

July 6, 1937.

J. R. COX ET AL

2,085,730

ELECTROPLATING MACHINE

Filed Feb. 18, 1933

3 Sheets-Sheet 1

Fig. 1.

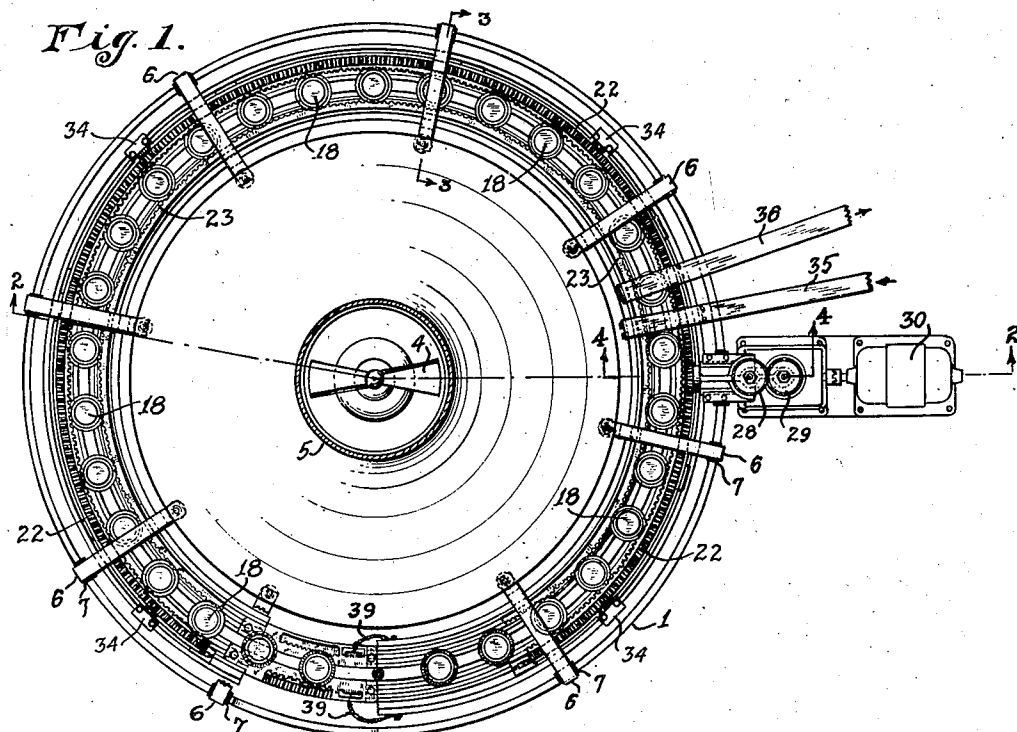
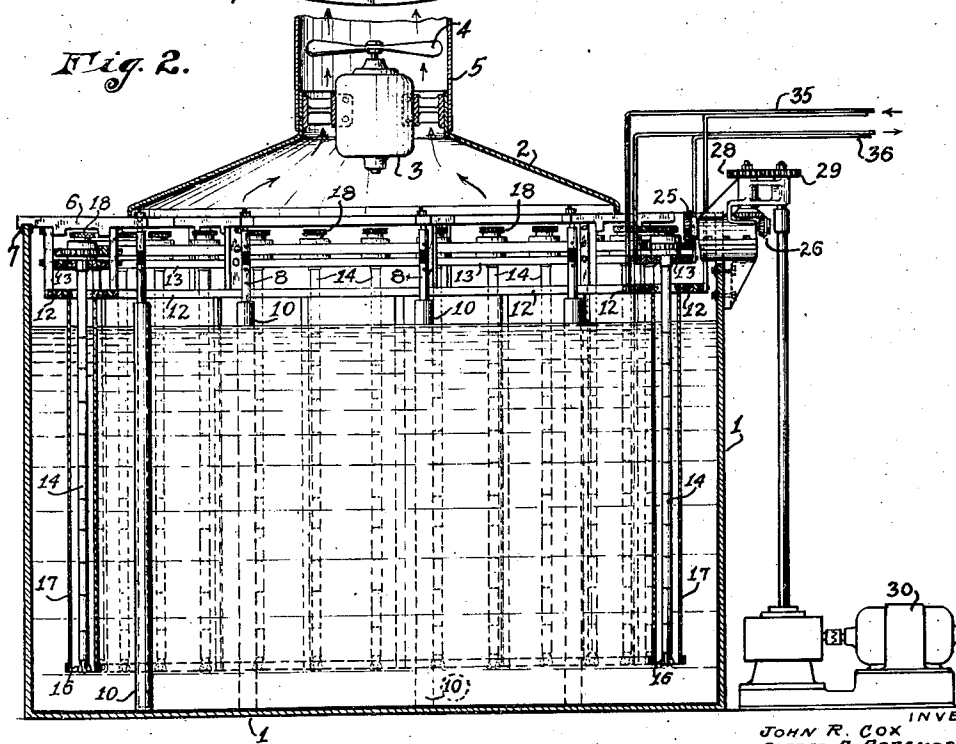


