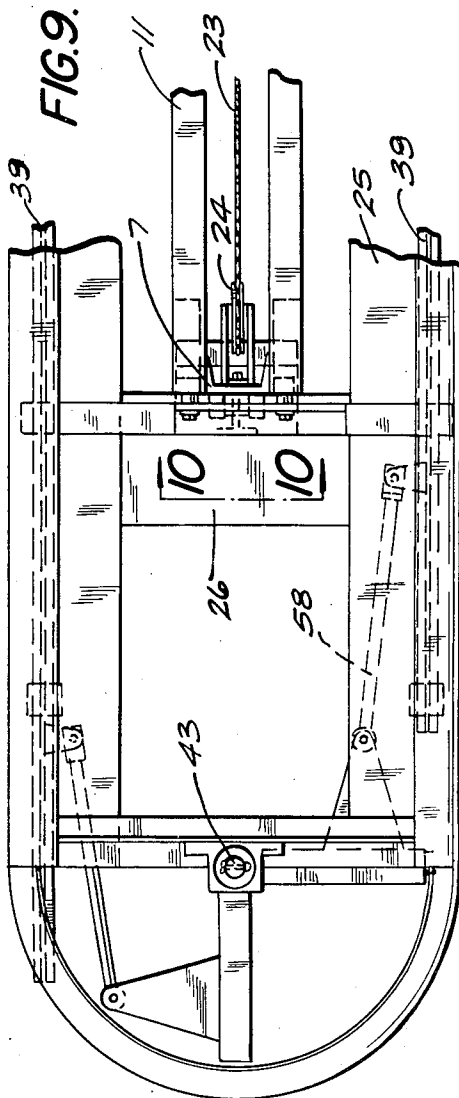


FIG. 11.

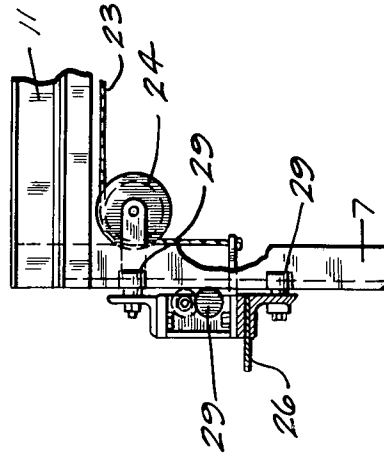
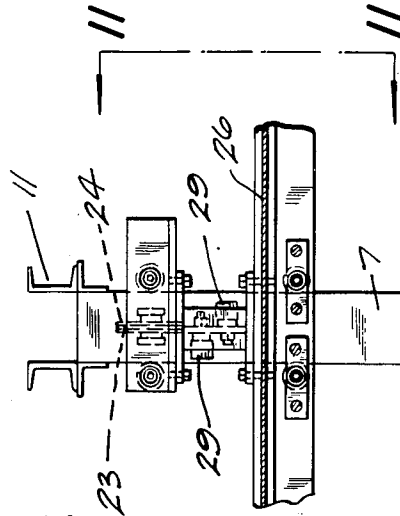


FIG. 10.



INVENTOR.
JOHN V. DAVIS

BY
Samuel W. W. W.
ATTORNEY.

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 7

FIG. 12.

