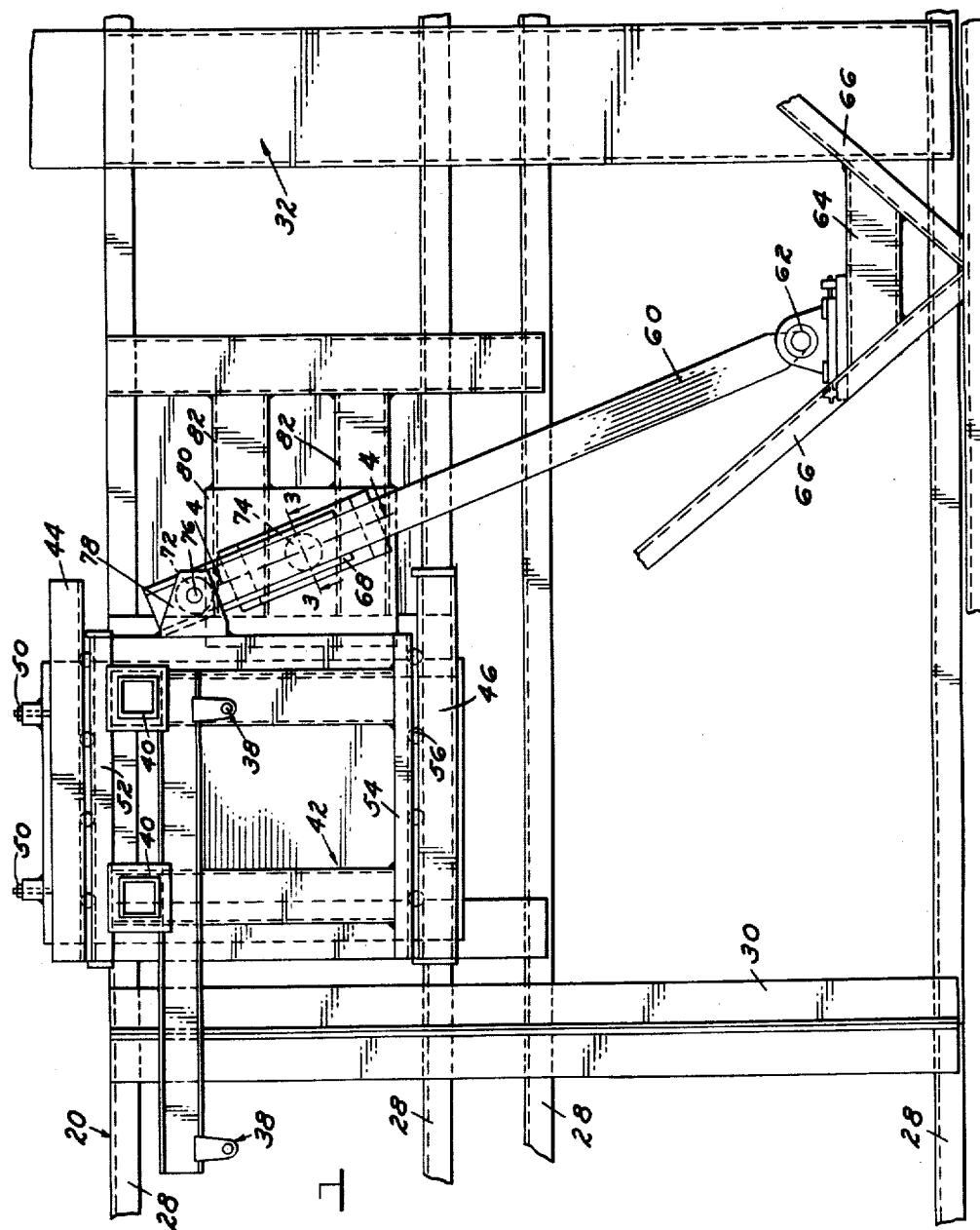


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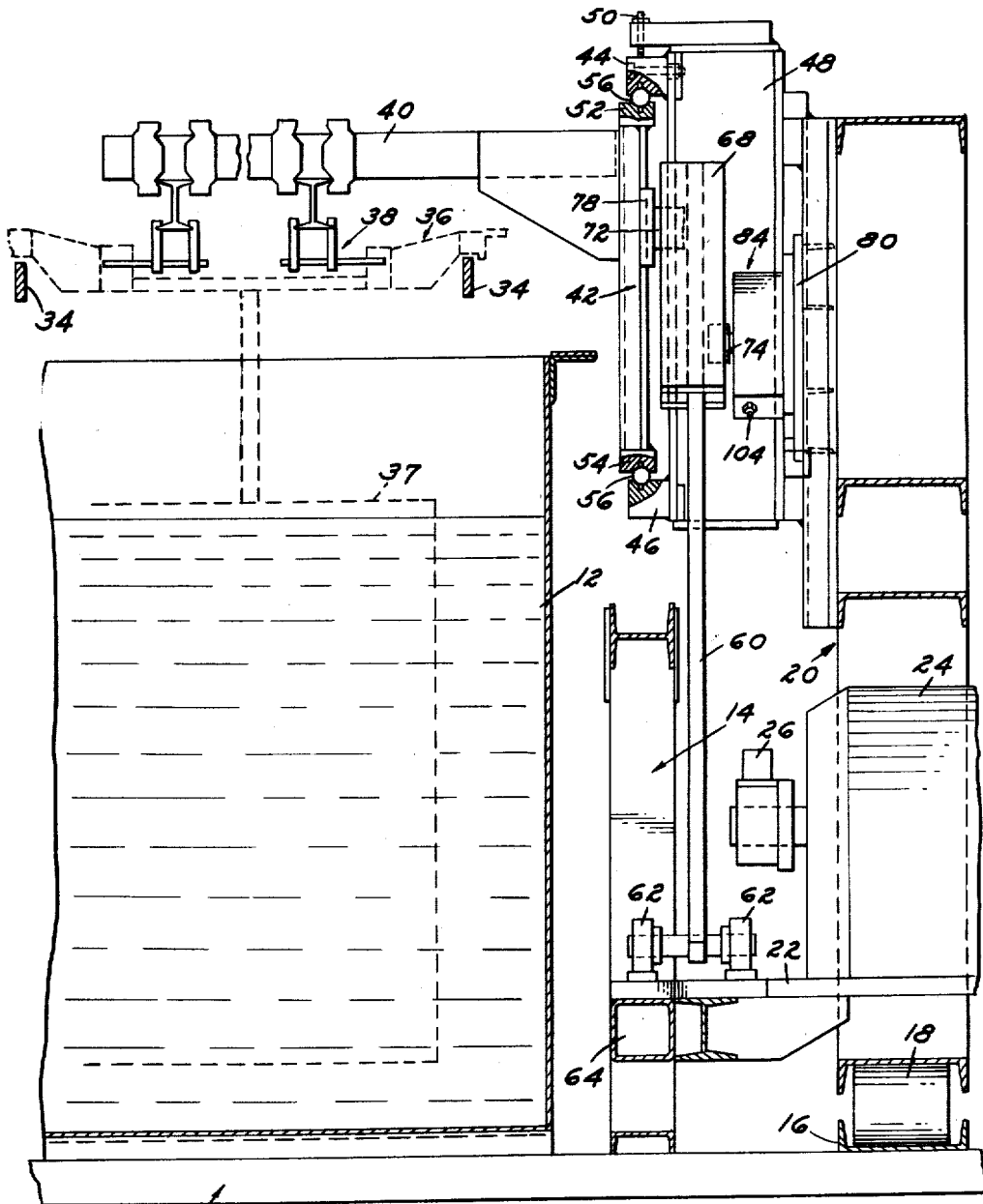
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PLATING MACHINE

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10 FIG. 2

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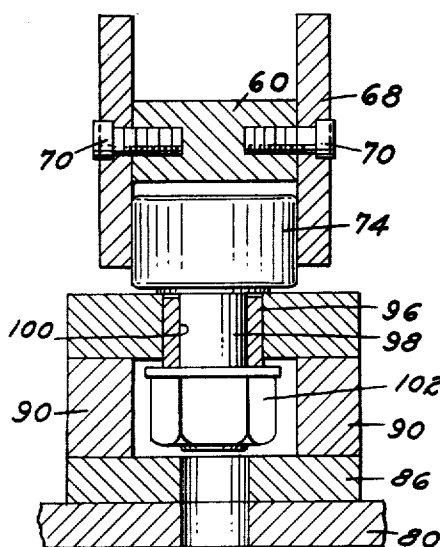


