

Aug. 16, 1949.

J. V. DAVIS

2,479,323

PLATING MACHINE

Filed June 13, 1946

6 Sheets-Sheet 1

FIG. 2.

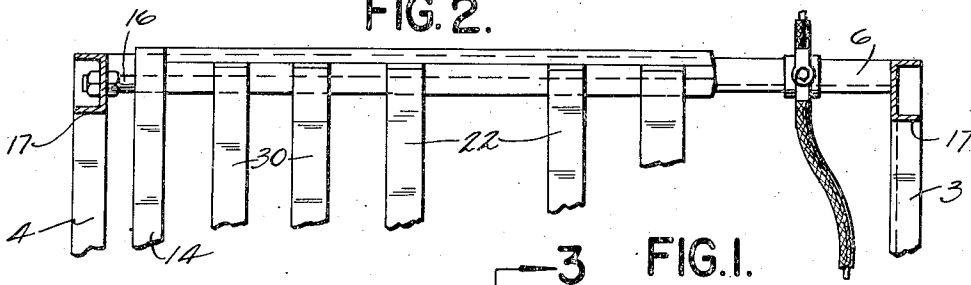
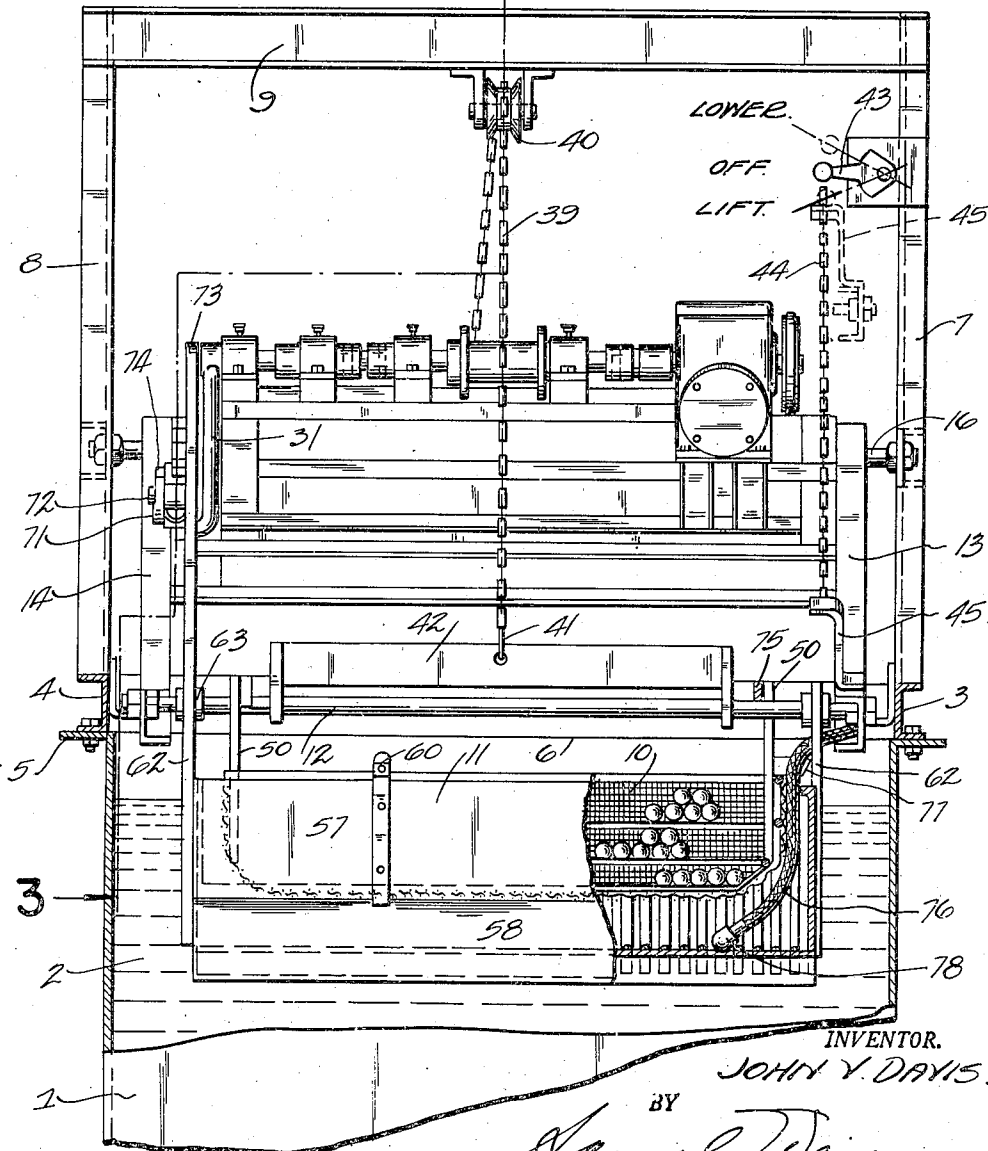


FIG. 1.



