Oct. 28, 1969 J. F. GILEWSKI 3,474,800

TRANSFER APPARATUS

Filed Nov. 21, 1966 4 Sheets-Sheet 1

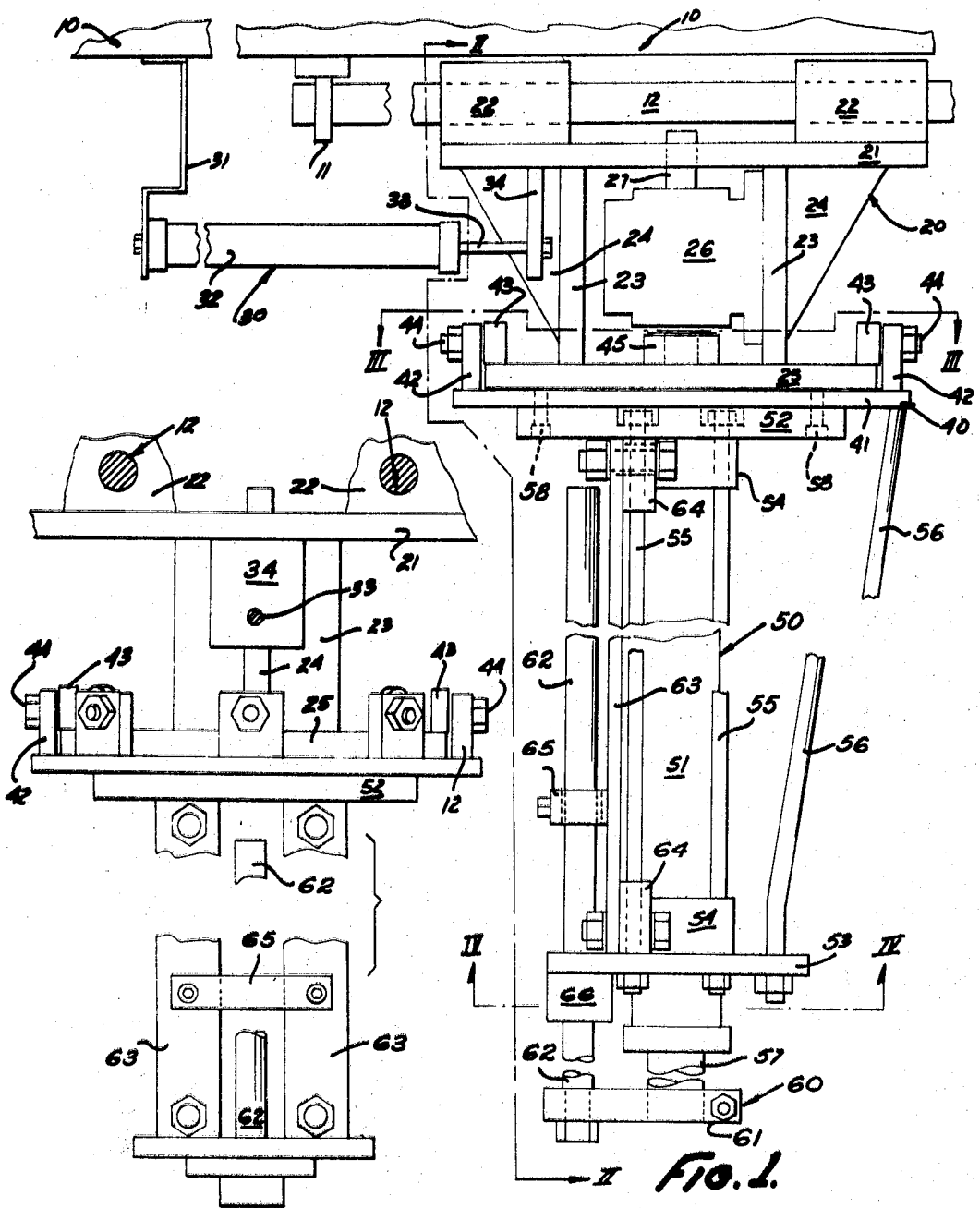


FIG. 1.

FIG. 2.