FIG. 3

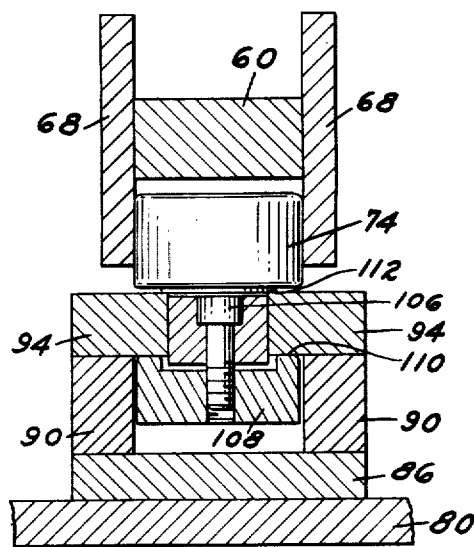


FIG. 5

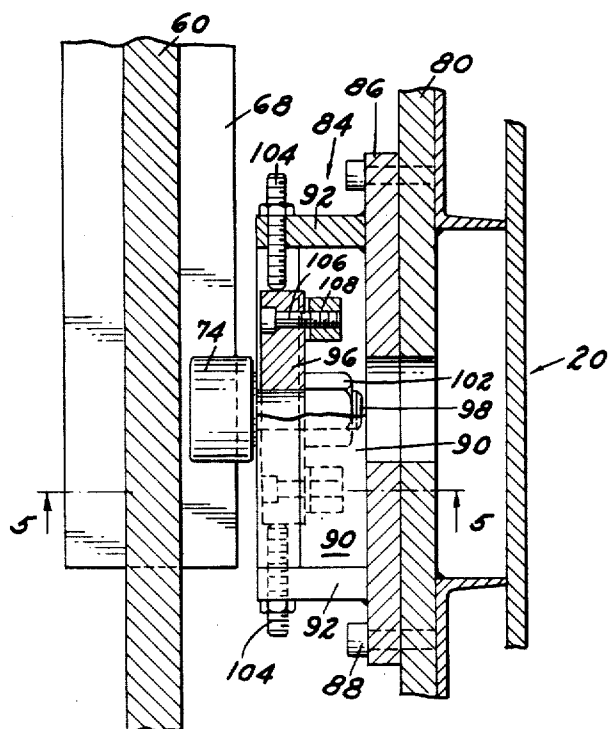


FIG. 4

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