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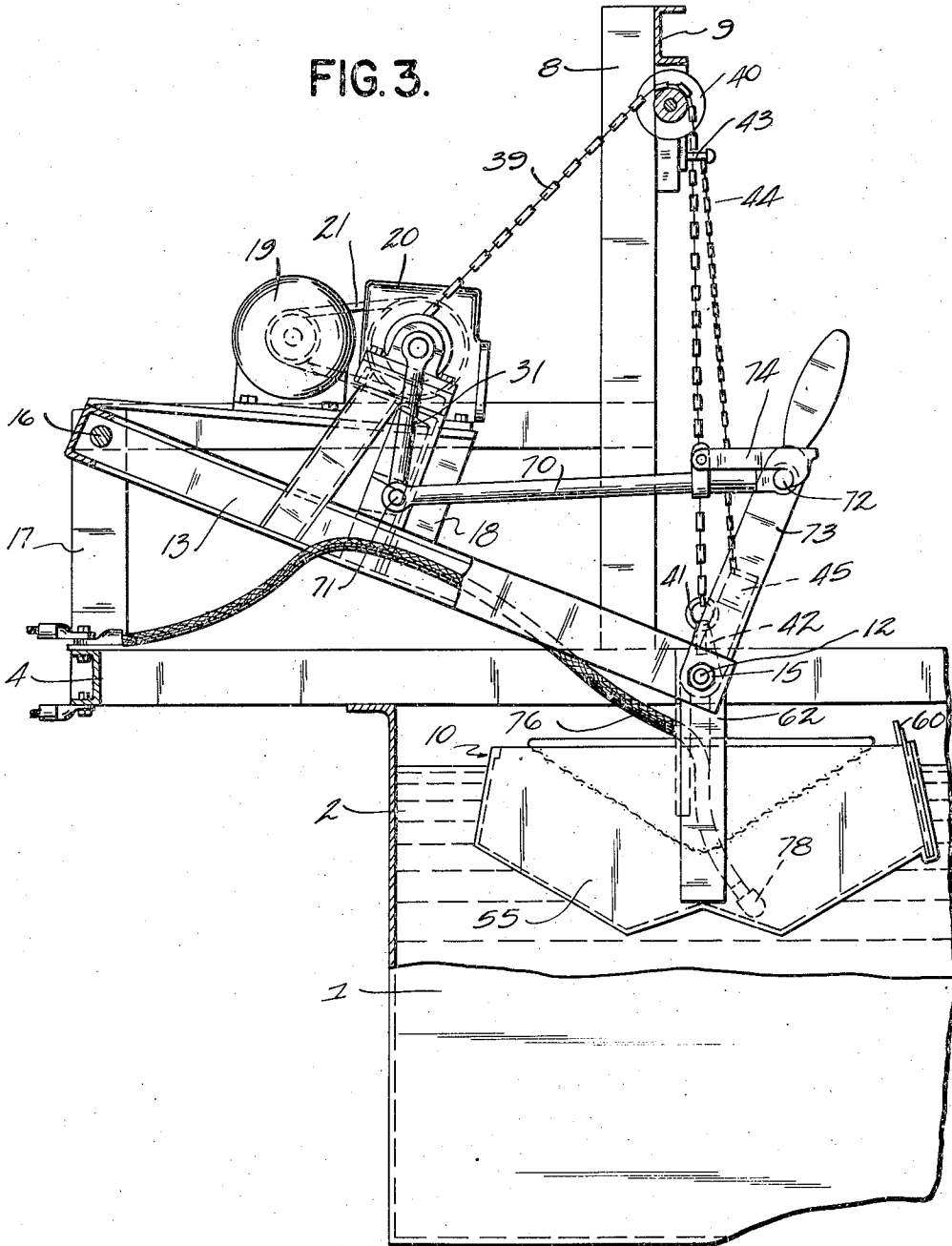
J. V. DAVIS  
PLATING MACHINE

2,479,323

Filed June 13, 1946

6 Sheets-Sheet 2

FIG. 3.



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2,479,323

PLATING MACHINE

Filed June 13, 1946

6 Sheets-Sheet 3

FIG. 4.

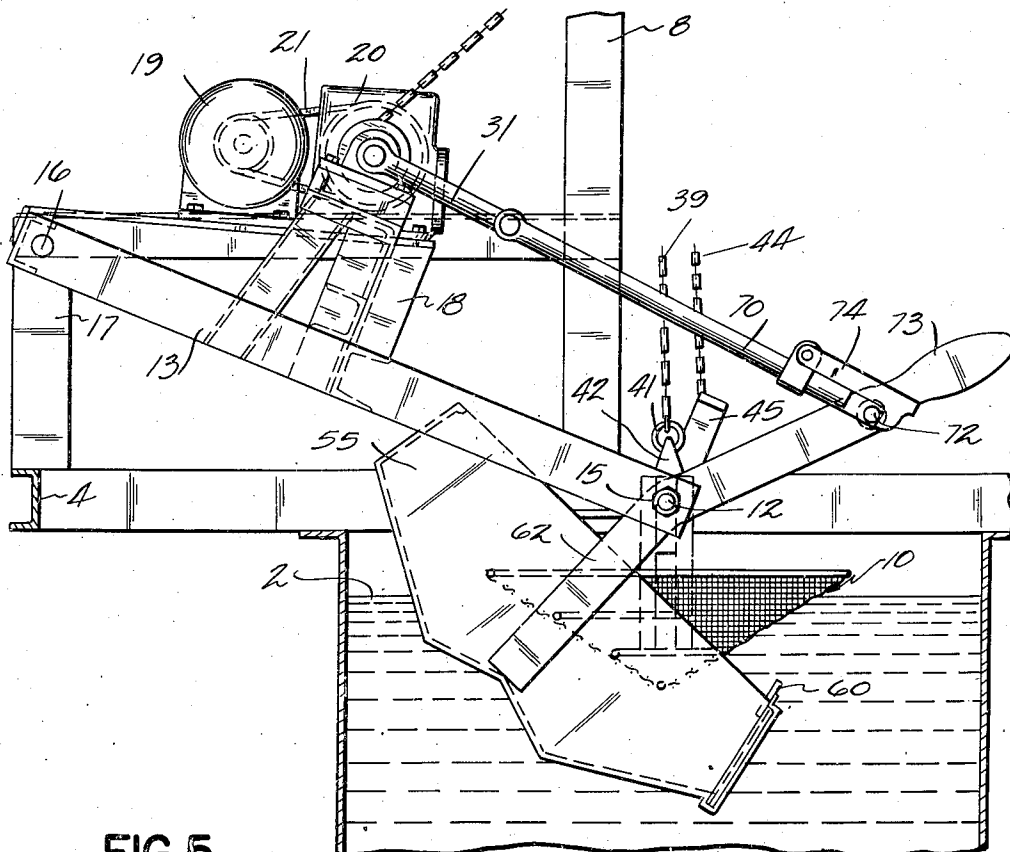


FIG. 5.

