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(54) IMPROVEMENTS IN OR RELATING TO ARRANGEMENTS FOR WET IMPACT PLATING

(71) We, WALDES KOHINOOR, INC., of 47-16 Austel Place, Long Island City, New York 11101, U.S.A., a corporation organized and existing under the laws of the State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improvements in arrangements for wet impact plating of metal parts, more particularly the invention relates to an improved method for wet impact plating of such parts.

It has been common for many years to provide a base metal with a bright and permanently adhered metallic coating through wet mechanical plating processes. Such processes generally involve the utilization of metal dust particles that are cold welded to the base metal by impacting against its surfaces. An impacting medium placed with the particles in an agitated container, with or without promoter chemicals to aid in the plating process, and immersed in a liquid carrier such as water, serves to provide the impacting force necessary to the plating operation.

Generally the parts to be plated are cleansed prior to the actual plating operation. Other phases of the entire operation involve the separation of the plated parts from the impacting medium.

One previously known arrangement includes the utilization of two separate parts container units, one, a generally solid unit, functioning as a pre-treating and plating barrel, and the other, a generally sieve-like unit, functioning as a separating drum. Parts to be plated may be cleansed in the first container or barrel into which a chemical solution is placed. The parts are then plated in the same barrel. Transfer of the barrel contents to the separating drum is followed by rotation of that drum.

The drum is specially constructed so that rotation in one direction tumbles the load with liquid and small particles falling through perforations in the drum. Opposite

rotation discharges the parts from the drum. Water may be added for cleansing purposes and to aid in the separation. The entire drum contents passing through the perforations are collected in a pan and then transferred to the first container, or barrel, for further use.

Although such system may be adequate for some purposes, their use may sometimes prove undesirable for a number of reasons. For example, cleansing and impact plating of the parts in the same solid barrel may result in the need for substantial fresh water rinsing and ensuing effluent disposal. During a cleansing operation in the solid barrel, corrosion, scale and carbon smut, etc. is often removed from the parts to be plated. In the absence of some special steps taken for complete removal of these elements from the barrel prior to the plating operation, contact of the impacting medium with these elements while agitating the barrel during plating may adversely affect the impacting medium and/or the quality of the finished product. It will be appreciated that in the prior proposed system, a chute for drainage during rinsing cycles is provided. Although this chute may permit disposal of the rinsing effluent prior to plating, the use of substantial fresh water is required for rinsing since the rinse water must be spilled or overflowed out of the barrel into the chute.

It would, therefore, be highly desirable to provide a wet impact plating system wherein cleansing and rinsing are accomplished prior to plating while minimizing the amount of rinse water required and insuring separation of the rinse water and effluent from the parts prior to plating.

A particularly significant disadvantage of the prior proposed system involved the re-use of the impacting medium transferred to the plating barrel from the pen beneath the separating drum. Since spent plating material and promoter chemicals are present in the mass of material so transferred, and since these spent materials become present in increasing amounts during subsequent cycles, the length of time between periods of needed rectification of the