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TRANSFER APPARATUS

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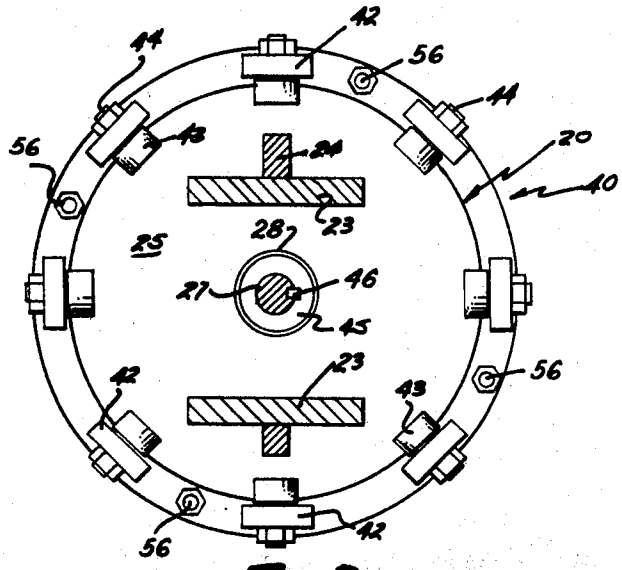


FIG. 3.

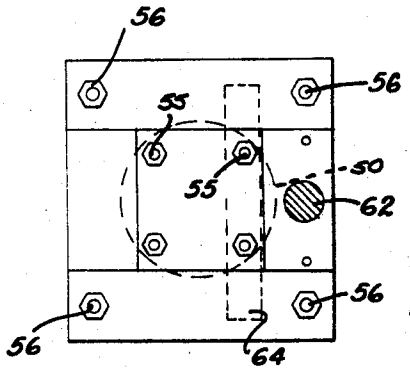


FIG. 4.

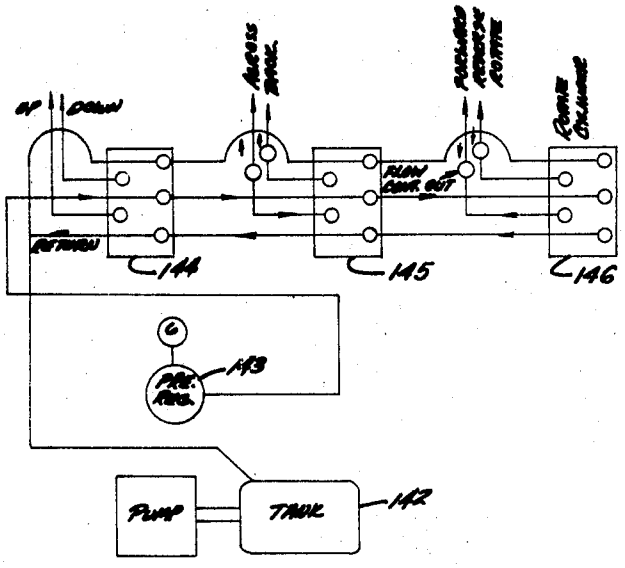


FIG. 8.

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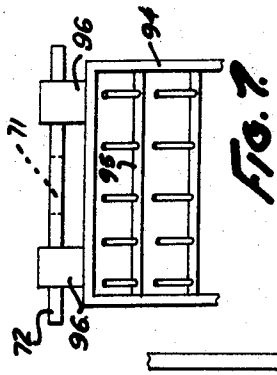


FIG. 7.