Fig. 2.



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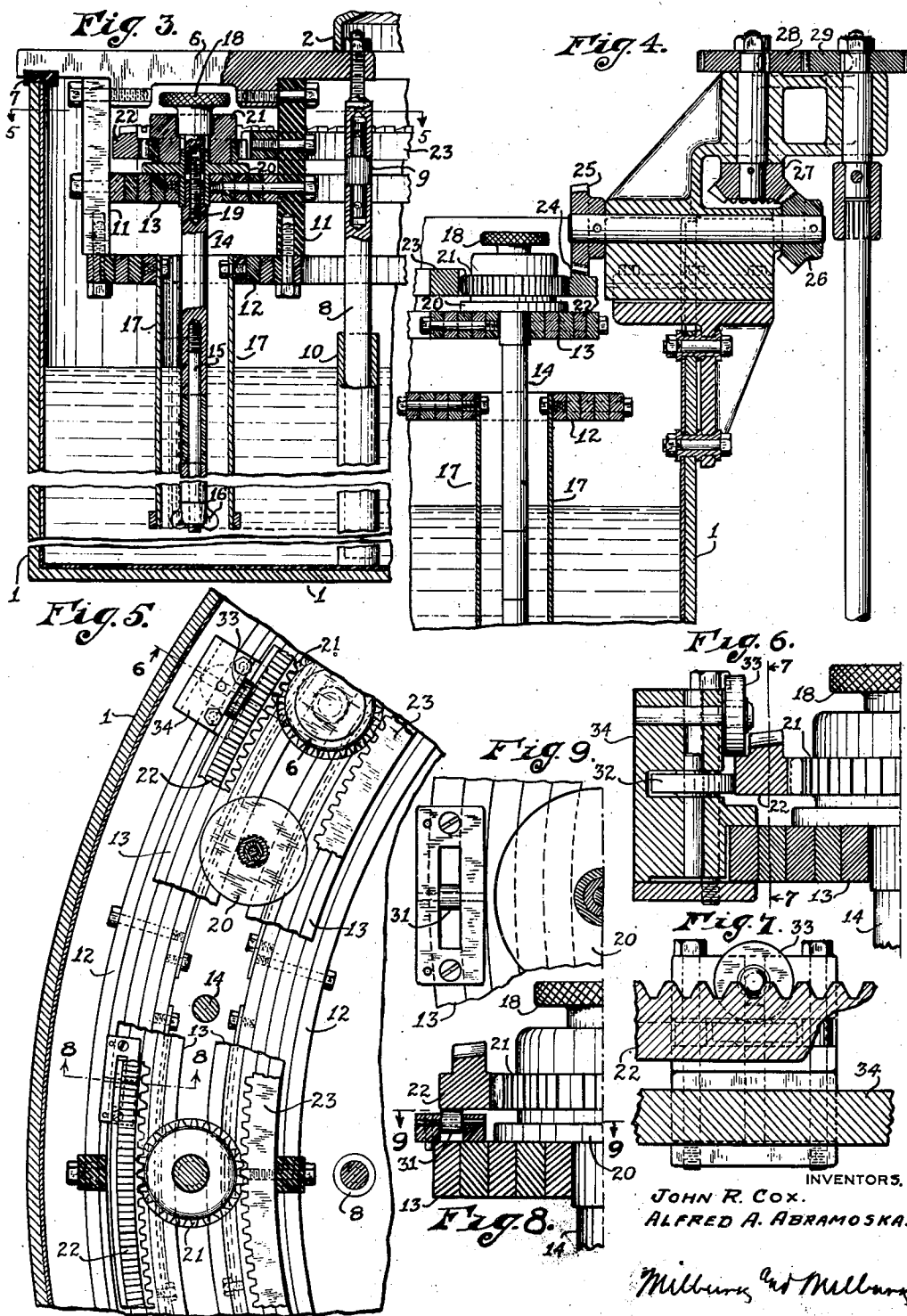
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