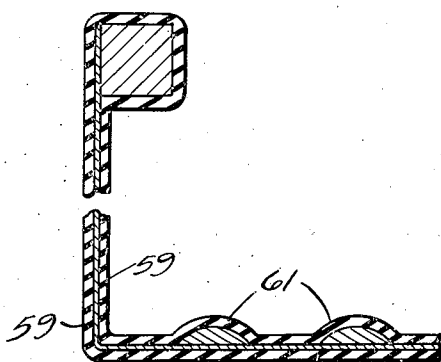
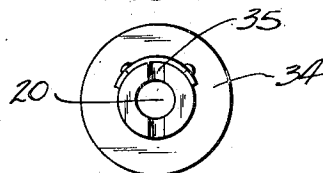


FIG. 6.



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PLATING MACHINE

2,479,323

Filed June 13, 1946

6 Sheets-Sheet 4

FIG. 7.

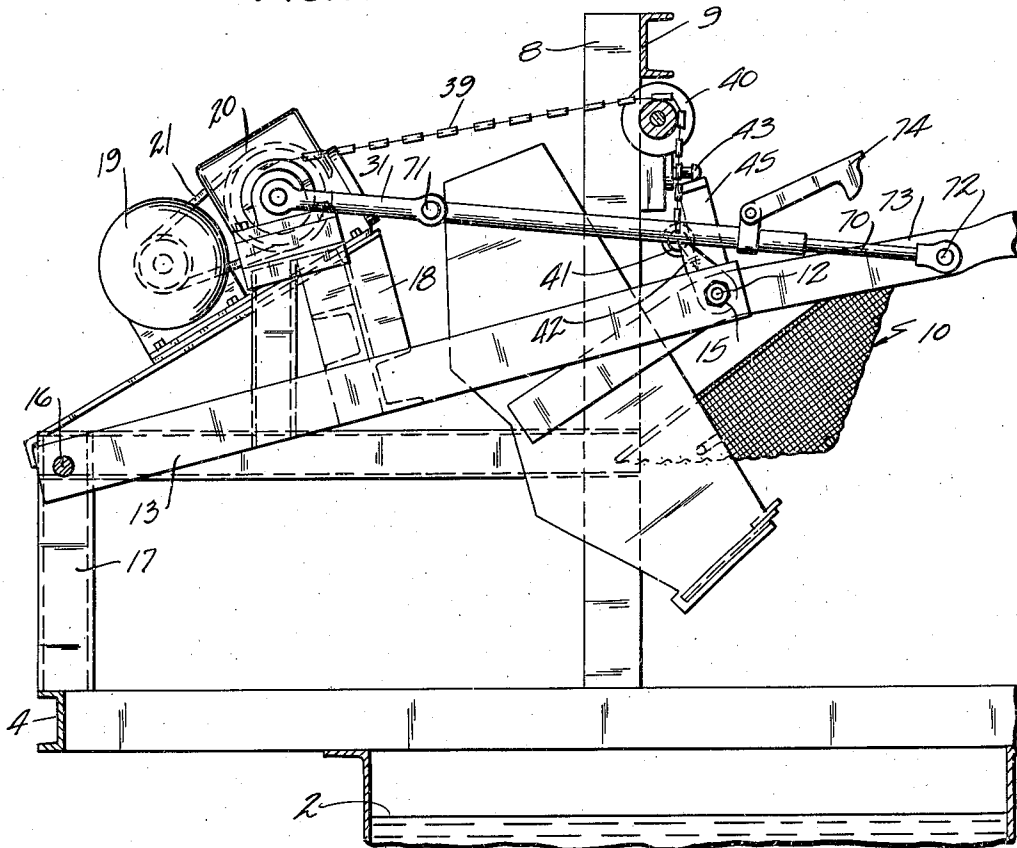
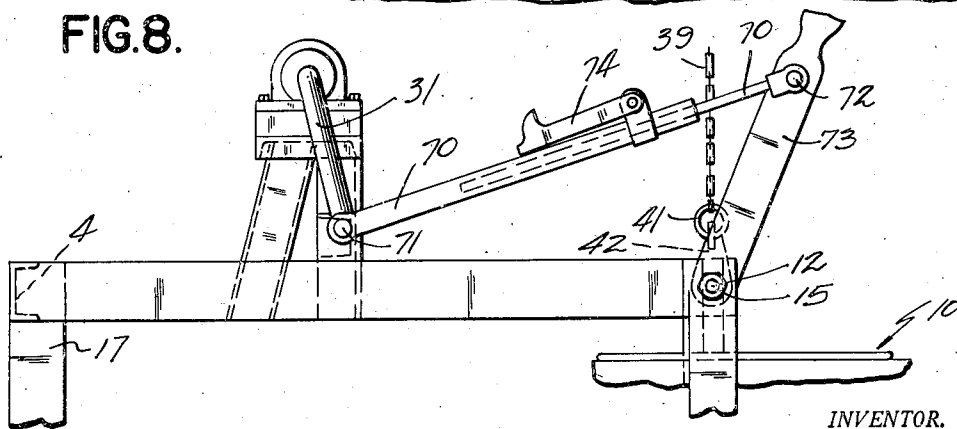


FIG. 8.