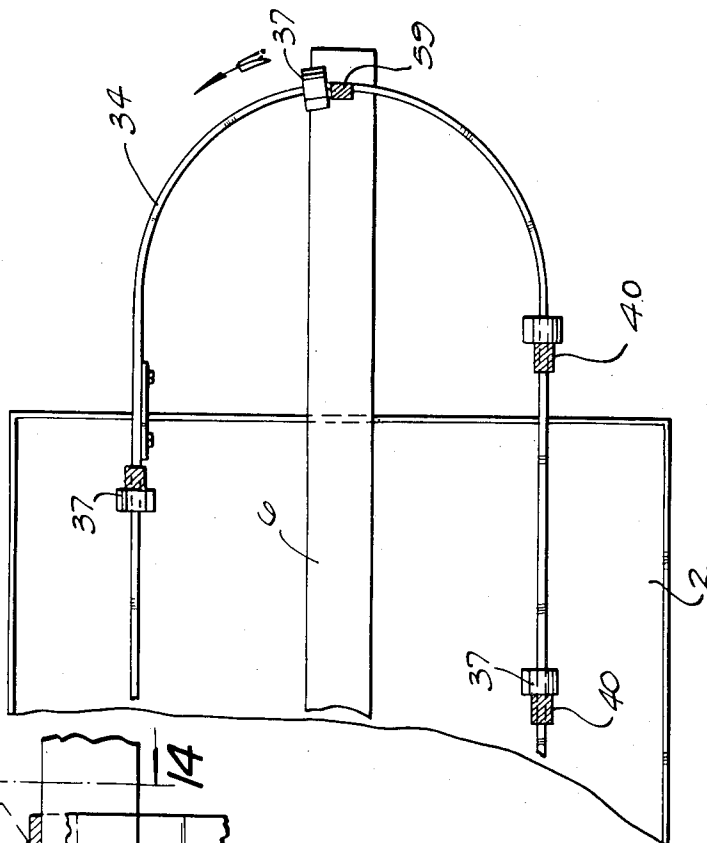


FIG. 13.

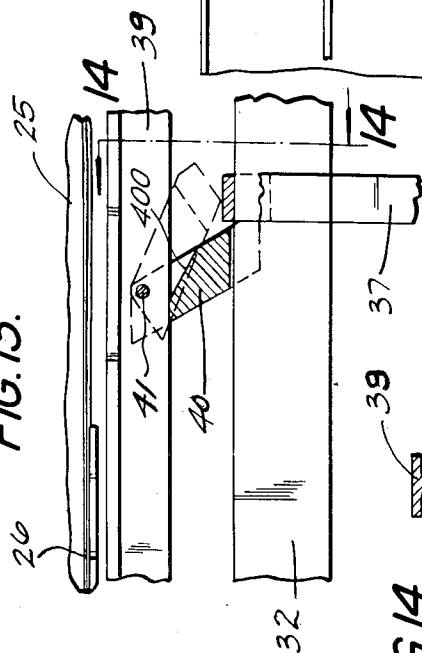
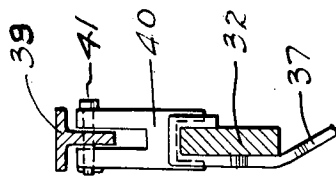


FIG. 14.



INVENTOR.
JOHN V. DAVIS
BY
Samuel W. Wernin
ATTORNEY.

April 8, 1952

J. V. DAVIS

2,591,681

WORK-IMMERSION MACHINE WITH SELECTED DELAYED IMMERSION

Filed March 8, 1950

8 Sheets-Sheet 8

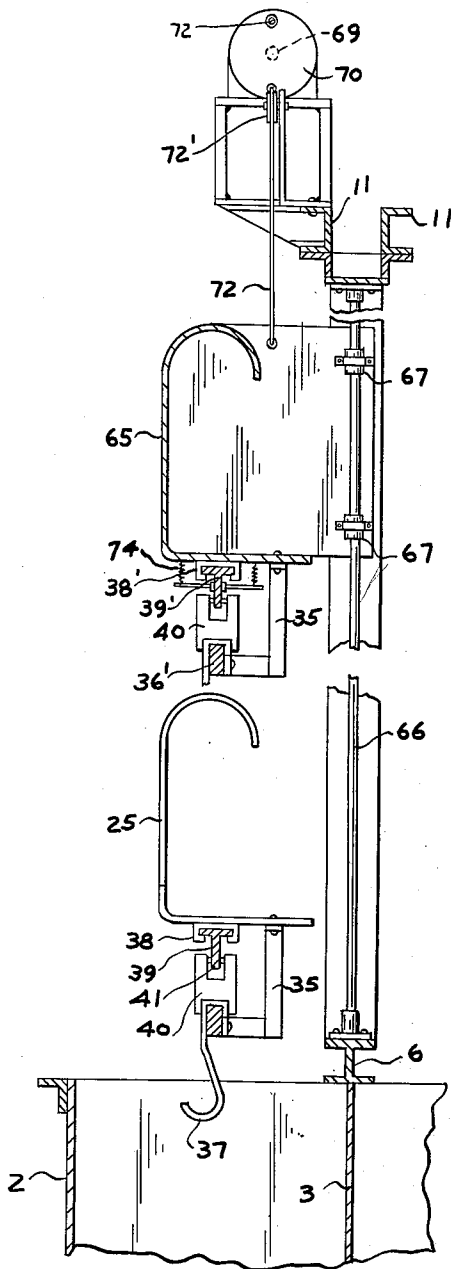


Fig. 15

INVENTOR.
JOHN V. DAVIS.