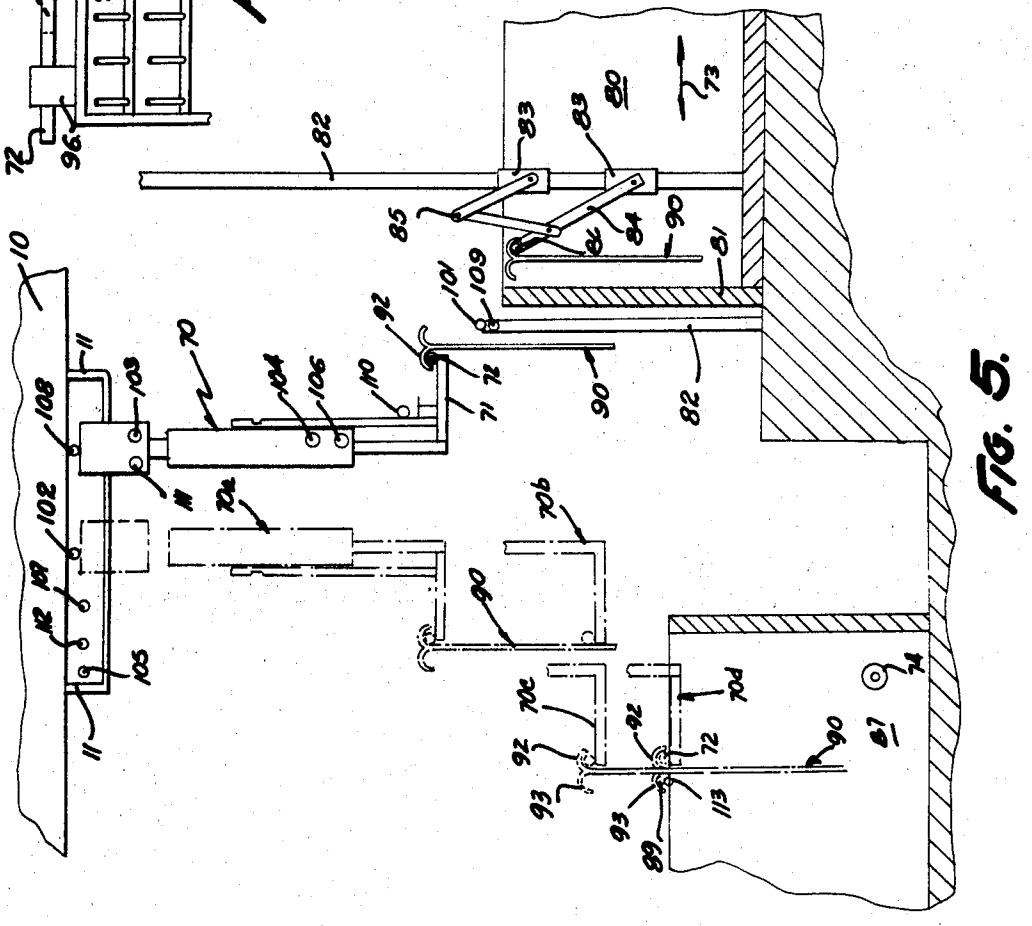


FIG. 5.

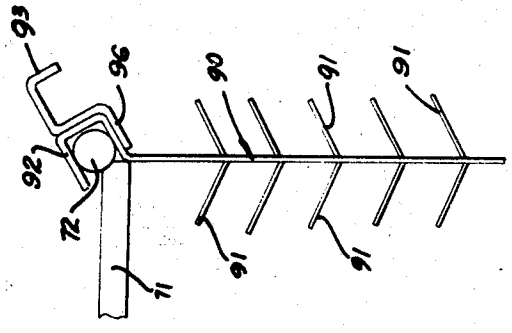


FIG. 6.

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TRANSFER APPARATUS

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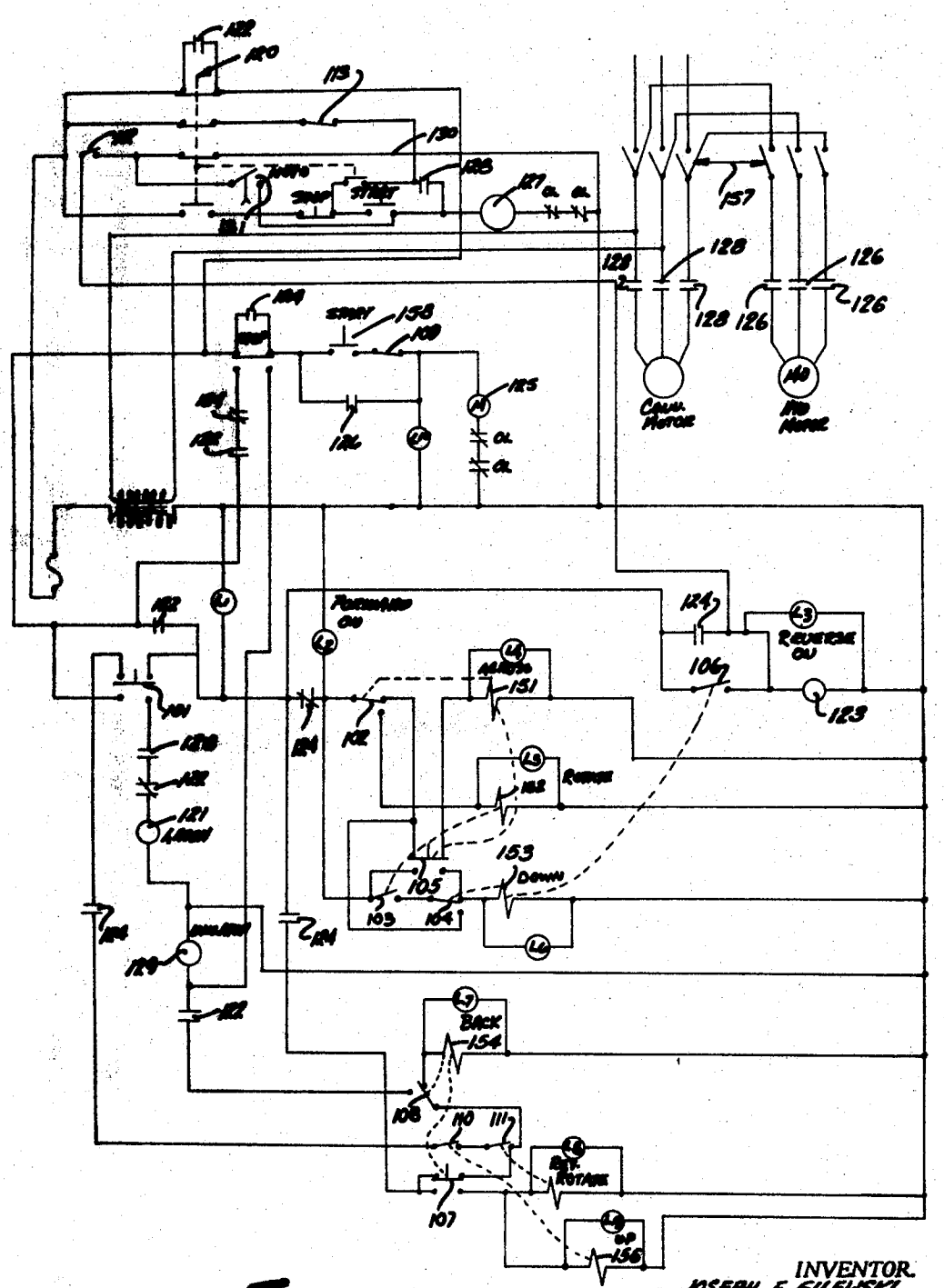