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2,479,323

PLATING MACHINE

Filed June 13, 1946

6 Sheets-Sheet 5

FIG. 9.

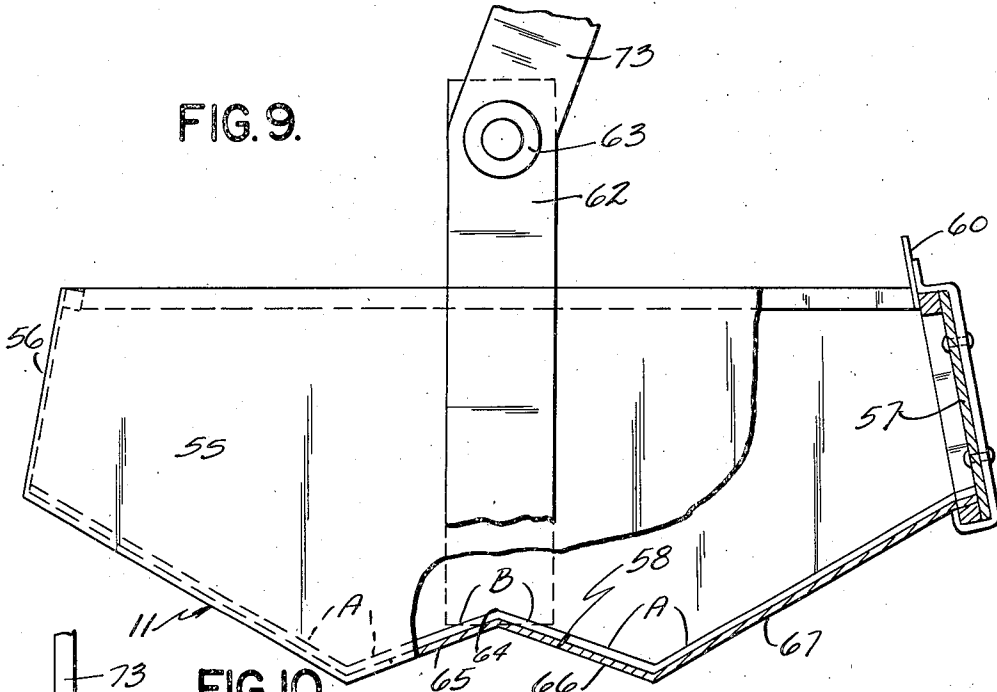
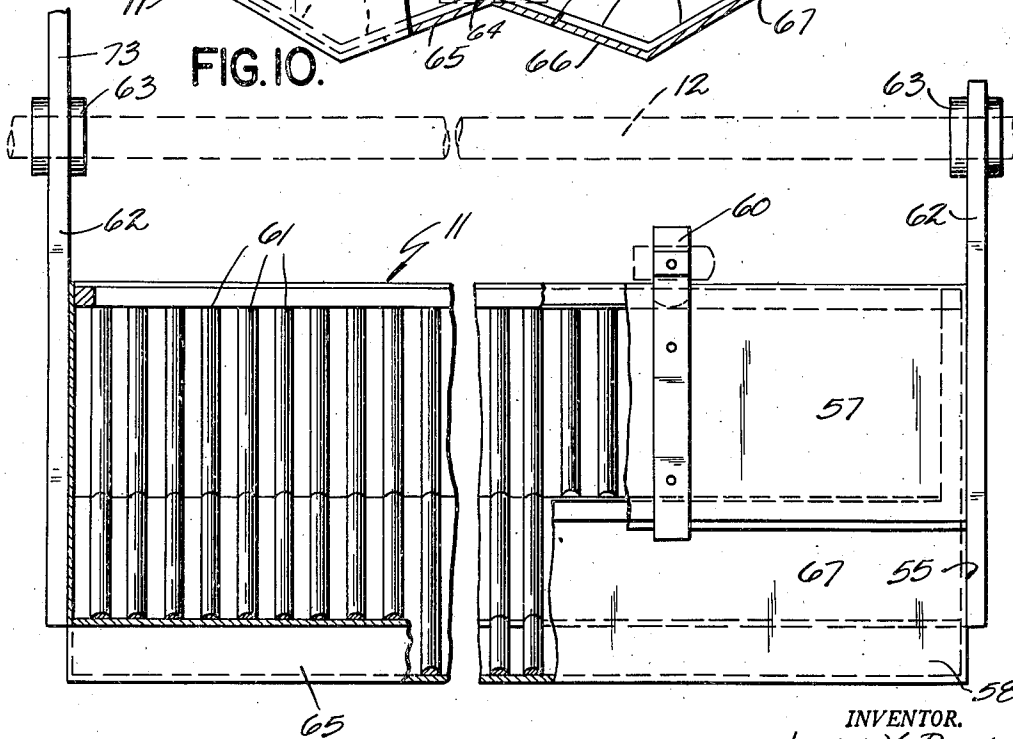


FIG. 10.



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2,479,323

PLATING MACHINE

Filed June 13, 1946

6 Sheets-Sheet 6

FIG. II.