BY
Samuel Weisman
ATTORNEY.

UNITED STATES PATENT OFFICE

2,591,681

WORK-IMMERSION MACHINE WITH
SELECTED DELAYED IMMERSIONJohn V. Davis, Detroit, Mich., assignor to The
Udylite Corporation, Detroit, Mich., a corpo-
ration of Delaware

Application March 8, 1950, Serial No. 148,435

6 Claims. (Cl. 134—77)

1

The present invention pertains to a work-immersion machine wherein the work is advanced from bath to bath, as in a plating system of the general character shown in my United States Patent No. 2,479,322 of August 16, 1949, or in my pending application Serial No. 755,365, filed June 18, 1947.

In these machines the work is advanced on a rail by means of pusher elements. In transferring the work over the partitions that define the bath compartments, sections of the rail with the work thereon are elevated together with corresponding pusher elements. The work is advanced in this elevated position, and the elevated rail sections are then returned to the lower position, whereby each formerly elevated work piece is immersed in the bath following that from which it was previously lifted.

The principal object of this invention is to provide, in conjunction with a system of vertically movable rail sections, a means whereby the immersion period of work pieces in any selected bath or baths may be reduced or entirely eliminated. In other words, the work pieces are held out of certain baths while the remaining baths contain work pieces from the lowered rail sections.

This object is accomplished generally by the provision of at least three contiguous vertically movable rail sections in a unit. All three sections are elevated simultaneously, and transfer of work occurs to and from the middle section. The two end sections are then lowered, leaving the middle section elevated and its work piece or pieces out of the bath hole. The middle rail section has its own independent raising and lowering means and follows the end sections to the lower position after a pre-determined time interval. Thus it will be seen that the work carried by the middle section has a shorter time of immersion than the work carried by the end sections. The desirability of a shortened immersion period in certain cases will be apparent to those versed in the art, and an example of such a case is given in the detailed description. Further, the timing of the descent of the middle section may be such that work may be transferred to it and from it without being immersed in the bath beneath, in which case this bath is in effect eliminated from the system.

Several such units may be provided in order to effect a similar delayed operation at other selected baths in the system. Also, a unit may consist of more than three continuous rail sections, if desired, for special cases.

2

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

Figure 1 is an elevation of the device with a unit of rail sections in elevated position;

Figure 2 is a top plan view;

Figure 3 is a section on the line 3—3 of Figure 2;

Figure 4 is a bottom plan view on the line 4—4 of Figure 3;

Figure 5 is detail side elevation on the line 5—5 of Figure 4;

Figure 6 is a section on the line 6—6 of Figure 2;

Figure 7 is a section on the line 7—7 of Figure 1;

Figure 8 is a side elevation similar to Figure 1, showing the middle rail section of the unit elevated while sections are lowered;

Figure 9 is a detailed plan view on the line 9—9 of Figure 1;

Figure 10 is a section on the line 10—10 of Figure 9;

Figure 11 is a section on the line 11—11 of Figure 10;

Figure 12 is a section on the line 12—12 of Figure 8;

Figure 13 is a detailed section in a plane parallel to that of Figure 5;

Figure 14 is a section on the line 14—14 of Figure 13, and

Figure 15 is a section on the line 15—15 of Figure 8.