FIG. 9

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3,474,800

TRANSFER APPARATUS

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U.S. Cl. 134—46 2 Claims

ABSTRACT OF THE DISCLOSURE

A transfer apparatus particularly adapted for transferring plating racks from one bath to another having means to grasp the rack and move it upwardly and downwardly, rotatably, and linearly between baths. The apparatus is activated and runs in response to a predetermined program during a given transfer cycle. The cycle is initiated by removal of one of the racks from the bath for transfer to the other bath.

This invention relates to automatic transferring devices and, more particularly, to automatic transferring devices particularly adapted to transfer objects automatically from one position to a second position. In its more limited aspects, this invention relates to a transfer device particularly adapted to transfer objects being electroplated from one electroplating tank into a second electroplating tank automatically upon completion of the initial electroplating process.

Modern production techniques often necessitate the transfer of the article being manufactured from one operative assembly into or onto a second operative assembly whereby the manufacturing process may be continued. Traditionally, such transfers have been executed primarily by hand, reliance being placed upon manually actuated hoists and dollies in the event that the object was too heavy to be lifted. As production capacities are increased, the necessity of making such hand transfers tends to slow the manufacturing process and, thus, reduce the efficiency with which a particular article may be fabricated. Additionally, the mere necessity of providing men to handle such transfer operations results in increased overhead and, thus, markedly effects the manufacturing costs on the particular goods.

A somewhat independent drawback of the hand transferring process is presented by the fact that a number of consumers absolutely refuse to purchase certain types of goods unless their entire fabrication has been executed out mechanically. The reasons for such refusals stem mainly from quality control standards. Assume, for example, that the particular article being fabricated is a door handle for an automobile and that the process under consideration is the electroplating thereof. In order to insure that the particular handle has satisfactory wear characteristics, a number of separate platings of different metals are placed upon the raw part. Once the plating steps have been completed, it is virtually impossible to ascertain whether the required number and types of plating have been placed on the object and beneath the outer finished surface thereof. Most automobile manufacturers, therefore, require that such electroplating processes be carried out in continuous assembly-line fashion and refuse to accept parts that have been manipulated by hand during fabrication. Thus, if a particular manufacturer wishes to furnsh acceptable components, it is necessary that he have a single step-by-step electroplating tank having a sufficient number of separate baths to complete the various platings in a single automatic operation.

The drawbacks of this arrangement are evident. A tank with the required number of baths or sectionalized electroplating areas is extremely bulky and renders efficient utilization of floor space nearly impossible. This, of course, reduces the over-all efficiency of the fabrication process and, thus, adds markedly to the cost of the fabricated component.

It is an object of this invention to provide a transferring device capable of accurately and positively transferring objects from one position to a second position within a fabrication distribution or other type of plant.

More particularly, it is an object of this invention to provide such a device which is capable of executing any desired sequence of lift, rotate and slide motions during the transferring process as a means of orienting the component being transferred at the second position such that the fabrication thereof or other type of operation thereon may be continued.

It is an object of this invention to provide a device of the type described which is capable of completely automatic operation, thus eliminating the necessity of providing a worker to individually supervise and execute each transfer process.

It is an object of this invention to provide a device of the type described which permits systematic execution of the various steps of the fabrication or other process being executed with maximum efficiency and minimum overhead.