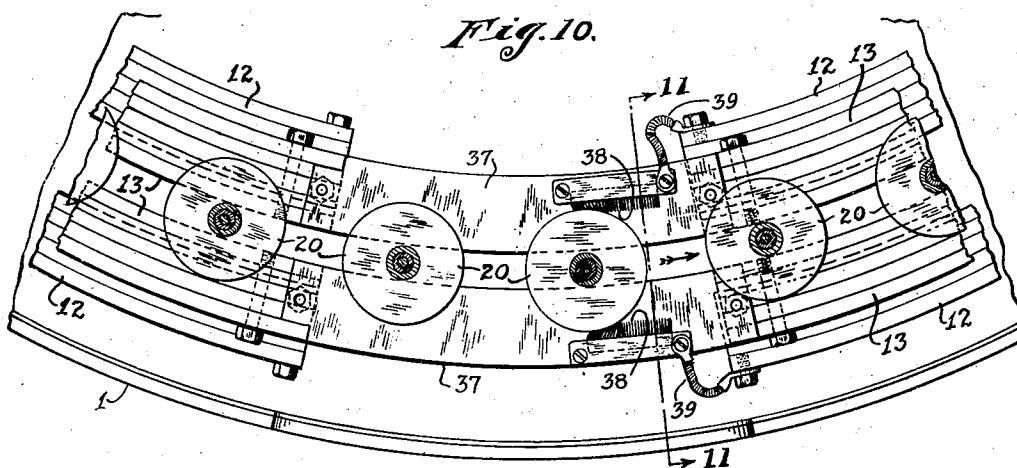


Fig. 11.

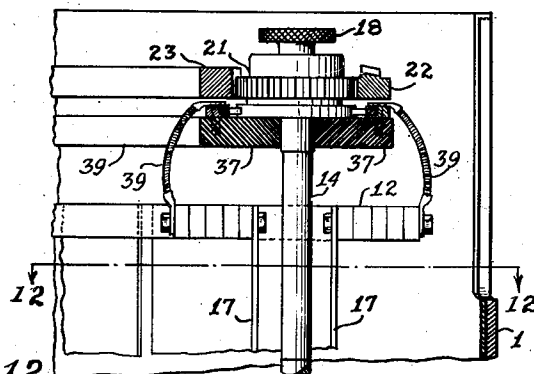
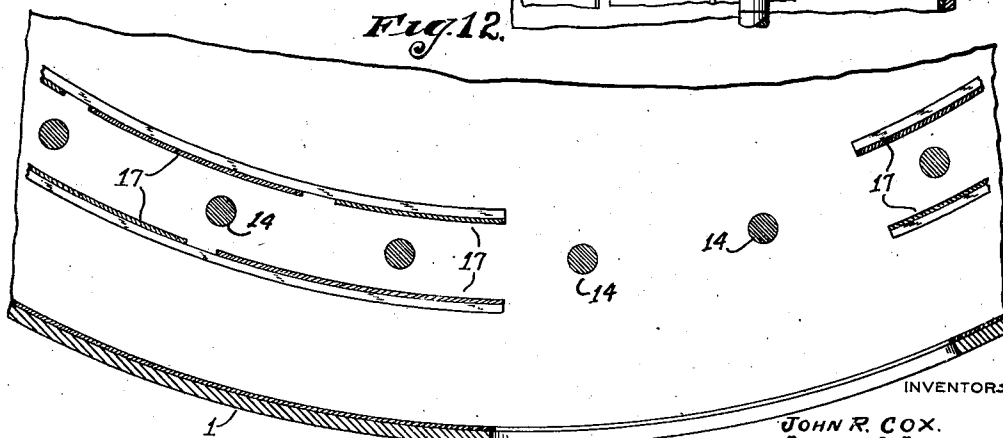