- impacting medium may be extremely short. Since the quantity of impacting medium utilized is generally disproportionately great in relation to the quantity of parts plated, the requirement of frequent rectification may make commercial plating operations impractical.
- Moreover, even if the water utilized in the prior system to transfer the impacting medium to the barrel for re-use, were drained off prior to a plating operation, the spent materials may not be effectively removed and, at any rate, drainage may significantly increase the amount of fresh water utilized.
- It would, therefore, be desirable to provide a wet impact plating arrangement wherein the frequency of impact medium rectification is reduced through separation of spent materials therefrom. It would also be desirable to incorporate a water recovery and re-use mechanism in the arrangement so as to minimize fresh water expenditure.
- According to one aspect of the present invention, there is provided a process for cleansing, rinsing and wet impact plating metal parts in a container which is mounted for at least rotating movement and provided with a peripheral portion selectively maintained in a perforate or imperforate condition, comprising the steps of loading the metal parts to be plated, an impacting medium and a cleansing solution into the container, cleansing the parts by rotating the container and supplying rinse liquid to the rotating container with the peripheral portion maintained in a perforate condition so as to retain the parts and impacting medium in the container and to pass the rinsing effluent through the peripheral portion, adding a plating material and a liquid carrier for the plating material to the container, plating the parts by rotating the container with the peripheral portion of the container maintained in an imperforate condition.
- According to another aspect of the present invention, there is provided apparatus for cleansing, rinsing and wet plating metal parts in accordance with the process defined in the preceding paragraph, the apparatus comprising a container mounted for at least rotating movement about an axis and defining an end opening on said axis, interchangeable closure means for selectively maintaining a peripheral side portion of the container in a perforate or imperforate condition, means for supplying rinse liquid to the container through the end opening during rotation of the container, the peripheral portion in its perforate condition having perforations adapted to retain the parts to be plated and the impacting medium while permitting rinsing effluent to pass through the perforations.
- Advantageously, the apparatus further comprises a stationary bin positioned beneath the container for collecting the impacting medium and spent plating material, conduit means communicating with the bin and an overhead hopper, means for hydraulically transferring the contents of the bin throughout the conduit means to the overhead hopper while generating sufficient turbulence to tend to cleanse the impacting medium of spent plating material, and means for hydraulically transferring aqueous solutions including suspended spent plating material from the overhead hopper to a water storage tank while retaining the impacting medium at the overhead hopper.
- Preferably, the container comprises a tumbling barrel rotatable about a generally horizontal axis, the barrel is utilized for independent parts cleansing, rinsing and impacting phases of the wet plating process. A rinsing valve communicates with means defining an opening in the barrel on the axis of rotation. A side opening extends longitudinally of the barrel between opposite ends, the barrel being otherwise imperforate. A large, imperforate door having an access opening is selectively securable to the barrel coextensively with the side opening thereof. Selectively and interchangeably securable to the large, imperforate door coextensively with its access opening are a smaller perforate door and a smaller imperforate door. The perforate door is sized to retain the metal parts and the impacting medium utilized in the process while permitting aqueous solutions to pass through the perforations in the door. The smaller imperforated door, together with the larger imperforate door when both are secured in position, entirely blocks the side opening of the barrel.
- A stationary bin is positioned beneath the barrel and supports a screen adjacent the bin top. The screen is sized to retain the plated parts and to pass the impacting medium and aqueous solutions. A venturi eductor communicates with the bottom of the bin in selectively operable relationship and a conduit provides communication between the venturi eductor and an overhead hopper positioned above the barrel. The bottom of the overhead hopper is provided with a valve selectively operable to permit the hopper contents to fall into the barrel.
- In gravity feed communication between the top of the overhead hopper and a water storage tank is an overflow strainer, the strainer blocking passage of the impacting medium. A pump is provided for pumping water from the water storage tank through the venturi eductor and to the overhead hopper from which overflow water and suspended spent materials pass to the water storage tank. Several container systems may be supported by a single water storage tank,

and the tank water level as well as its temperature are controlled.

In operation the metal parts to be plated are loaded into the tumbling barrel through the side opening thereof. The selectively operable valve, or pet cock, of the overhead hopper is opened to permit a charge of impacting medium settled at the bottom of the overhead hopper to drop into the barrel through its side opening. An amount of water in the overhead hopper, usually enough to cover the charge in the hopper is also permitted to pass into the barrel with the impacting medium. The larger imperforate door is then secured in position on the barrel across its side opening.

Conventional cleansing chemicals are then added to the barrel through the access opening in the larger imperforate door. Upon securing of the smaller imperforate door to the larger imperforate door so as to block its access opening, the barrel is rotated about a generally horizontal axis for a time period sufficient to cleanse the parts. At the same time the cleansing chemicals will effect the cleansing of the impacting medium.

Thereafter the smaller imperforate door is replaced with the perforate door. Used cleansing chemicals and dirty solution may be rinsed out by opening the rinsing valve and admitting rinsing water to the barrel during rotation thereof. Thus a rolling rinse is accomplished with minimum water expenditure. During the time period of the rinsing cycle, the parts and the impacting medium are retained in the barrel by the perforate door and the rinsing effluent comprised of the remaining barrel contents passes through the perforate door, through the screen adjacent the top of the bin beneath the barrel and into the bin.