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

The machine is built on a base 1 on which is erected an elongated tank structure 2 consisting preferably of metal plate. The structure is divided by a longitudinal partition 3 and further by a number of suitably spaced partitions 4 forming two parallel rows of compartments 5. Upon the partition 3 is secured a longitudinal I-beam 6 to support a super structure as will presently be described. At the ends and at the center of the beam 6 are mounted vertical columns 7, 8 and 9, as shown in Figure 1. To the upper ends of the columns are secured angle-irons 10 on which are mounted horizontal connecting channels 11 which brace the columns for the load to be carried by them. Actually there are two pairs of channels, the members of each pair being joined face to face to form a box-beam. The beams 11 terminate somewhat short of the end column 9 and have their ends

joined by a bracket 12 for a purpose that will presently be described. The members 11 are then extended somewhat beyond the column 9 by means 13 secured to the outer lateral surfaces thereof, and the means 13 are further extended horizontally in the same direction by channels 14 secured to their inner surfaces and also to the column 9. The members 14 are substantially aligned with the beams 11, and a wider spacing is formed between the members 13.

The bracket 12 serves for the pivotal attachment of the closed end of a fluid cylinder 15 that extends approximately to the column 9. The piston rod 16 extending through this end of the cylinder carries a crosshead 17 pivotally attached thereto by a horizontal pin 18. The ends of the latter ride between spaced horizontal guide rails 19 fastened on the mutually facing surfaces of the channels 14. A bracket 20 is mounted on the upper end of the column 9 and carries a sheave 21. Cables 22 and 23 are fastened to the ends of the crosshead 17. The cable 22 passes over the sheave 21, and the cable 23 is passed over a pulley 24 mounted at the opposite end of the beam structure 11.

The cables 22 and 23 suspend a vertically movable structure comprising an enclosing wall 25 substantially as long as the series of tanks and about as wide. The wall 25 carries a floor consisting of open plates 26 and is braced by diagonal cross-bars 27. Roller frames 28 are secured to the floor and carry rollers 29 riding on three surfaces of the several vertical columns to guide the chassis 25, 26 in its up and down movement.

Transverse supporting bars 30 are secured across the fixed beam 6 and have longitudinal plates 31 secured across their ends for supporting fixed and spaced rail sections 32, with insulation 33 inserted between the parts 31 and 32. The sections 32 are aligned along both rows of compartments, and included in the fixed rail construction is a semi-circular connecting piece 34 at each end of the apparatus. The tank structure is open at one end to constitute a loading and unloading station. One of the compartments at this end may be open and may constitute a drying station on the outgoing side of the curved section. Brackets 35 on the bottom of the chassis 25, 26 carry movable rail sections 36 adapted to enter and fill the spaces between the fixed sections 32 to form a continuous work-carrying rail when the chassis is lowered. There will presently be described another rail section that is moved vertically independently of the sections 36 which remains raised for a longer interval than the chassis and then brought down to meet it. Current is applied to the rail in any manner well known in the art, and work carriers 37 are suspended from the several rail sections in any approved manner.

Pairs of longitudinal shoes 38 are carried by the bottom of the chassis and support a pair of pusher bars 39 of T-section over the two aligned series of rail sections at opposite sides of the partition 3. Pushers 40 straddle the webs of the bars 39 and are pivotally suspended therefrom by pins 41. The pushers engage the carriers 37 to advance them on the rails. The bottom of the slot in each pusher has a portion thereof sloped downward at 400 in the direction of work movement. In this movement the unsloped portion bears against the bottom of the bar 39 as a stop. In the retracting movement of the pusher bar, presently to be described, the slope 400 permits

the pusher to swing upward in passing over the carrier 37 which it is to push on the next forward stroke.

The pusher bars are actuated from a drive or pusher cylinder 42 mounted on the chassis 25, 26 adjacent to and longitudinally of one of the bars. At each end of the chassis is mounted a vertical shaft 43 concentric with the adjacent curved rail section and passing through the bottom of the chassis. Each shaft is held in suitable bearings 44 attached to partitions 45 carried by the chassis. The shaft 43 nearer the cylinder 42 has a link 46 pivotally connected to the exposed end of the piston rod 47 by a suitable swivel 48. The partition 45 carrying the bearings 44 is formed with an opening 49 to permit passage of the link 46 and the piston rod 47 therethrough. In other respects the assembly at each end of the rail is similar, and only one assembly need be described in detail.