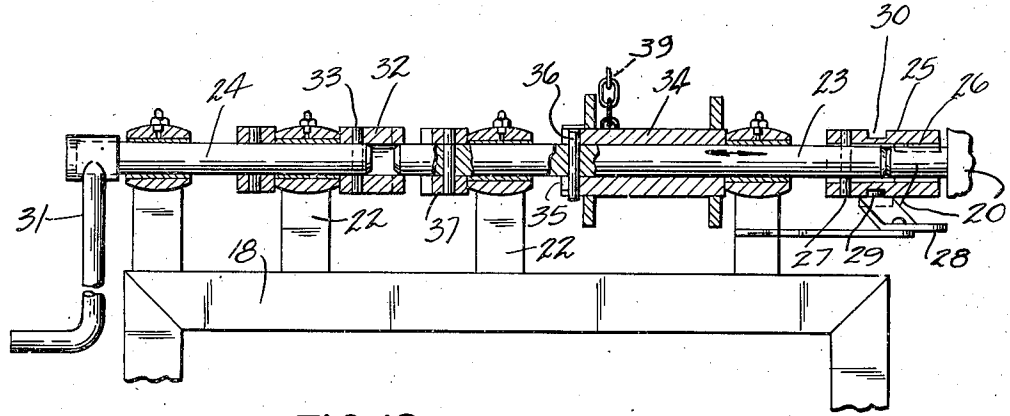


FIG. 12.

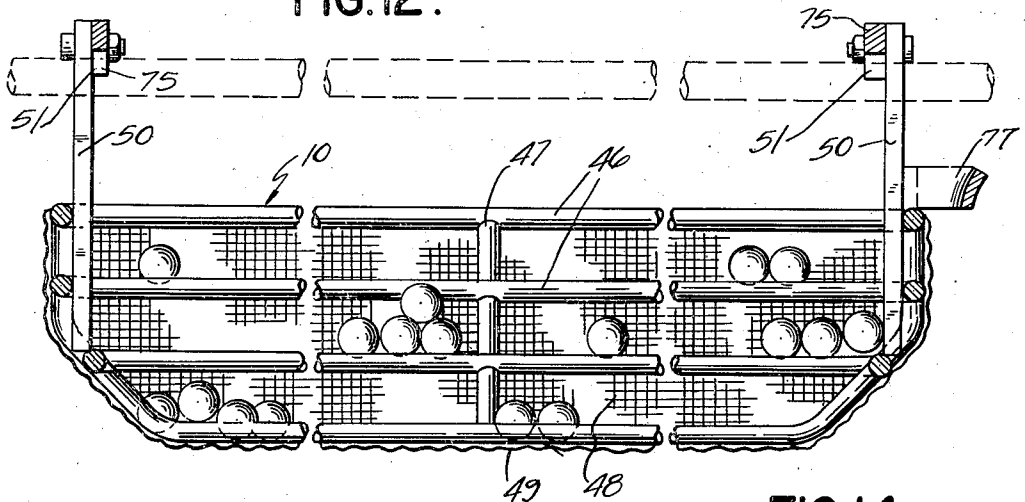


FIG. 13.

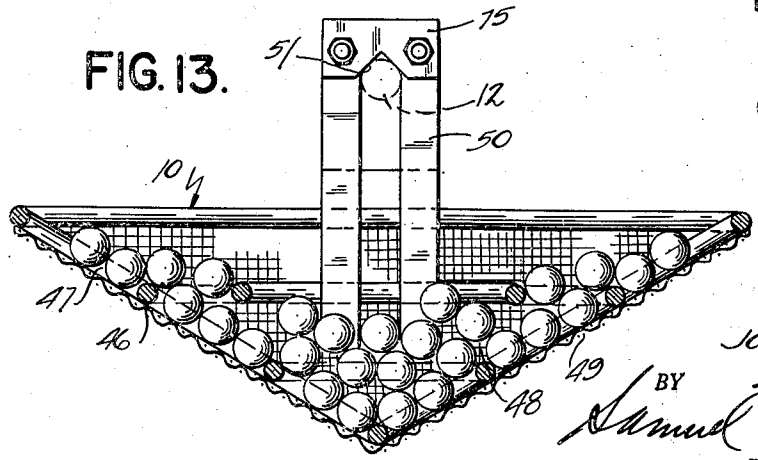
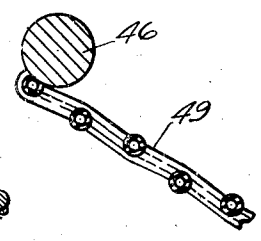


FIG. 14.



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## UNITED STATES PATENT OFFICE

2,479,323

## PLATING MACHINE

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Application June 13, 1946, Serial No. 676,369

7 Claims. (Cl. 204—222)

1

The present invention pertains to a novel plating machine and more particularly to one designed for the plating of small articles, such as washers, nuts, bolts, screws, etc.

The principal object of the invention is to provide a machine of this character which produces an excellent plate on articles of the type enumerated and at a relatively rapid rate. In the accomplishment of this object, the apparatus includes a cross shaft mounted over the plating tank and having a work container and a perforate anode basket swingably suspended therefrom. The work container lies outside of the anode basket and is oscillated in relation thereto in the plating operation.

The invention also provides mechanism for lifting the cross shaft and then tilting the work container relatively to the anode basket for emptying the container. In order to accomplish the last named function, the mechanism for oscillating the work container within the tank includes a telescopic rod which, however, is locked against telescopic action at this time. When the cross shaft supporting the anode basket and the work container is raised, the telescopic rod is unlocked to permit a greater displacement of both the basket and the container about the shaft and thus enable the emptying the container without interference from the basket.

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

Figure 1 is a front elevation, partly in section, of the plating machine;

Figure 2 is a fragmentary horizontal section in a parallel plane, showing the pivot for the frame which supports the motor, cradle and anode basket;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a side elevation showing the position of the work cradle and anode basket during operation;

Figure 5 is a detail section of the work cradle;

Figure 6 is a detail of the clutch;

Figure 7 is a side elevation showing the work cradle unlatched and in unloading position;

Figure 8 is a detail elevation of the cradle rocking mechanism showing the cradle unlatched before being elevated to unloading position;

Figure 9 is a longitudinal section of the work cradle;

Figure 10 is a front elevation thereof, partly broken away;

Figure 11 is a detail longitudinal section of the drive shaft and clutch mechanism;

Figure 12 is a section of the anode basket taken longitudinally of the machine;

Figure 13 is a section of the anode basket taken transversely of the machine, and

2

Figure 14 is a detail section of the anode basket.