Fig. 12.



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2,085,730

ELECTROPLATING MACHINE

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Application February 18, 1933, Serial No. 657,405

15 Claims. (Cl. 204—5)

This invention relates to the art of electro-plating and comprehends an improved process and machine structure.

Heretofore in the art just referred to, it has been found that in certain classes of work, as for instance, bodies of cylindrical form, the old processes do not produce a uniform degree of plating over the entire surface which is intended to be so treated.

We have discovered that this unevenness of the plating is due to the fact that only certain portions of the surface area of the object to which the plating is being applied are subjected or exposed to the direction of flow of the electrolytic deposit, while the other portions of the surface area occupy a zone or zones more or less inactive with respect to the electrolytic flow.

It is upon the basis of this discovery that we have proceeded to remedy this condition, as will hereinafter appear.

It is therefore the object of our present invention to devise a machine by which the plating of an object can be accomplished in a perfectly uniform manner throughout its entire surface area.

A further object is to provide such a machine with automatic, electrical means for first cleaning the surface of the work to be plated so as to remove any foreign matter preparatory to the plating operation.

The present invention is directed also to the process of performing the cleaning and plating operations in the manner as herein set forth.

Other objects will appear from the following description and claims when considered together with the accompanying drawings.

Fig. 1 is a plan view of a machine embodying our present invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional detail view taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional detail view taken on line 4—4 of Fig. 1;

Fig. 5 is a partial view taken on section line 5—5 of Fig. 3;

Fig. 6 is a detail view taken on line 6—6 of Fig. 5;

Fig. 7 is a view taken on line 7—7 of Fig. 6;

Fig. 8 is an enlarged sectional view taken on line 8—8 of Fig. 5;

Fig. 9 is a view taken on line 9—9 of Fig. 8;

Fig. 10 is a plan view of a portion of our machine, with the upper parts removed, illustrating the electric insulation at the front thereof;

Fig. 11 is a transverse sectional view taken on line 11—11 of Fig. 10; and

Fig. 12 is a view taken on line 12—12 of Fig. 11.

It is to be understood that the present disclosure is merely for purposes of illustration and that other modifications and variations may be made without departing from the spirit of the present invention as herein set forth and claimed.

The present embodiment of our invention is especially adapted for chromium-plating wrist pins which are employed in an internal combustion engine, although the same general machine structure and process of operation is adapted for use in the plating of other objects as well. Thus, the present invention is not limited to the plating of any one particular class of work.

Referring to the accompanying drawings, the chromium-plating solution, or whatever solution might be employed, is contained within the lead-lined tank 1 which is provided above its central part with a hood 2 and a motor 3 and fan 4 for carrying off any fumes through the discharge pipe 5. The hood 2 may be supported in any suitable manner, the fan 4 and its motor being supported within the pipe 5.

The outer or lower edge of the hood 2 is spaced inwardly from the side wall of the tank 1 so as to afford sufficient space for the operating mechanism and to permit ready access thereto. Across this space there extend the series of bars 6 from which are suspended the electrodes, the work-carriers and the mechanism for manipulating the work-carriers in their path through the plating solution.