Removal of the perforate door is followed by the addition of plating materials through the access opening in the larger imperforate door. Conventional promoter chemicals may also be added at this time. Afterwards the smaller imperforate door is secured in position across the access opening of the larger imperforate door.

The barrel is then rotated about the generally horizontal axis for a time period sufficient to impact plate the parts through the interaction of the impacting medium, the plating material and the parts. During this period, water which has been added to the barrel serves as a carrier for the plating material and as a mass lubricant whereby damage to the parts through abrasion and tangling of the parts is minimized.

Following removal of the larger imperforate door from the tumbling barrel, the barrel contents are emptied onto the screen adjacent the top of the bin. The screen serves to separate the plated parts from the remaining barrel contents which pass into

the bin through the screen. The parts may be hosed down at this time. Since the bin is generally sized to accommodate the volume of a single impacting medium charge utilized, virtually all of the rinsing effluent previously accumulated in the bin is displaced out of the bin.

After accumulation of the charge of impacting medium in the bin, water is pumped from the storage tank through the venturi eductor to hydraulically transfer the bin contents to the overhead hopper. During this time sufficient turbulence is generated so as to tend to cleanse the impacting medium of spent plating material, and promoter chemical if utilized. Overflow water is drained from the overhead hopper, with the spent material, to the water storage tank through the overflow strainer. The strainer retains the impacting medium in the hopper and the impacting medium then settles to the hopper bottom.

The spent material which is carried with the overflow water into the storage tank settles out, by reason of the turbulent free condition in that tank, and may be manually cleaned from the storage tank periodically.

In practice, a single storage tank may support a plurality of tumbling barrel systems, with the water level in the storage tank being maintained constant through a float valve. Make-up water supplied through the float valve to the storage tank may be thermostatically controlled to control the temperature of water in the system.

Throughout the operation the need for frequent impacting medium rectification is further minimized through the use of two impacting medium charges. One charge is present in the overhead hopper while the other remains in either the tumbling barrel or the bin. Prior to transfer of the one charge from the bin to the overhead hopper, the tumbling barrel is recharged with the impacting medium maintained in the hopper.

Embodiments of the present invention will now be more particularly described with reference to the accompanying drawings, in which:—

Figure 1 shows a schematic illustration of an overall arrangement for wet impact plating of metal parts;

Figure 2 shows a side elevational view illustrating the relationship of a tumbling barrel, overhead hopper, and lower bin which may be utilized in the arrangement of Figure 1;

Figure 3 shows an end elevational view of the arrangement illustrated in Figure 2;

Figure 4 shows a side elevational view of a water storage tank assembly which may be utilized in the arrangement of Figure 1;

Figure 5 shows a top plan view of the water storage tank assembly shown in

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Figure 4, together with a pump utilized to draw water from the tank assembly.

With reference now to Figure 1, an overall system for wet impact plating of metal parts may be understood.

The system includes a tumbling barrel 10 which is utilized for independent parts cleansing, rinsing and impacting phases of the system operation. A conduit means 12 provides, through a valve means 14 (which for convenience is hereinafter termed a rinsing valve) selective communication between a source of water and the barrel 10.

The water source may be provided in any convenient manner and for purposes of example is illustrated as being provided by a water storage tank 16. As hereinafter more fully described, this water storage tank 16 also serves to provide a source of water for conveying an impacting medium for re-use, and to provide a portion of a water recovery system.

Positioned beneath the tumbling barrel 10 is a stationary bin assembly 18 and an overhead hopper 20 is mounted above the tumbling barrel. For a purpose which will hereinafter become apparent, the bin assembly 18 is in selectively operable communication with a venturi eductor 22, the eductor being in communication with the hopper 20 through a suitable conduit means 24.

A pump 26 is provided for selectively pumping water from the water storage tank 16 through the venturi eductor 22 and to the overhead hopper 20. Suitable conduit means, such as those indicated at 28 and 30 provide for water flow respectively from the storage tank 16 to the pump 26 and from the pump 26 toward the venturi eductor 22. A suitable valve means 32, for example a simple gate valve, is located in the conduit means 30 for the purpose of selectively controlling the supply of water through the venturi eductor.