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 a plating tank 1 adapted to contain an electrolyte 2. The plating machine, which constitutes this invention, comprises a cradle or work basket which can be assembled as a unit and installed on any conventional plating tank. The work cradle may serve as both a container for the work and a container for a quantity of plating solution.

For this purpose the supporting frame work for the plating machine comprises a base consisting of side channel irons 3 and 4 bolted to the top of the tank 1, as at 5, and an end channel iron 6. The base of the frame supports two upright channel irons 7 and 8 which in turn support at their upper ends a transverse channel iron 9. These members of the frame may be fastened together in any suitable manner.

An anode basket 10 and a work cradle 11 are movably mounted with respect to the tank 1. In order to permit the movements described below, the basket and the cradle are mounted on a cross shaft 12. The ends of the cross shaft 12 pass through ends of the channel iron members 13 and 14 and are secured in this position by nuts 15. The remaining ends of the members 13 and 14 are pivotally supported on a shaft 16 carried by upright channel iron members 17 which in turn are supported by the lower frame members 3, 4 and 6. Thus, the members 13 and 14 swing as arms about the shaft 16 as a center in the raising and lowering of the work cradle and anode basket, as will presently be shown.

For the purpose of raising and lowering the work basket and anode baskets from the plating solution, the pivoted members 13 and 14 carry a support 18 (Figure 3) which in turn carries an electric motor 19. A reduction drive 20 is also mounted on the support 18 and is connected to the motor by a belt 21.

The support 18 has mounted thereon a number of pillow blocks in which are journaled a longitudinally shiftable drive shaft 23 and a separate driven shaft 24. The shaft 23 is in alignment with the shaft 24 of the reduction gear 20 to which it is connected by a sleeve 25 splined at 26 on the shaft 23 and pinned at 27 to the shaft 24. A pivotally mounted lever 28 carries a pin 29 which engages in an annular groove 30 in the collar 25.

The free end of the driven shaft 24 carries a crank 31 for operating the basket elevating mechanism, as will presently be shown. The other end of the shaft 24 carries a clutch element 32 held by a pin 33. The driving shaft 23 has loosely mounted thereon a drum 34 formed at one end with a notched sleeve 35. The shaft also

carries a pin 36 receivable in the sleeve 35 and a clutch element 37 engageable with the element 32. Figure 11 shows the pin 36 received in the collar 35, for driving the drum 34, and the element 37 separated from the element 32, so that the driven shaft 24 is idle. To drive the shaft 24 and release the drum 34, the lever 28 is actuated to slide the shaft 23 to the left in Figure 11, thereby withdrawing the pin 36 from the collar 35 and engaging the clutch element 37 with the element 32, to rotate the shaft 24 and the crank 31 attached thereto. However, in the position illustrated in Figure 11, the shaft 23 drives the drum 34 through the pin 36 and collar 35.

A chain 39 which is fixed at one end to the drum 34 passes over a pulley 40 supported by the cross member 9 and is secured at its other end as at 41 to a member 42 pivotally mounted on the shaft 12. Thus, when the shaft 21 is in driving relation with the drum 34, the rotation of the drum winds the chain 39 thereon and thereby swings the pivoted frame members 13, 14 about their shaft 16 which in turn raises the anode basket 10 and the work cradle 11 from the bath, as shown in Figure 7.

The operation of the motor 18 is controlled through a switch lever arm 43 shown in Figure 1. The arm 43 is connected by means of a chain 44 to a bracket 45 fixed to the cradle support shaft 12. As shown, when the lever arm 43 is in center position, the current is shut off from the motor. If the anode basket and work cradle and the pivoted support frame 13, 14 has been swung upward about the shaft 16 to raised position, as shown in Figure 4, and it is desired to lower them into the plating tank and solution, the lever arm 43 is turned clockwise to the dotted line position indicated by the word "lower." As the pivoted frame 13, 14, the anode basket and the work cradle swing downwardly and reach the full lowered position, the chain 44 straightens out. Its length is so calculated that the lever 43 is swung from its above center or "lower" position to its center or "off" position, thus cutting off the motor 18. On the other hand, in the raising of the pivoted frame 13, 14, the anode basket and the work cradle, the lever 44 is swung downwardly below center to the "lift" position. As the chain 39 winds up on the drum 34 to raise the frame 13, 14 and the anode basket and work cradle, the bracket 45 gradually approaches and finally engages the switch lever 43, throwing the same to center or "off" position, shutting off the motor and terminating the movement of the frame, anode basket and work cradle about the shaft 16.

The anode basket 10, as shown in Figures 12, 13 and 14, comprises a skeleton of spaced parallel horizontal steel wires 46 held apart by cross wire spacers 47. The wire framework 46, 47 is covered by an expanded metal mesh 48. The mesh 48 is preferably covered with rubber which, however, need not be used if not desired. The wire mesh cooperates with the frame work 46, 47 to form downwardly and inwardly converging bottom walls 49 of the basket 10. Thus, the anode basket 10 in vertical section has a V-shape. The horizontal parallel wire members 46 serve as steps upon which rests the soluble anode material or metal which may be in the form of balls, scrap pieces or the like. Thus, the cross wires 46 materially assist in keeping the soluble anode material distributed throughout the entire area of the bottom walls 49 of the basket 10, thus insuring a large soluble anode area relative to the cathode or work surface area which is to be plated.