In the present form of illustration, there are shown eight supporting bars 6, as indicated in Fig. 1. The outer end of each bar 6 rests upon the edge of the tank wall, with electric insulation 7 therebetween. The inner end of each bar 6 has threaded, adjustable connection with the upper end portion of the post 8, which has an insert 9 of electric insulation and has its lower end portion set in the casing 10 of lead which rests upon the bottom of the tank 1. The casing 10 extends above the level of the plating solution so as to prevent any corrosive action upon the post 8. The threaded connection at the upper end of the post 9 permits the elevation of the bar 6 to be changed according to the height of the tank to which applied, and a nut is provided upon the upper end of the post 8.

Thus, the bars 6 are insulated from the tank; also the posts 8 are insulated therefrom and are protected from the plating solution.

As indicated in the drawings, the hood 2 rests upon the inner end portions of the supporting bars 6.

The bars 6 also support the electrodes by means of the depending electric insulation members 11 which are arranged in inner and outer annular series upon the under side of the bars 6. These suspension members 11 are bolted to the bars 6 and the electrodes are bolted in laminated form to the suspension members 11, the electrodes being arranged in oppositely disposed sections between which the work-holders are adapted to travel during the electro-plating operation.

The positive electrode is indicated by reference numeral 12 while the negative electrode is indicated by reference numeral 13, these two sets of electrodes being arranged in the form of rings, the one set being located immediately above the other.

The work-holder is, in the present instance, in the form of a rod 14 which is bored out in its lower end portion and is threaded for attachment of the pin 15 which is adapted to extend through the wrist pins which are held in such position by means of the wing nut 16 threaded upon the bottom end of the pin 15. Thus, the wrist pins are held between the wing nut 16 and the end of the rod 14 and can be readily loaded thereupon and removed therefrom.

Depending from the positive electrode 12 and extending into the plating solution are the spaced curtains 17 of suitable metal to co-operate with the positive electrode in the electrolytic action. These curtains 17 are spaced so as to permit the flow of the plating solution throughout the tank.

The work-holder 14, in each case, has readily engageable and disengageable connection with the head or nut 18 by means of the screw-threaded pin 19. Surrounding the upper end of the rod 14 and the lower end of the head 18 is the hub portion of the electric contact disk 20 which rests upon and has sliding electric contact engagement with the opposite parts of the negative electrode 13.

The upper hub part of the disk 20 has fixed engagement with the pinion 21 which meshes with the floating ring gear 22 and the spur ring gear 23 which is fixedly mounted upon the depending supporting members 11.

The floating ring gear 22 has spur teeth meshing with the pinion 21 for driving the same and has also bevel teeth 24 by which it is operated from the train of bevel pinions 25, 26, and 27, and the spur gears 28 and 29. These gears and pinions are operated by the electric motor 30.

The floating ring gear 22 rests upon the fibre rollers 31 which are located at suitable intervals upon the negative electrode 13. As a means of properly centering the floating gear 22 during its operation, there are provided the idlers 32 and 33 which are mounted in the stationary frame 34 so as to engage the side and top, respectively, of the ring gear.

The positive and negative electrodes are provided with their leads 35 and 36 respectively carrying a current of high amperage and low voltage.

With the mechanism as thus far described, it will be seen that with the work-holders loaded with work and placed in the machine, operation of the motor 30 will, through the train of gears and pinions, cause rotation of the ring gear 22 and the pinions 21, thereby causing rotation of the work-holders about their own individual

axes. Then too, meshing engagement of the rotating pinions 21 with the fixed gear 23, will at the same time cause orbital or revolving movement of the pinions 21. Such orbital movement of the pinions 21 means that the work-holders will travel in a circular path between the concentrically arranged, open, annular curtains 17.

At the same time, with the current turned on, the current will flow in through the positive electrode 12, through the curtains 17, through the plating solution to the work, thence through the disk contact 20 and out through the negative electrode 13, whereby there is established an electrolytic flow and consequent deposit upon the work.

A section of the positive electrode 12 and of the negative electrode 13 is cut out upon both sides of the path of the work holders, and this gap in the negative electrode 13 is filled with electric insulating material, as indicated at 37, and the top part of the wall of the tank is cut away at the corresponding point so as to facilitate the insertion and removal of the work holders. Also, the curtains 17 are eliminated at the same point and for the same purpose (see Figs. 10, 11, and 12).