It is yet another object of this invention to provide a device of the type described particularly adapted to transfer articles being electroplated from a first electroplating tank to a second electroplating tank without the necessity of manually intervention.

Similarly, it is an object of this invention to provide a device whereby a prescribed electroplating process may be executed upon a particular article without manual intervention and without the utilization of a continuous tank, thus permitting efficient utilization of available floor space and components.

These and other objects of this invention will be readily understood by those skilled in the art with reference to the following specification and accompanying figures in which:

FIG. 1 is a broken, side-elevational view of the transfer mechanism;

FIG. 2 is a broken, cross-sectional view taken along line II—II of FIG. 1;

FIG. 3 is a cross-sectional view taken along line III—III of FIG. 1;

FIG. 4 is a cross-sectional view taken along line IV—IV of FIG. 1;

FIG. 5 is a schematic illustration of the transfer device in an electroplating environment showing the manner in which the device may be programmed to perform a desired sequence of steps during the transfer operation;

FIG. 6 is a schematic, side-elevational view of a plating rack suitable for use in the plating environment shown in FIG. 5;

FIG. 7 is a schematic, front-elevational view of the plating rack shown in FIG. 6;

FIG. 8 is a schematic diagram of a typical hydraulic circuit which may be utilized to power the transfer device; and

FIG. 9 is a schematic diagram of an electrical circuit particularly adapted to initiate and execute the transfer operation illustrated in FIG. 5.

Briefly, this invention comprises a transfer device having a system of rails suitably affixed to the ceiling or other fixed partition of an enclosure within which the transfer operation is to take place. Suitable carriage means are slidably mounted on the rails and means are provided for reciprocating the carriage therealong. Rotatably affixed to the carriage in turntable fashion is a support means which has an expandable and retractable lift means

depending downwardly therefrom. Means are provided for rotating the support means with resect to the carriage and for engaging the object to be moved at the lower extremity of the lift means.

A plurality of position sensing switches are provided for sensing the relative positions of the engaging section of the transfer apparatus with respect to the rail means and the carriage. These sensing means preferably take the form of conventional limit switches. By wiring the limit switches and the various transfer apparatus actuating means in proper sequence, the transfer device may be programmed to execute any desired transfer operation.

In its more limited aspects, this invention comprises a transfer device of the type described above operatively associated with a pair of electroplating tanks and arranged such as to automatically transfer the plating racks upon which the articles to be plated are suspended between the tanks upon initiation of the proper transfer sequence by the plating apparatus in the first tank. Conveniently, the rack conveying apparatus within the second tank may be wired directly into the circuit to render the transfer and plating operation completely automatic.

Referring now to the figures, a preferred embodiment of this invention will be described in detail. FIGS. 1 through 4 illustrate the structural characteristics of a preferred embodiment of the transfer device per se. The reference numeral **10** indicates the ceiling or other stationary wall of the enclosure within which the transfer device is to be operated. A pair of parallel rails **12** are supported from the ceiling by suitable rail support brackets **11** as indicated in FIGS. 1 and 2.

Slidably mounted upon rails **12** is the carriage assembly **20** which comprises an upper plate **21** suitably journalled for sliding movement along rails **12** by means of longitudinal slide bearings **22**. Upper plate **21** has a pair of supports **23** depending therefrom which are stabilized by suitable reinforcing gussets **24**. A circular track plate is affixed symmetrically to the lower extremities of depending supports **23** by any suitable means such as cap screws. Track plate **25** has a circular aperture **28** at its center, the purpose of which will become obvious hereinafter.

Mounted to the side of one of the depending supports **23** is a hydraulic motor **26** having a shaft **27**. Hydraulic motor **26** functions, when activated, to rotate the turntable assembly **40** with respect to the carriage **20**. Depending upon the particular transfer environment within which the apparatus is used, the rotational displacement of hydraulic motor **26** may be confined by means of suitable stops within predetermined limits.

The carriage assembly **20** is slid along the rails **12** by means of slide assembly **30**. The slide assembly **30** comprises a depending ceiling or wall bracket **31** having one extremity of a two-way ram cylinder **32** affixed thereto. The connecting rod **33** of the ram cylinder **32** is similarly affixed to a suitable bracket **34** depending from upper plate **21** on carriage assembly **20**. As will be apparent from an examination of FIGS. 1 and 2, the expansion of ram cylinder **32** causes the carriage assembly **20** to move along rails **12** to the right as viewed in FIG. 1 and the retraction thereof causes movement in the opposite direction.