It will be appreciated that the overhead hopper 20 is also in fluid communication with the water storage tank 16, through gravity flow, by a further conduit means 34. Thus, the supply of water to the hopper 20 by means of the pump 26 need not be controlled to a great degree, since overflow into the storage tank 16 is permitted. As will hereinafter become apparent, an amount of such overflow is in fact desired during operation of the system.

The water level in the water storage tank 16 is maintained substantially constant by means of a conventional float valve means 36 located adjacent the top of the storage tank 16. A suitable source of water schematically indicated at 38, supplied make-up water to the storage tank 16 through a conduit means 37 communicating with the float valve means 36 in order to

maintain the water level in the storage tank substantially constant. The water at the make-up source 38 may be thermostatically controlled by suitable means 39 so as to ultimately control the temperature of the water in the storage tank, and therefore in the system. As indicated at 40, an overflow conduit means may be provided to place the water storage tank 16 in gravity feed relationship with a water disposal area (not shown). It will be appreciated that the outlet from the storage tank 16 into the overflow conduit means 40 is located at a level adjacent the level of the float valve 36.

With particular reference to Figures 2 and 3, the particular structure of the tumbling barrel 10, stationary bin assembly 18 and overhead hopper 20 may be seen.

The tumbling barrel 10 is provided with axis and bearing assemblies 42 and 44 on opposite ends thereof. These assemblies 42 and 44 mount the tumbling barrel 10 for rotation about a generally horizontal axis indicated at 45 and are supported on suitable frame members 46 and 48 stationarily positioned on opposite sides of the barrel. Adjacent one axle and bearing assembly 44 a suitable motor means 50 may be provided for revolving the barrel 10 at selected times and at a desired adjustable rate. The other axle and bearing assembly 42 of the barrel 10 is hollow and provides communication between the barrel interior (through passage means 51 defining a barrel end opening located on the axis 45) and the previously identified conduit means 12 in which the rinsing valve 14 is located. It will be appreciated that when water is supplied to the barrel through that conduit means 12 from the water storage tank 16 the level of connection of the conduit means to the water storage tank is elevated above the end opening of the barrel so as to permit water to flow to the interior of the barrel by gravity (see Figure 1).

A side opening, indicated at 52, extends longitudinally of the barrel between opposite ends, and except for that opening and the barrel and opening, the barrel 10 is otherwise imperforate. The side opening 52 is sufficiently large to permit easy access to the barrel interior during loading of the metal parts to be plated. A large door 54 may be selectively secured to the barrel co-extensively with the side opening 52. The large door 54 is itself provided with an access opening indicated at 56, the door being otherwise imperforate. Suitable means 58 are provided for removably securing the large door 54 to the barrel in substantially water-tight engagement.

Selectively securable to the large door 54 are either of two smaller doors, one being perforate and the other being imperforate. The imperforate door 60 is illustrated in

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Figure 2 while the perforate door 62 is shown in the schematic diagram of the overall system in Figure 1. Each of these doors 60 and 62 have overall dimensions co-extensive with the access opening 56 in the large door 54. Again suitable means 64 may be provided for releasably securing the smaller doors 60 and 62 in position. When the small imperforate door 60 is secured in position, the barrel is substantially watertight. The small perforate door, however, is sized with a mesh sufficient to retain the metal parts and the impacting medium utilized in the process while permitting aqueous solutions to pass through the perforations in the door.

It will be appreciated that the door arrangements thus far described function to selectively maintain a peripheral side portion of the barrel or container in a perforate or imperforate condition. Other arrangements that function to do the same may be employed if desired.

The previously identified stationary bin assembly 18 is positioned beneath the barrel 10 between the frame members 46 and 48 supporting the barrel. Adjacent the top of the bin assembly 18, a stationary screen 66 is mounted with the screen extending entirely across the bin assembly 10. It will become apparent that the overall extent of the bin assembly should be at least commensurate with the longitudinal extent of the side opening 52 in the barrel 10 so that the barrel contents may be unloaded into the bin assembly merely by removing the large door 54 and rotating the barrel to a position wherein the side opening 52 overlies the screen 66.