In order to remove a work-holder from the machine, the operator will grasp the same at a point just below the insert 37 with one hand and disengage the nut or head 18 with the other hand. The work-holder can then be readily removed from beneath the insert 37. The reverse manipulation is followed for inserting the work-holders into the machine.

For the purpose of removing any foreign matter from the work after its insertion into the plating solution and immediately prior to the commencement of the plating operation, we have provided the electric contact fingers 38 which are mounted in sets upon the opposite parts of the insulating material 37 so as to have wiping contact engagement with the disk 20 of each newly filled work-holder immediately after being placed in the machine. The sets of fingers 38 are connected electrically by means of the cables 39 with the positive electrode sections 12.

The insulating insert 37 serves to support the work-holders through the zone where they are inserted and removed, and also forms part of the current-reversing means.

With the arrangement just described, the direction of current flow will be initially and temporarily reversed through the work which has just been placed in the machine, as will be understood from the direction of movement indicated by the arrow in Fig. 10. That is, the current, as it enters the positive electrode, will flow through the cables 39 to the upper end of the work holder and thence down the same and out therefrom through the plating solution to a neighboring work-holder through which the current flows thence upwardly to the negative electrode. As a result of the reversed flow of current through the newly inserted work, any foreign matter upon the surface of the same will be removed and the work will thereby be automatically cleansed for application of the plating thereto, this plating process commencing as soon as the work-holder moves beyond the section of insulation 37.

The mechanism is so constructed and arranged that during operation of the machine, the work-holders travel at such a comparatively slow rate of speed that there is allowed ample time to remove a work-holder and to insert a newly loaded

one, in the manner just explained, while the machine still continues in operation. There is also allowed ample time for the initial cleansing of the surface of the work, as above described.

In the particular form of machine herein set forth, the rate of travel of the work-holders about the tank is such that the plating operation is performed during their time of travel once about the tank.

To recapitulate briefly, the operation is as follows. With the plating solution in the tank, the motor 30 is started so as to set the mechanism in operation. This will start the combined revolving and rotating movement of the pinions 21 which will give such movement to the work-holders as soon as they are placed in the machine. The work-holders having been filled with the work, are then placed in position, one at a time as the pinions 21 present themselves at the front of the machine, that is, at the zone of the insulation insert 37. The manner of inserting the loaded work-holders is explained above.

As soon as the first loaded work-holder is placed in the machine, the current is turned on so as to start the electrolytic flow in the manner heretofore explained. As above stated, the work carried by each work-holder is automatically cleaned after being inserted in the plating solution and immediately prior to the commencement of the plating operation upon the work carried by any given work-holder.

When the plating operation has been completed, the work-holders will be removed one at a time in the manner above explained, as they present themselves at the front of the machine. As soon as the work-holders have all been removed, the current will be turned off and the motor can be stopped, or other re-filled work-holders can be placed in the machine without stopping the motor, as will be readily understood.

With this machine, the constant rotation of the work about its own axis as it travels about the tank, ensures that all surface portions thereof will be exposed to the direction of flow of the electrolytic deposit, and consequently there will be obtained a uniform deposit over the entire surface area of the work.

Another advantage resides in the automatic, preliminary cleaning of the surface of the work without requiring handling of the same between the cleaning and plating operations.

Another advantage consists in the particular form and arrangement of bars for supporting the electrodes and work-holders, whereby they and their means of support can be applied to tanks of different depths.

Also, our machine is constructed in a manner which renders it wholly dependable in its operation and in the quality of results produced; the machine can be loaded and unloaded in an expeditious manner; and there is nothing that is apt to get out of order.

As above explained, applicants' plating machine is especially adapted for chromium plating wrist-pins employed in an internal combustion engine and these wrist-pins are mounted end to end upon the work-holder. By mounting the wrist-pins in this manner, it is possible to employ a bleeder or dummy at each end of the work-holder, such bleeder or dummy to be used repeatedly with the successive loads of wrist-pins which are mounted upon the work-holders. In this way, the bleeder or dummy at each end of the work-holder may receive the excess electro-

lytic deposit and in this way there may be avoided any excess deposit upon the wrist-pins themselves. As a result, there may be obtained a uniform deposit upon all of the wrist-pins especially with the combined revolving and rotating movement of the work through the plating solution. With our present device, the wrist-pins may be given a uniform coating of from 3/10,000ths of an inch to 5/10,000ths of an inch thickness without requiring any machining after the plating operation.