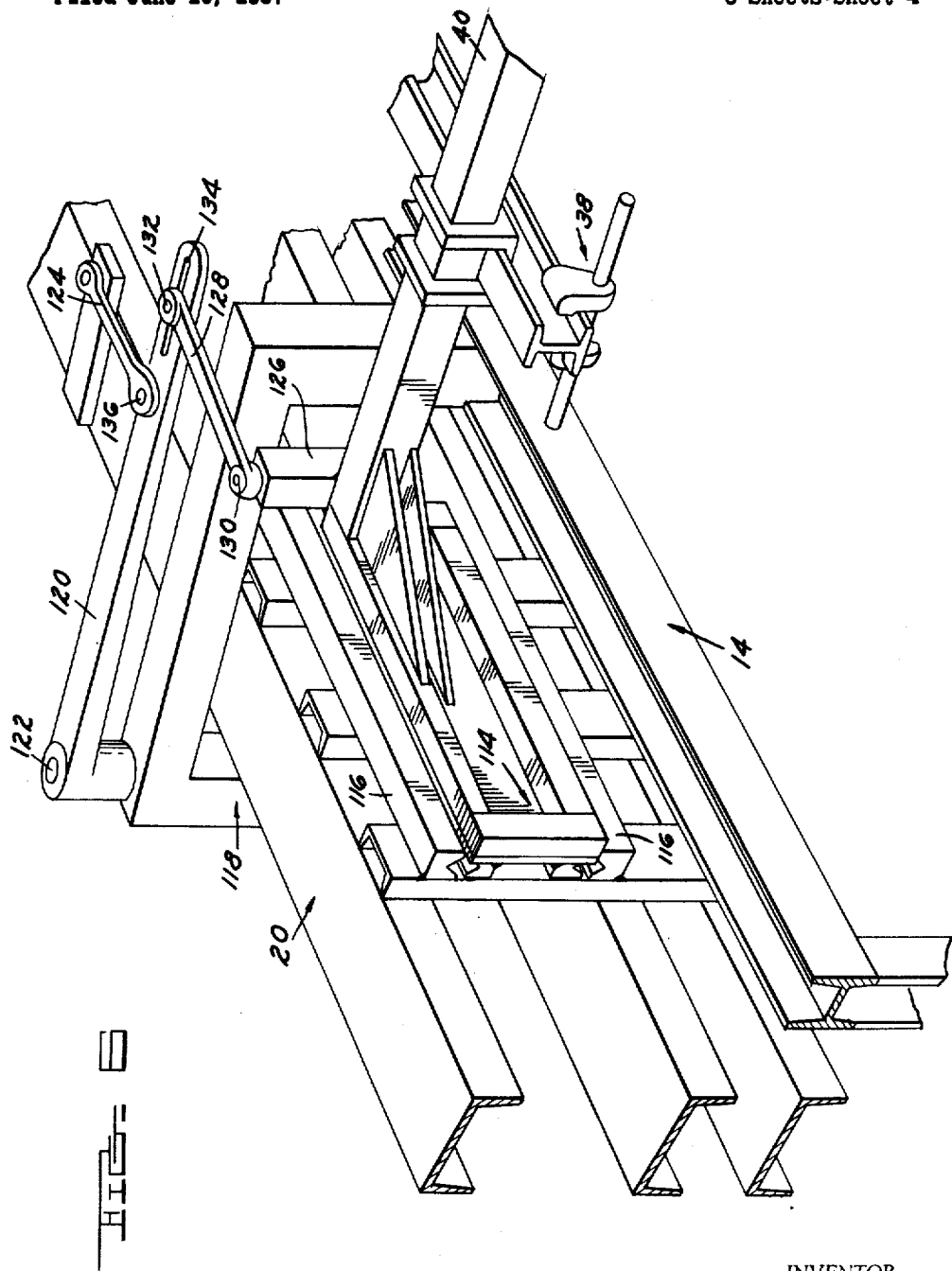
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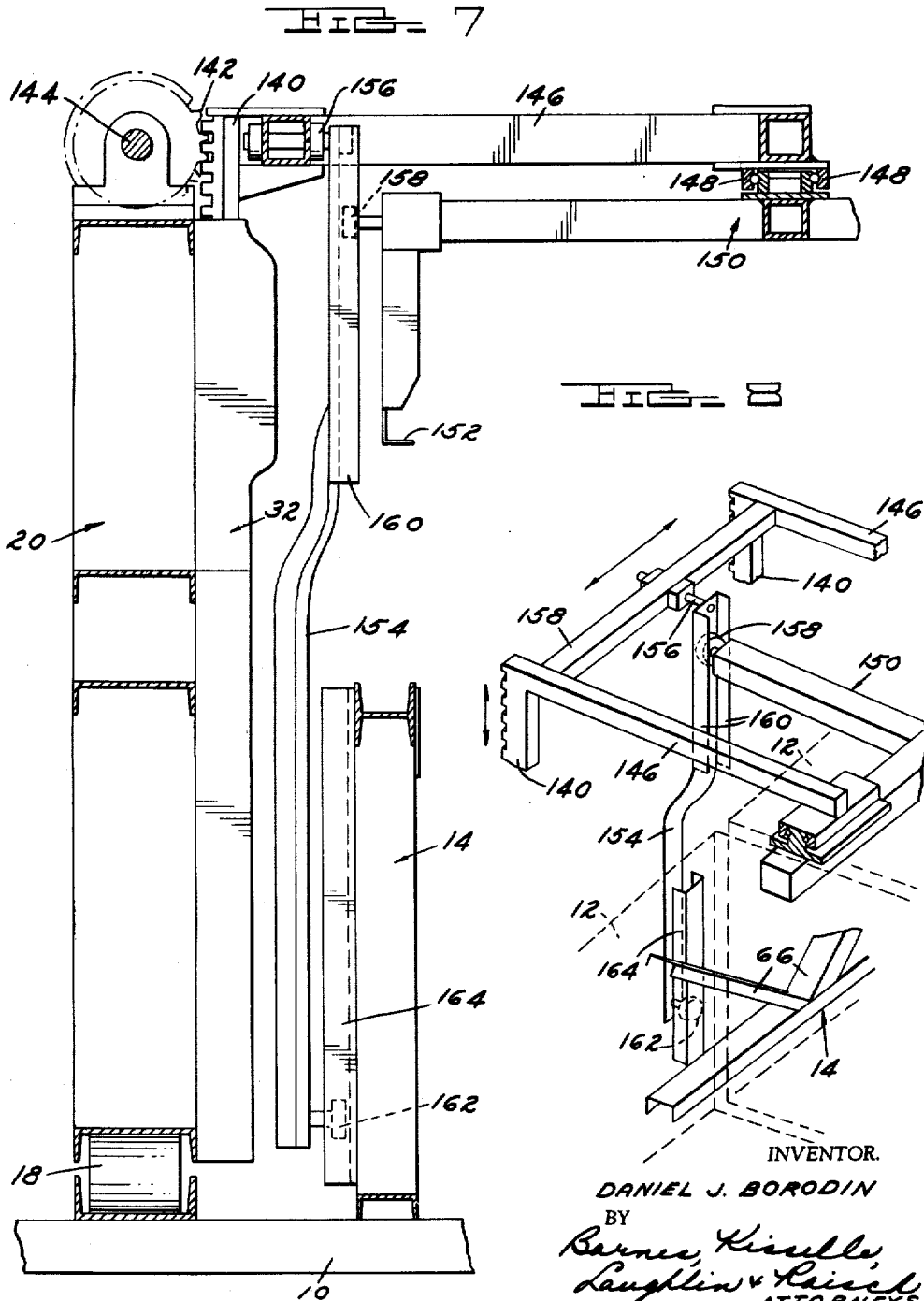