The screen 66 is sized with a mesh sufficient to retain the plated parts while permitting the impacting medium and aqueous solutions to pass through. Since the bottom of the bin is sloped, as indicated at 68, when the impacting medium is to be conveyed to the overhead hopper 20 through the utilization of the venturi eductor 22, the impacting medium readily passes down the sloped bottom. Communication between the lower portion of the bin assembly 10 and the venturi eductor 22 is provided in any suitable manner as shown at 70. Water supplied through the venturi eductor 22 creates a pressure differential which tends to draw the contents of the bin along with the water to the overhead hopper 20. For a purpose hereinafter described, the bin assembly 18 is generally sized so as to be capable of holding substantially the exact volume of one charge of the impacting medium utilized in the system.

During hydraulic transfer of this charge of the impacting medium to the overhead hopper, sufficient turbulence is generated so as to tend to cleanse the impacting medium

by removing spent plating material or promoter chemicals used in the process and which may have adhered to the particles of the impacting medium. It will be apparent to one skilled in the art that such turbulence may be created by proper sizing of the conduit means 24 to which the impacting medium is transferred with the sizing taking into account such factors as the hydrostatic head available for transfer, the transfer time, etc.

When the impacting medium is transferred to the overhead hopper 20, excess water supplied overflows and passes from the overhead hopper back to the storage tank 16 through the previously identified return conduit means 34. The portion of the return conduit means 34 in communication with the hopper interior is located within a strainer 70. The strainer 70 is sized so as to have a mesh sufficient to retain the impacting medium in the hopper while permitting overflow water to hydraulically transfer suspended particles to the water storage tank 16. The retained impacting medium, of course, settles to the bottom of the hopper 20. At the hopper bottom, a selectively operable valve 72, or pet cock, is provided.

As illustrated in Figures 2 and 3, the hopper 20 is supported by suitable strut assemblies 74 mounted on the frame members 46 and 48 so that the pet cock 72 is generally centrally located over the tumbling barrel 10. During the portion of the system cycle when the tumbling barrel 10 is to be supplied with a charge of the impacting medium, the tumbling barrel 10 is rotated to a position wherein its access opening 52 is directly beneath the pet cock 72.

With reference to Figures 4 and 5, details of a suitable water storage and supply system may be seen. The previously identified water storage tank 16 is stationarily supported by suitable legs 76. Communicating with the top of the tank is the previously identified conduit means 34 which provide gravity return of overflow fluid from the hopper 20. Two such conduit means 34 are illustrated since, in practice, a single water storage tank 16 may support several impacting medium handling units (i.e. barrel 10, overhead hopper 20 and bin assembly 18), and thus may communicate with the hoppers of each of these assemblies.

The previously identified pump 26 may be a high capacity, open impeller, centrifugal pump which at appropriate times, draws water from the storage tank 16 through the conduit means 28. Leading from the pump is the conduit means 30 for supplying water to the venturi eductor 22. Again two such conduit means 30 are illustrated insofar as water may be pumped to the eductors of the several impacting medium handling units supported by the

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single water storage tank 16. The supply of water by means of the centrifugal pump 26 may be controlled in any suitable manner with a conventional line pressure valve (not shown) being preferred so that upon manual opening of the gate valve 32 in the conduit means 30 the necessary water will be supplied to the eductor 28.

The condition of the water in the storage tank 16 is generally turbulent free so that the microscopic particles separated from the impacting medium and carried into the tank from the overhead hopper 20 tend to settle out. Periodically, these materials may be manually cleaned from the tank. It is readily apparent that access to the water storage tank 16 for this purpose may be had through the provision of any suitable door or the like.

It will thus be seen that by means of the return conduit means 30 and the pump 26 both being in communication with the water storage tank, the system of the present invention provides for water recovery and reuse, thereby minimizing water expenditure. That water which is supplied to the tumbling barrel through the conduit means 12 and which is lost as subsequently described, is minimal and is replenished through the make-up water conduit means 37 extending from the make-up water source 38.

From the foregoing, operation of the wet impact plating system may be readily understood.