Furthermore, with our particular manner of operation as just referred to, there can be employed a current density of 200 or 250 amperes for a period of approximately twenty minutes without any lack of uniformity in the plating upon the wrist-pins since any irregularities in the coating of the work will increase according to the length of time of the plating operation. Thus, with our machine, it is possible to plate wrist-pins with a substantial coating as required in certain classes of automobiles, and this substantial plating can be produced at sufficiently high rate of speed to make it quite practical to employ this class of plated wrist-pins. The practical value of the present machine for the particular class of work for which it is especially adaptable should be appreciated by those who are familiar with the art just referred to.

Other advantages will be apparent to those who are skilled in the art to which the present invention relates.

What we claim is:

1. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity associated with the tank, means for holding the work, means for suspending the work-holding means from only their upper ends and in contact with the upper one of the terminals so as to permit movement of the same through the plating solution, means of electric communication between the lower terminal and the plating solution, and means for simultaneously revolving and rotating each individual work-holder so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit.

2. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the plating solution, the upper one of said terminals having a non-conducting portion and the lower one of said terminals having a cut-out portion to permit insertion and removal of the work-holders, means for conveying the work-holders about an annular path through the plating solution and for simultaneously rotating each individual work-holder about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit, and means provided at the point of the non-conducting portion, for reversing the direction of current flow with respect to the work-holder as it is first inserted in the device, whereby any foreign matter is removed from the work preparatory to the plating operation.

3. In an electro-plating device, the combination of a tank for holding the plating solution, pairs of spaced annular electric terminals of opposite polarity arranged above and below each

other within the tank, readily detachable work-holding means suspended upon the upper and between the upper and lower annular terminals so as to afford electric contact with the upper terminals and so as to permit movement of the work through the plating solution, and means for conveying the work about an annular path through the solution and for simultaneously rotating each individual piece of work about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit.

4. In an electro-plating device, the combination of a tank for holding the plating solution, pairs of spaced annular electric terminals of opposite polarity arranged above and below each other within the tank, readily detachable work-holding means suspended upon the upper and between the upper and lower annular terminals so as to afford electric contact with the upper terminals and so as to permit movement of the work through the plating solution, a fixed annular rack and a rotatable annular gear arranged upon opposite sides of the annular path of the work, and a pinion carried by each of said work-holding means and meshing between said rack and said annular gear, and means for operating said rotatable gear, so as to convey the work-holders about an annular path through the plating solution and for simultaneously rotating each individual work-holder about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit.

5. In an electro-plating device, the combination of a tank for holding the plating solution, annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with one of the terminals so as to permit movement of the same through the plating solution, means for conveying the work-holders about an annular path through the plating solution and for simultaneously rotating each individual work-holder about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit, and means for temporarily reversing the direction of current flow with respect to the work-holder as it is first inserted in the device, whereby any foreign matter is removed from the work preparatory to the plating operation.

6. In an electro-plating device, the combination of a tank for holding the plating solution, pairs of spaced annular electric terminals of opposite polarity arranged above and below each other within the tank, readily detachable work-holding means suspended upon the upper and between the upper and lower annular terminals so as to afford electric contact with the upper terminals and so as to permit movement of the work through the plating solution, means for conveying the work about an annular path through the solution and for simultaneously rotating each individual piece of work about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit, and means for temporarily reversing the direction of current flow with respect to the work-holding means as it is first inserted in the device, whereby any foreign matter is removed from the work preparatory to the plating operation.