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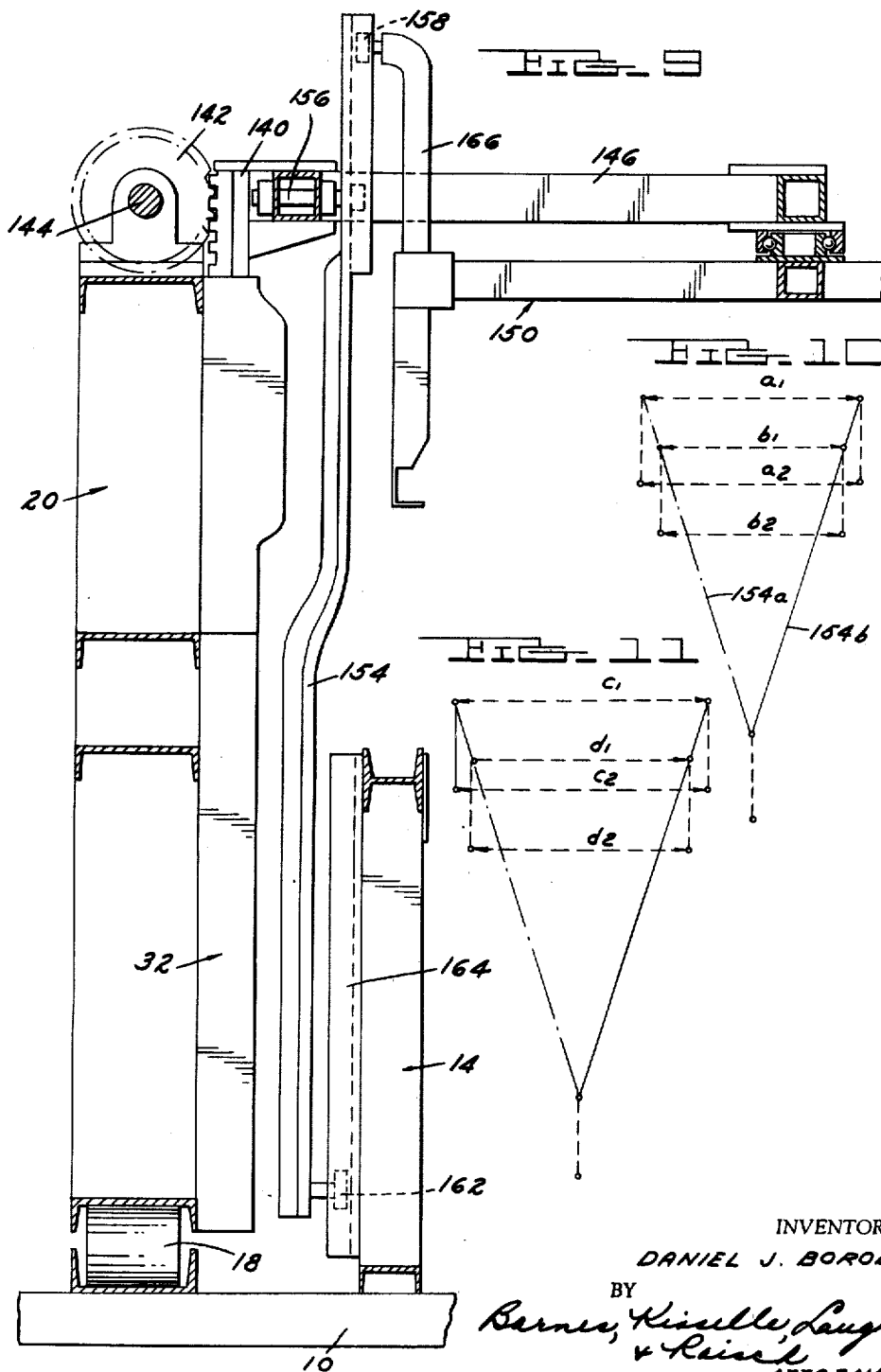
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PLATING MACHINE