Beneath the bottom of the chassis, the shaft 43 carries a pair of fixed arms 50, 51 at a right angle to each other. From the arm 50 a lug 52 extends toward the cylinder 42 and is joined by a link 53 to an ear 54 on the adjacent pusher bar, the link having its ends swiveled to the parts 52 and 54. The forward stroke of the piston rod 47 is such as to swing the link 46 and turn the shaft through an angle of 90 degrees, swinging the arm 50 and pulling the adjacent pusher bar 38 by means of the parts 52, 53.

A lug 55 extending from the arm 51 is joined by a link 56 to an ear 57 extending from the other pusher bar 39, so that the aforementioned motion of the shaft 43 slides the last named bar 39 simultaneously in the direction opposite to that of the first named bar. At the other end of the apparatus, the bar 39 nearer the cylinder 42 is connected to the arm 50 by a link 58. The free ends of the arms 50, 51 carry pushers 59 that propel the work 90 degrees on the end sections 34 on each 90 degree movement of the shafts 43. The closed end of the cylinder 42 is pivotally mounted to accommodate the arcuate movement of the swivel 48.

The superstructure carries limit switches 60 and 61 at opposite sides of the crosshead 17 and engageable thereby for timed control of the lifting cylinder 15 and the drive cylinder 42 in proper sequence. For the same purpose the partition 45 carries limit switches 62 and 63 engageable by the arms 50 and 51 at the ends of their respective movements.

It has been indicated that one of the vertically movable rail sections is movable independently of the chassis. Several such independent sections may be provided, as required, spaced apart or in juxtaposition or in spaced groups of juxtaposed elements. For the purpose it is considered sufficient to define one such independent section 36' lying between a pair of sections 36 carried by the chassis as described.

A section 65 of the chassis, corresponding to and directly above the independent rail section 36', is severed from the remainder of the chassis and carries the rail section 36'. For the independent travel of the section 65 there are provided upright tracks 66 receiving rollers 67 carried by the section 65. For moving the section 65, another cylinder 68 is mounted on the framework and has a piston rod 69 with an external crosshead 70. Cables 72 extend from the ends of the crosshead over guide pulleys 72 and suitably fastened to the chassis section 65.

The pusher bar 39 is interrupted adjacent to

5

the rail section 36', forming a gap 73 which is filled at times by a pusher bar 39' slidably mounted in shoes 38' carried by the section 65. A return spring 74 joins the bar 39' to the chassis section 65 and operates in a manner presently to be described.

In the operation of the device, the valves of the several cylinders are timed to operate in the sequence that will be described, by the limit switches shown and by such additional switches that may be necessary. The operation is described in more detail, with regard to the cylinders and limit switches, in my copending application Serial No. 755,365, filed June 18, 1947.

Let it be assumed that the entire chassis, including the independent section 65, is in the down position with the rail sections and pusher bars carried thereby. The entire chassis is then raised, and it will be noted that the entire pusher system is raised with it. The independent bar 39' fits between the adjacent bars 39, so that the pusher bar system is continuous. The cylinder 42 is now automatically operated to advance the bars 39 and also the bar 39' which is fitted in the system as set forth. The work pieces suspended from the rail sections 36, as well as from the section 36', carried by the chassis section 65, are advanced. On this movement the elevated work pieces are for the most part transferred, that is, they are moved across the partitions that separate the baths. The work pieces remaining on the fixed sections and not elevated have not received a corresponding movement, since the entire pusher system is in the elevated position.

The chassis 25 is now lowered by the operation of its cylinder 15, but the section 65 is retained in its elevated position, as in Fig. 8. On the downward movement of the chassis, the bars 39 disengage the bar 39', and the latter is retracted by the spring 74 in position for another advance. When the chassis 25 comes to rest in the lower position, the cylinder 42 operates to retract the pusher bars 39, advance them with the work pieces engaged thereby, and again retract them. The work pieces on the fixed rail sections are given a push to compensate for the advance of the pieces that were pushed while in the elevated position. The pieces on the now lowered sections 36 may be so spaced that this second push on them is necessary for a proper progression of the work, or in the case of no special spacing, means may be provided for idling the associated pushers on this particular movement. Such means may take the form of an automatic mechanical device for lifting these pushers clear of the work on this movement as disclosed, for example, in the nature of a cam mechanism in my copending application Serial No. 755,365, filed June 18, 1947. Notwithstanding the gap 73 in the pusher bar system, the movement is effected by reason of the link and arm connections between both sides of the pusher system at both ends.