With the larger door 54 removed from the tumbling barrel 10, metal parts to be plated are loaded into the empty barrel. The barrel is then rotated so that the side opening 52 underlies the pet cock 72 of the overhead hopper 20. The pet cock 72 is operated to permit the charge of impacting medium located in the overhead hopper 20 to drop into the barrel 10. At the same time water from the overhead hopper enters into the barrel. The amount of water usually utilized in this portion of the cycle is that sufficient to cover the charge within the barrel. In the event that more water than is available from the hopper is needed, this water may be supplied through manual operation of the rinsing valve 14.

The term impacting medium is well known in the art so that a detailed description thereof is not deemed necessary. Generally the impacting medium is comprised of a matrix material consisting of a mass of discrete solid granules, which may be metallic, ceramic, etc. and which may have various shapes, e.g. spherical or irregular. These materials are usually a great deal smaller than the articles to be plated but larger than the plating material added at a later phase of the cycle.

After supplying the barrel with the parts to be plated and with the impacting

medium, the large door 54 is secured in position coextensively with the side opening 52 of the barrel. This door 54 remains in that position until the end of the process cycle.

The smaller imperforate door 60 which has been secured to the larger door during a previous portion of the cycle, is then removed. Cleansing chemicals, which together with water in the barrel form a cleansing solution, are then added through the barrel 10 through the access opening 56 in the large door 54. These cleansing chemicals are conventionally employed in impact plating systems and need not be described in detail. The small imperforate door 60 is then secured again in position and the barrel is rotated about its generally horizontal axis for a time period sufficient to cleanse the parts. During this time the cleansing chemicals will also affect the cleansing of particles, if any, adhered to the impacting medium. Corrosion, scale and carbon smut which may be removed during the process is, however, still present in the barrel.

Therefore, after the cleansing phase of the cycle, the imperforate door is replaced by the perforate door 62. While supplying rinse water to the barrel through the end opening 51 upon opening of the rinsing valve 14, the tumbling barrel 10 is again rotated. During this rotation the parts and the impacting medium are retained in the barrel 10 by the perforate door 62 while the rinsing effluent passes through that door. It will be apparent that this rinsing cycle, by reason of the rolling rinse, is accomplished with a minimum of water expenditure. The rinsing effluent is thus efficiently separated from the parts to be plated and falls into the stationary bin assembly 18 through the screen 66 at the top of the bin.

At the end of the rinsing phase of the cycle, the perforate door 62 is removed. At this time, a metal plating powder such as zinc, cadmium, tin or other metal or alloy is added to the barrel 10 along with a conventional plating agent or promoter chemical. The small imperforate door 60 is then secured in position and the barrel is rotated for a time period necessary to plate the parts. Water is also added to the barrel 10 during the plating phase of the cycle. This water serves as a carrier for the plating material and as a mass lubricant so as to minimize the possibility of damage to the parts through abrasion and tangling of the parts.

In this respect it may be mentioned that agitation of the barrel other than by pure rotation about a horizontal axis may be employed. However, agitation by pure rotation about a horizontal axis is preferred insofar as through horizontal rotation the

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criticality of the time of rotation during a plating cycle as well as the criticality of differences in barrel contents during different cycles, is minimized, thereby decreasing the possibility of deplating by abrasion in the event of variations in these factors.

At the end of the plating phase of the cycle, the parts and remaining barrel contents which now need to be separated are dumped out of the plating barrel 10 and into the stationary bin assembly 18. The screen 66 at the top of the bin separates the plated parts from the mass of impacting medium and spent plating material and promoter chemicals which pass therethrough. At this time the parts may be hosed down to hydraulically assist in separation.

Since the bin is generally sized to accommodate the volume of a single charge of impacting medium normally utilized, the rinsing effluent previously accumulated in the bin is displaced through overflow and is disposed of. Thus the materials removed during the cleansing operation are separated from the impacting medium. If desired, the rinsing effluent may be earlier drained out of the bin through suitable means (not shown).

Upon opening of the gate valve 32 water from the pump 26 serves to hydraulically transfer the bin contents to the overhead hopper 20. During this time cleansing of the impacting medium of the spent plating materials and promoter chemicals is accomplished through the turbulence generated as previously discussed.