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Application June 10, 1957, Serial No. 664,840

20 Claims. (Cl. 134—76)

This invention relates to plating machines.

In my application Serial No. 596,712, filed July 9, 1956, I have disclosed an automatic plating machine of the type wherein work pieces are moved through stations of a plating tank by means of pushers mounted on a carriage which reciprocates alongside the tanks. The work pieces are transferred from one tank to the next adjacent tank by means by vertically moving elevators on the reciprocating carriage. In a machine of that type, the distance between stations in a multiple station tank has to be equal to the stroke of the carriage less the amount of over-travel necessary for the pushers to clear the flappers of the carriers. The transfer distance between successive tanks is necessarily equal to the stroke of the carriage. I have found that in many instances, it is desirable to vary the distance between successive stations. For example, in the loading area of the machine, it may be desirable to lengthen the distance between successive stations to accommodate loading devices. Also, in some tanks, it may be desirable to increase or decrease the transfer distance between successive tanks. Under some conditions of operation of the automatic plating machine, it may also be desirable to skip particular stations entirely.

The present invention contemplates an automatic plating machine of the type shown in my said copending application wherein auxiliary means are provided for varying the distance between successive stations within a tank or for varying the distance between transfer stations or for skipping particular stations entirely.

More specifically, the present invention contemplates an automatic plating machine wherein motion factoring means are provided for causing the work conveying members of the machine, that is, the pushers or the elevators, to move at a stroke less than, equal to or greater than the stroke of the reciprocating carriage.

In the drawings:

Fig. 1 is a fragmentary side elevational view of an automatic plating machine embodying the present invention, parts being broken away and the plating tanks being removed.

Fig. 2 is a fragmentary transverse sectional view of the automatic plating machine.

Fig. 3 is a sectional view along the line 3—3 in Fig. 1.

Fig. 4 is a sectional view along the line 4—4 in Fig. 1.

Fig. 5 is a sectional view along the line 5—5 in Fig. 4.

Fig. 6 is a fragmentary perspective view of an automatic plating machine showing a modified form of the invention.

Fig. 7 is a fragmentary vertical sectional view of a further modification of an automatic plating machine embodying the present invention.

Fig. 8 is a generally schematic perspective view of the arrangement shown in Fig. 7.

Fig. 9 is a view similar to Fig. 7 and showing a further modified form of the invention.

Figs. 10 and 11 are schematic diagrams showing the principle of operation of the modifications shown in Figs. 7 and 9, respectively.

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Referring now to Figs. 1 and 2, the general type of plating machine shown herein is substantially the same as the automatic plating machine shown in my copending application referred to above. Thus, as is the case with the machine shown in said application, the present machine includes a base 10 formed of structural members on which plating tanks 12 are supported in a row. The machine preferably includes two rows of tanks, one at each side, and a semi-circular arrangement of tanks at each end. In the drawings, the tanks at only one side of the machine are illustrated. Along the inner side of each row of tanks, there is mounted on base 10 a rigid upright frame 14 formed of structural members and referred to as a panel. Along the longitudinal center line of base 10, there is arranged an inverted channel 16 which forms a guide for rollers 18 on which an upright carriage 20 is mounted to reciprocate lengthwise of the machine. A platform 22 at one end of the machine supports a hydromotor 24. Hydromotor 24 drives a crank 26 which is connected with carriage 20 to reciprocate the carriage lengthwise of the machine along channel 16. Means not shown are provided for supporting carriage 20 laterally in an upright position between the panels 14. Carriage 20 comprises a plurality of longitudinally extending, vertically spaced channels 28 that are interconnected by vertical braces 30. At predetermined intervals along carriage 20 are arranged elevators 32. The function of these elevators will be described hereinafter.

Above the tanks are mounted rails 34 on which are slidably arranged carriers diagrammatically shown at 36. Carriers 36 support work racks 37 which are designed to be conveyed through successive stations of the tanks 12 by pusher assemblies 38 supported on arms 40 extending laterally over the tanks 12 from carriage 20. As pointed out above, in numerous instances, it is desired to move the carriers 36 a distance greater or less than the stroke of carriage 20. To accommodate for such movement, the pusher arms 40 are mounted on an auxiliary frame 42. Frame 42 is in turn mounted for rolling movement on carriage 20. To provide for such mounting, carriage 20 has upper and lower guides 44 and 46 mounted thereon. Upper guide 44 is adjustably clamped on a bracket 48 and, if desired, may be made adjustable as by the provision of screws 50. Frame 42 on which pusher arms 40 are fixedly mounted are also provided with upper and lower guides 52 and 54, respectively. Anti-friction elements 56 are arranged between the respective guides so that frame 42 is free to reciprocate on carriage 20.