The turntable assembly **40** comprises a circular support plate **41** having a somewhat larger radius than that of circular track plate **25**. Support plate **41** has a plurality of upstanding members **42** about its outer periphery onto which are affixed a series of rollers **43** by means of suitabe shafts **44**. As will be obvious from an examination of FIGS. 1 through 3, rollers **43** function to rotatably support plate **41** with respect to track plate **25** such that load forces on the lower plate are transferred by the contacting surfaces of the rollers **43** onto the upper plate **25** and thence to the overhead rails **12**.

Support plate **41** has a central hub **45** which protrudes through aperture **28** in track plate **25**. As shown best in FIG. 3, hub **45** is connected for rotation with shaft **27** of hydraulic motor **26** by means of a suitable key **46**. Thus, as motor **26** is activated, the turntable assembly **40** rotates with respect to carriage assembly **20**. The turntable suspension arrangement prevents the transmission of load forces through shaft **27**, thus, insures that motor **26** will not be sujected to undue wear.

Depending from turntable assembly **40** is the cylinder assembly **50** which comprises a conventional jacket or cylinder **51** having retaining sleeves **54** and reinforcing rods **55**. The reinforcing rods **55** have extended extremities which permit the cylinder to be affixed to assembly plate **52** and lower support plate **53**. Assembly plate **52** is affixed to the lower plate **41** of turntable assembly **40** by any conventional means such as cap screws **58**. If necessary, additional support may be gained by use of supporting rods **56** which run from the peripheral under surface of turntable plate **41** to the corners of lower support plate **53**. The number and size of exterior support rods **56** which are utilized in a given transfer apparatus, will depend, of course, on the environmental conditions within which the apparatus is to be utilized.

Affixed to the free extremity of rod **57** of cylinder **50** is a support platform assembly indicated generally by the reference numeral **60** comprising a platform member **61** suitably affixed to the rod **57**. Platform **61** is restrained from radial displacement with respect to cylinder **50** by means of a stabilizing rod **62** which is slidably journalled in bearings **65** and **66**. Slide bearing **65** is positioned by means of a pair of vertical straps **63** mounted in suitable blocks **64** positioned beneath and affixed to assembly plate **52** and above and affixed to support plate **53**. Straps **63** additionally, lend vertical strength to the cylinder assembly. As platform **60** is lowered and raised by the expansion and retraction of cylinder **50**, stabilizing rod **62** slides within slide bearings **65** and **66**.

In actual operation, some type of means for engaging the object to be moved must be affixed to platform **61**. Depending upon the particular type of operating environment, these means might comprise, for example, a set of jaws, a hook or any type of operative components adapted to mate with the object to be moved and suspended therefrom for transferral to a predetermined location.

Referring now to FIGS. 5 through 9, the operation of a preferred embodiment of the transfer device will be described in an electroplating environment. In FIG. 5 there is illustrated schematically a Hansen Van-Winkle automatic plating unit, indicated generally by the reference numeral **80**; a second plating bath, indicated generally by the reference numeral **87**; and the transfer device indicated generally by the reference numeral **70**. The transfer device **70** is affixed to the ceiling of the enclosure by means of rails **12** so as to be operative to transfer the articles being plated from the automatic plating unit **80** to the plating bath **87**.

In the Hansen Van-Winkle unit, the plating process is executed sequentially by dipping the parts to be plated into adjacent baths. The baths extend in oval fashion in a direction indicated by the arrows **73** and well-known means are provided for sequentially stepping the parts from bath to bath. Bath **87** may be of continuous type and may extend in the direction indicated by the arrows **74** (i.e., into and out of the paper).

During the plating process, the goods are placed on racks **90** such as that shown in FIGS. 6 and 7. The rack **90** comprises a body section **94** having vertical supports **96** and horizontal supports **95** suitably connected together. Extending in opposite directions from each of the horizontal supports **95** are a plurality of work support spikes **91** upon which the parts to be plated are hung. A pair of ears or tabs **96** extend upwardly from the top of the uppermost support. The upper extremities of these tabs form two pairs of opposed, generally U-shaped, grips **92** and **93**. Grips **93** are adapted to hang over on

the rack support **86** in plating conveyor **80** and the conveyor member **89** in plating conveyor **87** and thus, support the rack thereon. Grips **92** are adapted to hang over cylindrical rod **72** which is held in fixed relation with respect to transfer device **70** by means of a horizontal arm **71** and, thus, support the rack therefrom. It will be noted that the shape of grips **92** and **93** is such that the rack **90** may be removed from is resting position by merely lifting it upwardly and moving it away from the particular support from which it has been hung.