Overflow water drained out of the overhead hopper 20 through the conduit means 34 carried with it the suspended spent plating material and promoter chemicals to the water storage tank 16. The overflow strainer 70 permits this material to pass through while retaining the impacting medium which settles to the hopper bottom.

In this manner, during each cycle the impacting medium is maintained relatively pure so as to lessen the frequency with which impacting medium rectification is required by reason of attrition.

This time interval is further lengthened through the utilization of two impacting medium charges in each tumbling barrel assembly. Prior to transfer of the impacting medium charge to the overhead hopper 20, the previously transferred charge is placed into the barrel 10. Thus, one impacting medium charge is present in the overhead hopper while the other remains in either the tumbling barrel 10 or at a later time in the bin assembly 18.

WHAT WE CLAIM IS:—

1. A process for cleansing, rinsing and wet impact plating metal parts in a container

which is mounted for at least rotating movement and provided with a peripheral portion selectively maintained in a perforate or imperforate condition, comprising the steps of loading the metal parts to be plated, an impacting medium and a cleansing solution into the container, cleansing the parts by rotating the container and supplying rinse liquid to the rotating container with the peripheral portion maintained in a perforate condition so as to retain the parts and impacting medium in the container and to pass the rinsing effluent through the peripheral portion, adding a plating material and a liquid carrier for the plating material to the container, plating the parts by rotating the container with the peripheral portion of the container maintained in an imperforate condition.

2. A process as claimed in claim 1, comprising the further steps of emptying the container contents subsequently to plating the parts, separating the parts from the remaining container contents, collecting the remaining container contents in a bin and maintaining the collected contents separate from substantially the entire rinsing effluent.

3. A process as claimed in claim 2, including the steps of hydraulically transferring the collected contents to an overhead hopper while generating sufficient turbulence to cleanse the impacting medium of spent plating material, and hydraulically transferring suspended particles of spent plating material to a water storage tank while maintaining the impacting medium at the overhead hopper.

4. A process as claimed in claim 3, including the step of supplying water from the water storage tank for the step of hydraulically transferring.

5. A process as claimed in claim 4, including the step of maintaining the level of water in the water storage tank substantially constant by supplying make-up water thereto.

6. A process as claimed in claim 5, including the step of controlling the temperature of the water in the water storage tank by controlling the temperature of the make-up water.

7. A process as claimed in any one of claims 3 to 6, including the step of removing of settled spent plating material from the water storage tank.

8. A process as claimed in any one of claims 3 to 7, including the steps of adding promoter chemicals to the container before rotating the latter to impact plate the parts, and generating sufficient turbulence during the hydraulic transfer of the bin contents to the overhead hopper to tend to cleanse the impacting medium of spent promoter chemicals.

9. A process as claimed in any one of

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criticality of the time of rotation during a plating cycle as well as the criticality of differences in barrel contents during different cycles, is minimized, thereby decreasing the possibility of deplating by abrasion in the event of variations in these factors.

At the end of the plating phase of the cycle, the parts and remaining barrel contents which now need to be separated are dumped out of the plating barrel 10 and into the stationary bin assembly 18. The screen 66 at the top of the bin separates the plated parts from the mass of impacting medium and spent plating material and promoter chemicals which pass therethrough. At this time the parts may be hosed down to hydraulically assist in separation.

Since the bin is generally sized to accommodate the volume of a single charge of impacting medium normally utilized, the rinsing effluent previously accumulated in the bin is displaced through overflow and is disposed of. Thus the materials removed during the cleansing operation are separated from the impacting medium. If desired, the rinsing effluent may be earlier drained out of the bin through suitable means (not shown).

Upon opening of the gate valve 32 water from the pump 26 serves to hydraulically transfer the bin contents to the overhead hopper 20. During this time cleansing of the impacting medium of the spent plating materials and promoter chemicals is accomplished through the turbulence generated as previously discussed.

Overflow water drained out of the overhead hopper 20 through the conduit means 34 carried with it the suspended spent plating material and promoter chemicals to the water storage tank 16. The overflow strainer 70 permits this material to pass through while retaining the impacting medium which settles to the hopper bottom.