A lever 60 is fixedly pivoted on panel 14 as by bearing blocks 62. In the arrangement shown in Fig. 1, bearing blocks 62 are mounted on a brace structure 64 which is in turn fixedly mounted on the diagonal braces 66 of panel 14. Lever 60 is arranged for pivotal movement in a vertical plane. The upper end portion of lever 60 has spaced parallel flanges 68 secured to the opposite side edges thereof as by screws 70 (Figs. 3, 4 and 5). In effect, lever 60 forms a web between flanges 68. The flanges 68 at one side of the web provided by lever 60 form a guideway for a roller 72 on auxiliary frame 42, and the portions of flanges 68 on the opposite side of the web formed by levers 60 provide a guideway for a roller 74 on carriage 20. Roller 72 is mounted on a pin 76 fixed on a bracket 78 projecting from one end of frame 42.

The supporting structure for roller 74 is shown most clearly in Figs. 3, 4 and 5. This supporting structure comprises a base plate 80 securely fastened to a pair of horizontal struts 82 fixedly mounted on carriage 20. A roller mounting support generally designated 84 is in turn mounted on base plate 80. Roller mounting support 84 includes a base plate 86 of rectangular shape which is secured to base plate 80 as by screws 88. Side bars 90

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and end plates 92 are mounted on base plate 86 to form a rectangular enclosure. A pair of spaced apart, longitudinally extending guide bars 94 are fixedly mounted on side bars 90. Between guides 94 is arranged a slide 96. Roller 74 is mounted by means of a bearing, not shown, on a stud 98 which projects through an opening 100 in slide 96. After the slide 96 is adjusted longitudinally to the desired position between guides 94, it is adapted to be clamped in place by means of locking screws 106 at opposite ends of slide 96 that threadedly engage with clamps 108 which bear against the underside of slides 94 as at 110. It will be observed that by tightening screws 106, the inner race 112 of the bearing on which roller 74 is mounted is urged against the outer faces of guides 94.

With this arrangement, it will be observed that when carriage 20 is reciprocated, lever 60 is caused to pivot back and forth in the bearing blocks 62. Since the roller 74 engages the flanges 68 of lever 60 at a point between roller 72 and bearing blocks 62, the auxiliary frame 42 with the pusher assemblies 38 mounted thereon moves a greater distance relative to base 10 than carriage 20. In other words, the stroke of carriage 20 is amplified at pusher assemblies 38 by the particular arrangement of lever 60 illustrated. In this way, the distance between successive stations within the tanks serviced by pusher assemblies 38 can be varied to suit particular requirements. A minute adjustment of the stroke of pusher assemblies 38 can be effected by adjusting the position of roller 74 on base plate 80. Thus, if it is desired to increase slightly the stroke of pusher assemblies 38, then slide 96 is shifted by screws 104 in a direction longitudinally of lever 60; that is, downwardly toward bearing blocks 62. On the other hand, if it is desired to shorten slightly the stroke of pusher assemblies 38, slide 96 is shifted upwardly on bracket 84; that is, away from bearing block 62.

In Fig. 6, I have shown a modified form of construction for imparting movement of the pusher bar assemblies 38 relative to the carriage 20. In this form of construction, an auxiliary frame 114 is mounted for reciprocation on carriage 20 by means of upper and lower guides 116. The pusher arms 40 are mounted on auxiliary frame 114. A U-shaped bridge structure 118 is anchored at its lower ends on side panels 14 and a lever 120 is pivoted on bridge structure 118 as at 122. Carriage 20 is connected with lever 120 by a link 124. Auxiliary frame 114 is provided with an upright 126 which is in turn connected with lever 120 as by a link 128. Link 128 pivotally connects with upright 126 as at 130; and at its opposite end, it pivotally connects with lever 120 as at 132. It will be observed that the pivotal connection 132 is adjustable longitudinally of lever 120 in a slot 134 in which it is clamped.

With the arrangement shown in Fig. 6, it will be observed that as carriage 20 is reciprocated, lever 120 is caused to oscillate in a horizontal plane. The distance through which it oscillates is controlled by link 124. Since the pivotal connection 136 between link 124 and lever 120 is located intermediate the pivotal connections 122 and 132, it is apparent that the stroke of the carriage is amplified at the pusher assemblies 38. The exact stroke of pusher assemblies 38 is adjusted by adjusting the position of pivot 132 in slot 134. In the two arrangements shown in Figs. 1-6, it will be observed that the pivotal connection between the lever and the carriage is located at a point intermediate the pivotal connections of the lever with the base of the machine and the auxiliary frame on which the pusher assemblies are mounted. Thus, it will be apparent that if it is desired to move the pusher assemblies through a stroke less than the stroke of the carriage, then these pivotal connections would be reversed. For example, in the showing in Fig. 6 if it were desired to move pusher assemblies 38 through a distance

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less than the stroke of carriage 20, the pivotal connections 132 and 136 of links 128 and 124 would be reversed.