After the work pieces suspended from the lowered chassis have been immersed in the baths for a predetermined length of time, the section 65 is lowered by operation of its cylinder 68. The work is not advanced again until all the movable rail sections 36 and 36' are again raised with their chassis structures to initiate a new cycle.

Thus, it is evident that the work piece on the section 65 has been immersed in the particular bath below this section for a shorter time than in the other baths. It will be understood that each work piece is eventually raised and lowered by the section 65, with the result that the im-

6

mersion of each piece in the bath below the section 65 is of less duration than in the other baths, in accordance with one of the stated objects of the invention. The timing mechanism is set for the desired intervals. For example, the work may be immersed four seconds in the last named bath and twenty seconds in the adjacent bath, remaining elevated alone for 16 seconds. The movable rail sections overlap the compartment walls 4 in one direction to permit transfer of the work when the sections are raised. At the beginning of the second cycle, for example, the work piece on the raised rail section 36' is transferred, and a piece on the preceding section 36 is advanced to the section 36'. By a modified spacing of the pusher fingers 40 with relation to the length of the rail section 36' and appropriate timing, the work on this section may be caused to miss entirely the bath below the section 65. This operation is employed, by proper adjustment as indicated, when a number of pieces are to pass a given bath without immersion therein and when these pieces are not of sufficient number to warrant emptying the bath.

The invention is not limited to one independently movable rail section between two sections movable with the chassis, as shown. A unit may include more than one independently movable rail section and a different number of sections, than shown, carried by the chassis; and any desired number of such units may be distributed throughout the system.

The pusher or work-advancing mechanism is substantially as shown in my copending application Serial No. 755,365, filed June 18, 1947, to which reference may be made, if necessary, for a more complete description and which is intended to be embodied herein insofar as the pusher mechanism is concerned.

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

What I claim is:

1. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously with a rail section carried by said chassis, and work-advancing means carried by said chassis and chassis section.

2. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously between a pair of rail sections carried by said section, and work

7

advancing pusher bars slidably carried by said chassis and chassis section, a retracting spring connecting said chassis section with a pusher bar carried thereby, and timed means for sliding the pusher bars carried by the chassis in both directions.

3. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously with a rail section carried by said chassis, slidably mounted pusher bars carried by said chassis and by said chassis section, pushers carried by said bars and adapted to engage work on the several rail sections, and timed means for sliding said bars in both directions.

4. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously with a rail section carried by said chassis, slidably mounted pusher bars carried by said chassis and by said chassis section, pushers carried by said bars and adapted to engage work on the several rail sections, and timed means for sliding said bars in both directions, certain of said pushers being pivotally mounted to swing over obstructions while moving in the non-pushing direction.

5. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and

8

down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously between a pair of rail sections carried by said section, slidably mounted pusher bars carried by said chassis section and by said rail section, pushers carried by said bars and adapted to engage work on the several rail sections, a retracting spring connecting said chassis section with a pusher bar carried thereby, and timed means for sliding the pusher bars carried by the chassis in both directions.

6. In a work-immersion apparatus, a series of bath receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, timed means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis section and adapted to fit in the spaces between the first named sections and contiguously therewith, in the lower position of the chassis, and a chassis section movable independently of said chassis, an independent rail section carried by said chassis section and positioned to aline contiguously between a pair of rail sections carried by said section, slidably mounted pusher bars carried by said chassis and by said chassis section, pushers carried by said bars and adapted to engage work on the several rail sections, a retracting spring connecting said chassis section with a pusher bar carried thereby, and timed means for sliding the pusher bars carried by the chassis in both directions, certain of said pushers being pivotally mounted to swing over obstructions while moving in the non-pushing direction.

JOHN V. DAVIS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,479,322	Davis	Aug. 16, 1949