7. In an electro-plating device, the combination of a tank for holding the plating solution, pairs of spaced annular electric terminals of op-

posite polarity arranged above and below each other within the tank, readily detachable work-holding means suspended upon the upper and between the upper and lower annular terminals so as to afford electric contact with the upper terminals and so as to permit movement of the work through the plating solution, and means for conveying the work about an annular path through the solution and for simultaneously rotating each individual piece of work about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit, the lower terminals having a cut-out portion to permit insertion and removal of the work-holding means, the upper terminals having a non-conducting portion above said cut-out portion, and means provided at the point of the non-conducting portion, for temporarily reversing the direction of current flow with respect to the work-holding means as it is first inserted in the device, whereby any foreign matter is removed from the work preparatory to the plating operation.

8. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the plating solution, means of electric communication between the lower terminal and the plating solution, the lower terminal having a cut-out portion to permit insertion and removal of the work-holders during operation of the device, and means for conveying the work-holders about an annular path through the plating solution.

9. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower pairs of annular electric terminals of opposite polarity arranged within the tank, means for supporting said electric terminals from above, means for holding the work, means for suspending the work-holding means in contact with and between the upper terminals so as to permit movement of the same through the solution and between the terminals and with the lower end of the work-holding means free, means of electric communication between the lower terminal and the plating solution, the lower pair of said terminals having a cut-out portion to permit insertion and removal of the work-holders during operation of the device, and means for conveying said work-holders about an annular path through the plating solution.

10. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for suspending the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the solution, a series of spaced curtains of electro-conductive material depending from the lower of said terminals and at the side of the path of the work, said curtains being omitted in a limited zone, the lower terminal having a cut-out portion to permit insertion and removal of the work-holders during operation of the device, and means for conveying the work-holders about an annular path through the plating solution.

11. In an electro-plating device, the combination of a tank for holding the plating solution,

upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for suspending the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the solution, a series of spaced curtains of electro-conductive material depending from the lower of said terminals and at the side of the path of the work, the top part of the wall of the tank being omitted and said curtains being also omitted in a limited zone, the lower terminals being cut away to permit insertion and removal of the work-holders during operation of the device, and means for conveying the work-holders about an annular path through the plating solution.

12. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the plating solution, means of electric communication between the lower terminal and the plating solution, the upper one of said terminals having a non-conducting portion and the lower one of said terminals having a cut-out portion to permit insertion and removal of the work-holders, means for conveying the work-holders through the plating solution, electric conductor means connected to one end of said lower terminal at the cut-out portion and adapted for temporary electric engagement with the work-holders as they pass through the zone of the non-conducting portion, whereby the direction of current flow is reversed with respect to the work-holder as it is first inserted in the device so as to remove any foreign matter from the work preparatory to the plating operation.

13. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with the upper one of the terminals so as to permit movement of the same through the plating solution, means of electric communication between the lower terminal and the plating solution, the upper one of said terminals having a non-conducting portion and the lower one of said terminals having a cut-out portion to permit insertion and removal of the work-holders, means for conveying the work-holders through the plating solution, electric conductor means connected to one end of said lower terminal at the cut-out portion and adapted for temporary electric engagement with the work-holders as they pass through the zone of the non-conducting portion, whereby the direction of current flow is reversed with respect to the work-holder as it is first inserted in the device so as to remove any foreign matter from the work preparatory to the plating operation.

14. In an electro-plating device, the combination of a tank for holding the plating solution, upper and lower pairs of electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in electric contact with the upper terminals and between the same so as to permit movement of the same through the plating solution and between the lower terminals, series of curtains of electro-conductive material depending from the lower electrodes upon opposite sides of the path of the work, the curtains of each series being spaced from each other and being staggered with respect to those of the other series, and means for conveying the work-holders through the plating solution.

15. In an electro-plating device, the combination of a tank for holding the plating solution, annular electric terminals of opposite polarity arranged within the tank, means for holding the work, means for supporting the work-holding means in contact with one of the terminals so as to permit movement of the same through the plating solution, and means for revolving the pieces of work through the solution within the tank and for simultaneously rotating each individual piece of work about its own axis so as to uniformly expose all surface portions thereof to the direction of flow of the electrolytic deposit, said tank and electrolytic means having cut-out portions to permit ready insertion and removal of the work during operation of the device.

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