While the loaded rack **90** is cycling through automatic plating unit **80**, it is suspended by means of grips **93** on a suitable horizontal rod **86** attached to pivotable arm **84** of the plating unit. When upright **82** has completed its oval cycle around the plating bath **80**, slide bearings **83** are slid upwardly along upright **82** until such time as the lower section of the rack **90** clears the facing wall **81** of the bath. At this point, hinge **85** straightens and causes rack **90** to be swung over facing wall **81** of the bath and lowered adjacent the exterior surface thereof through coaction of the hinge and linear movement of bearings **83**. Transfer device **70** has been prepositioned such that the grips of **94** of the rack engage the horizontal rod **72** as pivotable arm **82** lowers, causing the weight of the rack to thereafter be borne by the transfer device **70**. Arm **84** continues downwardly out of engagement with grips **93** to a rest position upon upright post **82**. It maintains this position until the transfer operation has been completed. The striking of pivotable arm **84** against limit switches **101** and **109** on upright **82** initiates the automatic transfer of the rack from bath **80** to bath **87** by transfer device **70**.

By way of clarification, it should be pointed out that all of the components to the right of upright **82**, as viewed in FIG. 5 are well-known in the art. In previous electroplating operations, once the rack has been swung adjacent the exterior surface of the forward wall of the bath, it has been manually transferred to the next plating bath by suitable means such as a hydraulic hoist.

The reference numerals **101** through **113** in FIG 5 indicate the positions of limit switches on the various components of the transfer device. Referring additionally to FIGS 8 and 9, as arm **84** drops down onto upright **82** it closes limit switch **101** and opens switch **109**. This activates the coil of latching relay **121**, which, in turn, causes those contacts **122** of the latching relay which were previously closed (indicated by a slash across the contact symbol) to open and those contacts **122** which were previously open (indicated by the absence of a slash across the contact symbol) to close. Assuming that the manual-automatic select switch **120** has been depressed to the position shown in FIG. 9, the transfer sequence will continue automatically from this point.

By way of explanation, the symbols **L1**, **L2**, etc. on FIG. 9 indicate lights on a monitoring panel which are activated during the execution of a particular transfer step. For example, light **L4** lights during the period the across solenoid coil **151** is activated; light **L5** during the period rotate solenoid coil **152** is activated, etc.

Prior to the time that the pivoting arm **84** of the automatic conveyor strikes the surface of upright **82**, limit switch **109** is closed and limit switch **101** is opened. Once the switch banks **157** have been closed to route power to the unit, the hydraulic motor **140** may be activated by pressing start button **158**. This activates coil **125** of the conveyor motor relay and causes its contacts **126** to latch into closed position. Motor **140** runs pump **141** (see FIG. 8) to supply hydraulic pressure in a well-known manner to the solenoid valves **144**, **145** and **146** which activate and deactivate the various hydraulic elements of the transfer device.

The opening of limit switch **109** does not effect the operation of hydraulic motor **140**, since it has been latched into the circuit by relay **125**. The activation of latching relay **121** (by the closing of limit switch **101**) activates solenoid coil **151** of solenoid **145**. This pressurizes cylinder **32** (see FIG. 1) causing the unit **70** to move to the left as viewed in FIG. 5. As the unit moves to the left, it draws the rack **90** away from the forward wall **81** of plating bath **80** in order to provide clearance for rotation. When the transfer device has moved to the position indicated by the reference numeral **70*a***, it contacts limit switch **102**. The toggling of switch **102** stops the across motion by cutting off the power to solenoid coil **151** and initiates a forward rotation motion by energizing solenoid coil **152** of solenoid **146**.

In the embodiment illustrated in FIG. 5, the hydraulic motor **26**, which rotates the lower section of the transfer device, is limited preferably to forward and reverse movement of 180°. At the completion of this 180° rotation, the rack is hanging over bath **87** between the facing wall **88** and the conveyor line **89** therein. At this point, limit switch **103** closes. This activates solenoid coil **153** of solenoid **144** causing the cylinder **50** (see FIG. 1) to extend and, thus, lower the parts rack partially into the bath **87** as indicated by the reference numeral **70*b***. During this interval, switch **102** remains closed such that hydraulic solenoid coil **152** remains activated positively via motor **26** remain activated in the forward direction. This positively biases the rack into the rotational position illustrated to insure that no tendency exists for it to swing out of alignment.

When the rack reaches the position indicated by the reference numeral **70*b*** in FIG. 5, limit switch **4** is toggled which disconnects power to solenoid coil **153** and, thus, stops the downward motion of the transfer device. At this point, switches **102**, **103** and **104** are in their depressed positions, causing power to be rerouted to solenoid coil **151** which again activates cylinder **32** (see FIG. 1) to continue the movement of the transfer device to the left as viewed in FIG. 5. As the transfer unit begins this movement, switch **102** will return to its initial position, but this fluctuation will not effect the power transmission to solenoid coil **151**.