In Figs. 7 through 11, there is illustrated an embodiment of the present invention as applied to the elevator structure of the machine. As is shown in these figures, each elevator 32 includes a vertically extending rack bar 140 that is engaged by a gear 142 mounted on a shaft 144 extending horizontally on the top side of carriage 20. Means, not shown, are provided for rotating shaft 144 in opposite directions to thereby raise and lower the elevator rack bar 140. A laterally extending arm 146 is rigidly mounted at the upper end of elevator rack 140. Arm 146 has guides 148 fixed thereon and extending transversely thereof, that is, extending longitudinally of the carriage. Within guides 148, there is arranged for rolling movement a lifter assembly 150 which includes lift angles 152. Only one lift angle is shown in the drawings, but it will be apparent that two lift angles will be employed on opposite sides of guides 148 for engaging with opposite ends of carriers 36.

In the arrangement shown in Fig. 8, each pair of adjacent rack bars 140 are interconnected by a brace 158 so that the elevators operate in pairs. In this case, guides 148 are mounted at the ends of adjacent arms 146 and each lifter assembly will be supported by a pair of arms 146.

The operation of the elevators 32 are such that as each carrier 36 approaches the end of a tank, the lift angles 152 engage the carrier; and the elevator is actuated to lift the carrier to an elevated position wherein the work rack supported by the carrier will clear the upper edge of the tank. The carriage moves through its stroke and the work rack is thus advanced to a position above the next adjacent tank. The elevator is then actuated to lower the work rack onto the next adjacent tank.

In some cases, it may be desirable to limit the transfer distance between tanks to less than the stroke of the carriage; and in other cases, it might be desirable to increase the transfer distance beyond the stroke of the carriage. Under some circumstances, it is also desirable to skip a transfer station entirely. By incorporating the motion factoring mechanism of the present invention on the elevators, it is possible to accomplish these variations in the transfer distance as desired. In the arrangement shown in Figs. 7 and 8, the transfer distance is limited to less than the stroke of the carriage. In the arrangement shown in Fig. 9, the invention is applied to the elevator so as to increase the transfer distance to an amount greater than the stroke of the carriage.

Thus, as will be observed in Fig. 7, a lever 154 pivotally supported at its upper end by means of a pintle as at 156 on the elevator. Pintle 156 may be mounted at the upper end of rack bar 140, or as shown in Fig. 8, on cross bar 158. Roller 158 fixed on lifter assembly 150 is arranged to engage and be guided by a pair of flanges 160 attached to the opposite side edges of lever 154 at the upper end thereof. The lower end of lever 154 is provided with a second roller 162 which is guided for vertical movement by means of a channel guideway 164 fixedly mounted in a vertical position on the side panel 14. Thus, with this arrangement, when the elevator is actuated to elevate lifter assembly 150, roller 162 is shifted upwardly in guide 164. Thereafter, when carriage 20 is reciprocated, lever 154 is caused to oscillate about pintle 156, the roller 162 moving vertically in guideway 164. Since the roller 158 on lifter assembly 150 is disposed between pintle 156 and roller 162, the stroke of lifter assembly 150 will be somewhat less than the stroke of carriage 20. The relative strokes of the carriage and lifter assembly 150 is shown diagrammatically in Fig. 10. The two positions of lever 154 are designated 154a and 154b. The stroke of the carriage or the elevator is indicated in the elevated position a_1 , and a_2 in the lowered position. The reduced stroke of lifter assembly 150 is

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designated by b_1 in the elevated position and b_2 in the lowered position. The arrangement in Fig. 9 is generally the same as that shown in Fig. 7 with the exception, however, that the lifter assembly 150 is provided with a vertical extension 166 on which the roller 158 is journaled. In this arrangement, the pintle 156 by means of which the lever 154 is pivotally supported on the elevator is located intermediate roller 158 and roller 162 at the lower end of lever 154. Thus, in the arrangement shown in Fig. 9, the stroke of lifter assembly 150 will be amplified in relation to the stroke of carriage 20. This is illustrated diagrammatically in Fig. 11 wherein the stroke of the elevator in the raised position is designated c_1 and in the lowered position c_2 . The stroke of lifter assembly 150 in the elevated position is designated d_1 and in the lowered position d_2 .

Thus, it will be seen that I have provided a motion factoring mechanism for an automatic plating machine which enables movement of work racks or carriers through a stroke different from the stroke of the machine; that is, the stroke of the carriage. Furthermore, it will be appreciated that at one portion of the machine, the carriers may be moved through a distance different from the distance through which the carriers are moved between stations at another location in the machine. The variations in the distances through which the work carriers are moved between successive cycles can be varied either while the work is being conveyed through a tank or while the work is being transferred from one tank to another. The distance between successive stations within a tank can be varied to suit the requirements by incorporating the motion factoring mechanism between the carriage and the pusher bars such as shown at 40. The variations in the transfer distance between tanks can be accomplished by incorporating the motion factoring mechanism of the present invention between the carriage and the elevators. In connection with the latter, it will be appreciated that the arrangement illustrated in Fig. 9 can also be employed for skipping a station entirely.

Throughout the specification and the appended claims, reference is made to a plating machine and plating tanks. It will be appreciated that the motion factoring mechanism employed herein is applicable to any material treating apparatus wherein the work pieces have to be conveyed through successive stations. Thus, the invention is not limited strictly to a plating machine. It may be employed in any apparatus wherein the work pieces have to be conveyed in the manner described. Thus, the operation performed on the work pieces need not be plating, it may be any sort of chemical or electro-chemical treatment and the tanks need not contain plating solution. Therefore, the terms "plating machine" and "plating tanks" are used in a broad sense to indicate a general type of apparatus wherein work pieces are treated at successive stations.