Brackets 50 are fixed to the end walls of the

basket 10 and are provided with supporting plates 75 which are adjustable up and down along the brackets 50. The plates 75 have a V-notch 51 in which they engage the shaft 12, as shown in Figure 13, and thus serve to suspend the basket from the shaft. This permits the anode basket 10 to be adjusted toward and away from the work cradle 11 to vary the clearance between the work and the anode. This clearance, of course, will vary with the load of small articles placed in the cradle and plated at any one time. Although in the operation of the plating machine the basket 10 normally remains stationary, nevertheless the shaft 12 engages the brackets 50 in the V-notches 51, which permits the basket to rock or swing on the shaft 12 if desired and particularly to prevent destruction of the basket in the event that any work becomes lodged between the bottom wall 49 of the basket and the bottom of the work cradle. The anode lead (not shown) is connected to the shaft 12, and the current conducted through the brackets 50 to the wire frame members 46 which are in electrically conducting relation with the soluble anode material.

The work cradle 11 is shown in detail in Figures 5, 9 and 10 and comprises a container having end walls 55, front and rear walls 56, 57 and a W-shaped bottom wall 58. The cradle is preferably open at the top while the side, end and bottom walls are preferably imperforate so that the cradle also serves as a holder for the plating solution. The walls of the cradle are formed of sheet metal and covered on each side with a rubber coating 59. The front wall 57 is preferably removable to facilitate removal of the work from the cradle and normally is retained in position by latches 60. The inside face of the bottom wall 58 is provided with a plurality of parallel corrugations 61 extending transversely of the axis about which the cradle swings and lying parallel to the direction of swinging of the cradle. The parallel corrugations 61 cause flat work, such as washers, to stand somewhat on edge and prevent the clinging or adhering of such flat work to the bottom of the cradle. The corrugations also serve to prevent light work from sticking to the bottom of the work cradle. The cradle is provided at each end with a rubber coated bracket 62. The brackets 62 are rotatably mounted on the shaft 12 at 63 to prevent swinging of the cradle 11 about the shaft 12.

In a plating operation, it is desirable that the entire surface of small articles be plated. Consequently it is essential that the entire surface of each small article be exposed and not shielded from the ion flow during the plating operation. For this purpose the basket is swung back and forth during the plating operation upon the shaft 12 to tumble the work and thus expose all the surfaces of small articles to the plating solution. To reduce the angle of tilt of the cradle and yet obtain the tumbling of the work in the swinging of the cradle, the bottom 58 of the cradle is provided with a hurdle 64 over which the work must travel. This hurdle preferably takes the form of two diverging walls or inner surfaces 65 and 66 extending lengthwise of the longitudinal center of the bottom of the cradle and forming in section an inverted V or the center of the W formation of the entire bottom. The hurdle 64 is positioned between two upwardly and outwardly diverging wall portions or outer surfaces 67, as shown in Figure 9. This is desirable because, by thus inclining said bottom wall portions 67 to the horizontal, said inclination being measured when



the cradle is in center position, the angle of tilt is accordingly reduced, that is, the arc through which the cradle 11 must be swung to tumble and separate the work is thereby reduced when compared with a cradle having a horizontal bottom wall portion. Thus, in section the bottom 58 of the cradle takes the form of a W. The angles A, between the bottom wall portions 65, 67 and 66, 67 should be less than 180° and, although this angle will vary with the type of small article which is being plated and the speed at which the cradle swings, angle A has been found to be satisfactory within a range of about 120° to 130°, preferably about 125 degrees. The angle B falling between the bottom portions 65 and 66, will always be greater than 180°. Operating angle B has also been found to be satisfactory within a range of about 210° to 220°, preferably about 215 degrees. Here again angle B will vary with the speed at which the cradle is swung and the type of small article which is being plated. The bottom wall portions 65, 66 and 67 are preferably, but not necessarily, plane. In some cases it has been found desirable to avoid V formations at the junction of wall 65 with wall 67, of wall 65 with 66, and of wall 66 with the other wall 67 and to form the apexes about a 4 inch radius so that the junctions are curved rather than in the form of sharp angles.

For purposes of description the exact dimensions of a cradle 11, which was very successful in operation, will now be set forth, although it will be understood that these dimensions are not a limitation of the invention. The cradle has bottom wall portions 67 ten inches wide, wall portions 65 and 66 about four and a half inches wide, and wall portions 56 and 57 about five and five-eighths inches high. The angle A is 130° and the angle B is 220°, while the angles between the wall portions 56, 57 and bottom wall portions 67 are about 110° each. This arrangement gives very good tumbling action and resulted in almost constant current flow which indicates that the exposed work area was nearly constant at any working position of the cradle. Very good plating was obtained with parts varying from 1/4 inch flat steel washers to steel bolts having a diameter of one inch and a length of eight inches.

The speed of the cradle is a very important factor, it being necessary that all the work have sufficient time to roll across the cradle before it reverses its motion. Naturally, if the cradle moves too slowly, the parts will not mix and take an even plate during the limited plating time. Also, there is danger of burning. The tests indicate that the maximum speed of the above specified cradle is eight to twelve complete cycles per minute, depending upon the shape of the articles, balls, rolling over faster than light flat pieces. This can also be expressed as follows: The maximum average speed of the work as it travels relative to the bottom of the cradle is 25 to 38 feet per minute at a maximum cradle angle or angle of tilt of about 50° from horizontal, when the cradle speed is 12 complete cycles per minute. If this maximum cradle or tilting angle is increased, the rocking speed, that is, the average speed at which the cradle travels, should be increased approximately in proportion.