When the transfer device reaches the position indicated by the reference numeral **70*c*** and grip **93** is in vertical registry with conveyor member **89** in tank **87**, limit switch **105** is depressed. This disconnects the power to solenoid **151** and, thus, discontinues the across travel of the transfer device. At the same time, the depressing of switch **105** routes power to down solenoid coil **153**, which causes solenoid **144** to transmit fluid to cylinder **50** (see FIG. 1) and support rod **72** is lowered to the position indicated by the reference numeral **70*d*** in FIG. 5. During this lowering, grip **93** catches on and engages conveyor member **89** of electroplating bath **87** and is supported hereby as rod **72** continues its downward movement and slides from engagement with grip **94** on the opposite side of the rack **90**. This is the end of the forward cycle.

When the unit reaches a position indicated by the reference numeral **70*d***, limit switch **106** is depressed. This transmits power to relay coil **123**, opening those contacts **124** which were previously closed (indicated by a slash across the contact symbol) and closing those contacts which were previously opened (indicated by the absence of a slash across the contact symbol). The closing of switch **106** also energizes the back solenoid coil **154** activating solenoid **145**. As the transfer device moves to the right (FIG. 5) it depresses limit switch **112** and, thus, energizes the coil of relay **127** to close contacts **128** which start the conveyor motor **160** in tank **87** to move conveyor member **89** so as to be ready to receive another rack. The period of movement of conveyor motor **160** is preferably governed by a time relay **130** having contacts **131** but, it may also be disconnected by a suitably positioned limit switch **113**.

As the transfer device moves to the right from position **70*d***, it depresses switch **107** which disconnects the power to back solenoid coil **154**. The depressing of limit switch **107** also energizes solenoid coils **155** and **156**. The

activation of these coils causes solenoids **144** and **146** to supply pressure to motor **26** and cylinder **50** (see FIG. 1) to cause the transfer unit to move upwardly and to rotate in a reverse direction through 180°. At the end of the back rotation, limit switch **111** closes and, when the unit is all the way up, limit switch **110** closes. At this point pivot arm **84** lifts away from upright post **82** opening switch **101** and reclosing switch **109**. This causes the back solenoid coil **154** to be energized and the unit moves to the right as viewed in FIG. 5 via pressure on cylinder **32** until such time as it closes switch **108**.

The closing of switch **108** activates relay coil **129** which unlatches contacts **122** to stop operation of the circuit. At this point, the transfer unit is ready for a new forward cycle. At the completion of the reverse cycle of the transfer device, the series of upstanding supports **82** within tank **180** will rotate about the oval bath configuration and another rack **90** will be readied for transferal to bath **87**. As soon as the plating process is completed with respect to that rack, it will be transferred to tank **87** in an identical manner.

Thus it will be seen that this invention has provided a transfer device which is capable of automatically transferring objects from one position to another. While the operative form of the invention has been illustrated in an electroplating environment, it will be obvious to those skilled in the art that by altering the construction of the transfer device engaging members, repositioning the limit switches and redesigning the circuits, the transfer could be adapted to automatically perform a vast number of transfer operations many of which relate to fields quite widely separated from the electroplating process. It might be desirable, for example, to replace the stops in motor **26** such that the unit rotated at 270° or only 90° during the transfer process. Similarly, it might be desirable to curve the tracks **12** affixed to the ceiling such that the unit was not confined to a straight line path.

While a preferred embodiment of this invention has been described in detail, it will be obvious, as noted, to those skilled in the art that many other embodiments may be conceived without departing from the scope of this specification and the accompanying drawings.

I claim:

1. Plating apparatus comprising:

a first electroplating tank including means for removing plating racks therefrom and lowering them adjacent the outer surface thereof;

a second electroplating tank;

rail means supported above and in fixed relationship with respect to said tanks;

a carriage slideably mounted on said rail means;

means for sliding said carriage along said rail means;

support means affixed to said carriage and rotatable with respect thereto;

means for rotating said support means with respect to said carriage;

expandable and retractable lift means depending from said support means;

means affixed to the lower extremity of said lift means for engaging said plating racks;

a plurality of position sensing means for sensing the relative positions of said carriage with respect to said rail means, said support means with respect to said carriage and said engaging means with respect to said support means whereby said rotating means, said lift means and said sliding means may be activated automatically with a predetermined program; and

means for detecting when said removing means has removed one of said racks and for thereupon initiating said predetermined program.

2. The apparatus as set forth in claim **1** wherein said rack comprises grasping means protruding in opposite directions from the top thereof whereby said rack is adapted to be hung on said engaging means as said removing means lowers.

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U.S. Cl. X.R.

134—76; 212—23, 128; 214—16