I claim:

1. In a plating machine, the combination comprising a support, a row of plating tanks extending along said support, a carriage mounted on said support for reciprocation along said row of plating tanks, means mounted on said carriage for movement longitudinally thereof, said last mentioned means comprising a work conveying member, a lever, a pivotal connection between said support and said lever, a second pivotal connection between said lever and said carriage whereby movement of the carriage relative to said support produces pivotal movement of said lever and a third pivotal connection between said work conveying member and said lever, said three pivotal connections being spaced longitudinally of said lever whereby when said carriage is reciprocated, said work conveying member is caused to move relative thereto.

2. The combination called for in claim 1 wherein said carriage is provided with a vertically movable elevator member, said work conveying member being carried by

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said elevator member, said pivotal connection between said lever and said carriage being fixed on said elevator member.

3. The combination called for in claim 1 wherein said lever is pivotally supported for movement in a generally vertical plane and some of said pivotal connections are slidable.

4. The combination called for in claim 1 wherein the pivotal connection between the lever and the work conveying member is intermediate the other two pivotal connections.

5. The combination called for in claim 1 wherein the pivotal connection between the lever and the carriage is intermediate the other two pivotal connections.

6. In a plating machine, the combination comprising a support, a row of plating tanks extending along said support, a carriage mounted on said support for reciprocation along said row of plating tanks, means mounted on said carriage for movement longitudinally thereof, said last mentioned means comprising a work conveying member, a lever, a fixed pivotal connection between said lever and said support, means forming a driving connection between said carriage and one portion of said lever and means forming a second driving connection between said work conveying member and another portion of said lever.

7. The combination called for in claim 6 wherein one of said driving connections is adjustable longitudinally of said lever to vary the effective lever arm between said fixed pivotal connection and said last mentioned driving connection.

8. In a plating machine, the combination comprising a support member, a plating tank on said support member, a carriage member mounted on said support member for reciprocation lengthwise of the plating tank, a work conveying member mounted on said carriage member for reciprocation thereon in a path generally parallel to the path of reciprocation of said carriage member, said work conveying member extending over said tank and adapted for moveably suspending work pieces to be plated in said tank and means interconnecting said members comprising a lever pivotally mounted on one of said members and pivot means interconnecting said lever with said other two members, said pivot mounting and said pivot means being spaced apart along said lever.

9. The combination called for in claim 8 wherein said lever is pivotally mounted on said support member and said pivot means comprise pivotal connections between said lever and each of said other two members, said pivotal connections being slidable lengthwise of said lever.

10. The combination called for in claim 8 wherein said lever is pivotally mounted on said support and said pivot means comprise a pintle on said carriage member, a pintle on said work conveying member and guide means on said lever extending lengthwise thereof, said pintles being engaged within said guide means and being movable lengthwise thereof.

11. The combination called for in claim 10 wherein the pintle on the carriage member comprises a stud and a roller on said stud.

12. The combination called for in claim 10 wherein the pintle on said carriage member comprises a stud and a roller on said stud, said stud being adjustable on said carriage member in a direction generally towards and away from said pivotal mounting on said support whereby the stroke of the work conveying member relative to the carriage member may be varied.

13. The combination called for in claim 10 wherein said pintles comprise a roller on said carriage member and a roller on said work conveying member, said guide means comprising guideways on said lever in which said rollers are engaged.

14. In a plating machine, the combination comprising a support, a plating tank on said support, a carriage mounted on said support for reciprocation alongside and

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longitudinally of said plating tank, said carriage extending upwardly on said support above the upper edge of the plating tank, a work conveying member mounted on said carriage for reciprocation thereon in a path generally parallel to the path of reciprocation of the carriage, said work conveying member having a portion extending laterally over said tank from which work pieces to be treated in the tank are arranged to be suspended, a lever extending generally vertically between said tank and said carriage, said lever at its lower end having a pivotal connection and said support, the upper portion of said lever having individual pivotal connections with said carriage and said work conveying member, said last two mentioned pivotal connections being spaced apart lengthwise of the lever.

15. The combination called for in claim 14 wherein the lower end of the lever has a fixed pivotal connection with said support, the other two pivotal connections comprising rollers on said carriage and said work conveying member and guideways on said lever in which said rollers are engaged.

16. The combination called for in claim 15 wherein said guideways are formed on opposite faces of the lever.

17. The combination called for in claim 15 wherein at least one of the rollers is adjustable on the member on which it is mounted for movement in a generally upwardly and downwardly direction.

18. In a plating machine, the combination comprising

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a support, a row of plating tanks extending along said support, a carriage mounted on said support for reciprocation lengthwise and alongside of said row of plating tanks, an elevator mechanism vertically movable on said carriage, a work lifting device mounted on said elevator mechanism for reciprocation lengthwise of the tanks in a horizontal plane above the tanks, a lever extending in a generally vertical plane and pivotally mounted on said elevator for movement both vertically and horizontally therewith, the lower end of said lever having a vertically shiftable pivotal connection with said support, said lifting device having a pivotal connection with the upper portion of said lever, said last mentioned pivotal connection being slidable lengthwise of the lever.

19. The combination called for in claim 18 wherein the pivotal mounting of the lever on said elevator is intermediate said two pivotal connections.

20. The combination called for in claim 18 wherein said two pivotal connections are disposed below said pivotal mounting of the lever on the elevator.

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