The rocking of the cradle 11 is accomplished by means of a telescoping connecting rod 70 having one end pivotally connected at 71 to the crank arm 31 and the other end pivotally connected at 72 to an extension 73 of the bracket 62. The tubular sliding member of the telescoping

connecting rod 70 is provided with a latch 74 which is arranged to lock on the pivot 72, as shown in Figure 3, to lock the connecting rod against telescoping sliding action and to place the lever arm 73 in driving relation with the crank 31. Hence, as the crank 31 rotates, the connecting rod 70 causes the arm 73 to swing back and forth, thus rocking the cradle 11 about the shaft 12 between the positions of Figure 3 and Figure 7. It will be noted that normally the anode basket 10 remains stationary and that the major portion of the basket at all times projects within the cradle 11, thus maintaining the soluble anode area at all times in proximity to the work.

When it is desired to unload the cradle 11, the cradle supporting frame 13, 14 is swung upwardly about the shaft 16 as the lifting chain 39 winds upon the drum 34. The cradle and frame 13, 14 may be partially raised to the position shown in Figure 8 or completely raised to the position shown in Figure 7. At this time the latch 74 is disengaged from the pivot 72, thus permitting the telescoping rod members 70 to slide one within the other. The operator grasps the lever 73 and swings the cradle 11 clockwise about the shaft 12 through 90° or more or less to dump the work upon a tray. This work tray, of course, is positioned beneath the cradle 11 as soon as the latter is raised out of the solution and before it is tilted to dump the contents.

There are two cathode leads, one at each end of the work basket. Each cathode lead is in the form of a flexible rubber coated cable 76 which is carried along the channel support 13 (Figure 1) then passed through a loop 77 on the outside of the anode basket support bracket 50 and from there downward toward the bottom of the work cradle where the cable terminates and is provided with a steel cathode tip 78 freely exposed to the plating solution and resting upon the bottom 58 of the cradle. Thus, each cathode 78 contacts the work in the bottom of the cradle and is swung to and fro with the work during the rocking action of the cradle to insure a continuous circuit and continuous plating.

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 an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having side, end and bottom walls, said bottom wall being W-shaped in cross section and comprised of four plane surfaces forming three vertices parallel to said shaft, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, an insoluble container for soluble anode material in the form of a perforate basket positioned within said work container and swingably mounted on said shaft, and a cathode contact extending into said work container.

2. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having side, end and

bottom walls, said bottom wall being W-shaped in cross section and comprised of four plane surfaces forming three vertices parallel to said shaft, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, an insoluble container for soluble anode material in the form of a perforate basket positioned within said work container and swingably mounted on said shaft, said perforate basket approximately covering the bottom wall of said work container, said perforate basket having a smaller periphery than the open top of said work container, whereby the work container can swing back and forth about the perforate basket during the operation of the machine, and a cathode contact extending into said work container.

3. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having side, end and bottom walls, an insoluble container for soluble anode material in the form of a perforate basket with a V-shaped bottom positioned within said work container and swingably mounted on said shaft, the bottom wall of said container being W-shaped in cross section with its vertices parallel to the said shaft and its outer surfaces substantially parallel to the sides of said V-shaped bottom in the central position of the container, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, means for oscillating said work container on said shaft, and a cathode contact extending into said work container.

4. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having side, end and bottom walls, said bottom wall being W-shaped in cross section and comprised of four plane surfaces forming three vertices parallel to said shaft, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, an insoluble container for soluble anode material in the form of a perforate basket positioned within said work container and swingably mounted on said shaft, said perforate basket approximately covering the bottom wall of said work container, said perforate basket having a smaller periphery than the open top of said work container, whereby the work container can swing back and forth about the perforate basket during the operation of the machine, means for oscillating said work container on said shaft, and a cathode contact extending into said work container.

5. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having side, end and bottom walls, an insoluble container for soluble anode material in the form of a perforate basket with a V-shaped bottom positioned within said

work container and swingably mounted on said shaft, the bottom wall of said container being W-shaped in cross section with its vertices parallel to the said shaft and its outer surfaces substantially parallel to the sides of said V-shaped bottom in the central position of the container, said outer surfaces of said W-shaped bottom being substantially wider than the inner surfaces thereof in the direction transverse of said shaft, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, a power shaft, a crank thereon, linkage from said crank to said work container for oscillating the latter, and a cathode contact extending into said work container.

6. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a frame having one end pivotally mounted above and adjacent to said tank and its swinging end disposed directly over said tank, a cross shaft rotatably carried by said swinging end, a work container fixed to said shaft and a perforate anode basket pivotally suspended from said shaft, said basket normally lying within said container, a lever fixed to said cross shaft for rocking said container, a power shaft, a crank thereon, a telescopic rod having a section connected to said crank and another section connected to said lever, a latch on the first section adapted to lock on said lever to control the telescopic action of said rod, means for swinging said frame, and a cathode contact extending into said work container.

7. In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a frame having one end pivotally mounted above and adjacent to said tank and its swinging end disposed directly over said tank, a cross shaft rotatably carried by said swinging end, a work container fixed to said shaft and a perforate anode basket pivotally suspended from said shaft, said basket normally lying within said container, a lever fixed to said cross shaft for rocking said container, a power shaft, a crank thereon, a telescopic rod having a section connected to said crank and another section connected to said lever, a latch on the first section adapted to lock on said lever to control the telescopic action of said rod, a guide member above said cross shaft, a chain connected to said cross shaft and passing over said member for raising and lowering said shaft and swinging said frame, a rotatable drum to which said chain is applied for winding a clutch between said drum and said power shaft, and a cathode contact extending into said work container.

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