In this manner, during each cycle the impacting medium is maintained relatively pure so as to lessen the frequency with which impacting medium rectification is required by reason of attrition.

This time interval is further lengthened through the utilization of two impacting medium charges in each tumbling barrel assembly. Prior to transfer of the impacting medium charge to the overhead hopper 20, the previously transferred charge is placed into the barrel 10. Thus, one impacting medium charge is present in the overhead hopper while the other remains in either the tumbling barrel 10 or at a later time in the bin assembly 18.

WHAT WE CLAIM IS:—

1. A process for cleansing, rinsing and wet impact plating metal parts in a container

which is mounted for at least rotating movement and provided with a peripheral portion selectively maintained in a perforate or imperforate condition, comprising the steps of loading the metal parts to be plated, an impacting medium and a cleansing solution into the container, cleansing the parts by rotating the container and supplying rinse liquid to the rotating container with the peripheral portion maintained in a perforate condition so as to retain the parts and impacting medium in the container and to pass the rinsing effluent through the peripheral portion, adding a plating material and a liquid carrier for the plating material to the container, plating the parts by rotating the container with the peripheral portion of the container maintained in an imperforate condition.

2. A process as claimed in claim 1, comprising the further steps of emptying the container contents subsequently to plating the parts, separating the parts from the remaining container contents, collecting the remaining container contents in a bin and maintaining the collected contents separate from substantially the entire rinsing effluent.

3. A process as claimed in claim 2, including the steps of hydraulically transferring the collected contents to an overhead hopper while generating sufficient turbulence to cleanse the impacting medium of spent plating material, and hydraulically transferring suspended particles of spent plating material to a water storage tank while maintaining the impacting medium at the overhead hopper.

4. A process as claimed in claim 3, including the step of supplying water from the water storage tank for the step of hydraulically transferring.

5. A process as claimed in claim 4, including the step of maintaining the level of water in the water storage tank substantially constant by supplying make-up water thereto.

6. A process as claimed in claim 5, including the step of controlling the temperature of the water in the water storage tank by controlling the temperature of the make-up water.

7. A process as claimed in any one of claims 3 to 6, including the step of removing of settled spent plating material from the water storage tank.

8. A process as claimed in any one of claims 3 to 7, including the steps of adding promoter chemicals to the container before rotating the latter to impact plate the parts, and generating sufficient turbulence during the hydraulic transfer of the bin contents to the overhead hopper to tend to cleanse the impacting medium of spent promoter chemicals.

9. A process as claimed in any one of



claims 3 to 8, wherein two impacting medium charges are employed, one being in the overhead hopper and the other remaining in either the container or the bin.

5 10. A process for cleansing, rinsing and wet impact plating of metal parts as claimed in claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

10 11. Apparatus for cleansing, rinsing and wet plating metal parts in accordance with a process as claimed in any one of the preceding claims, the apparatus comprising a container mounted for at least rotating movement about an axis and defining an end opening on said axis, interchangeable closure means for selectively maintaining a peripheral side portion of the container in a perforate or imperforate condition, means for supplying rinse liquid to the container through the end opening during rotation of the container, the peripheral portion in its perforate condition having perforations adapted to retain the parts to be plated and the impacting medium while permitting rinsing effluent to pass through the perforations.

12. Apparatus as claimed in claim 11, comprising a stationary bin positioned beneath the container for collecting the impacting medium and spent plating material, conduit means communicating with the bin and an overhead hopper, means for hydraulically transferring the contents of the bin through the conduit means to the overhead hopper while generating sufficient turbulence to tend to cleanse the impacting medium of spent plating material, and means for hydraulically transferring aqueous solutions including suspended spent plating material from the overhead hopper to a water storage tank while retaining the impacting medium at the overhead hopper.

13. Apparatus as claimed in claim 12, comprising a supply of fluid at the water storage tank to provide a fluid to said means for hydraulically transferring the contents of the bin.

14. Apparatus as claimed in either claim 12 or claim 13, comprising a screen positioned adjacent the top of the bin, the screen having a plurality of perforations adapted to retain the metal parts and to pass the impacting medium and spent plating material into the bin.

15. Apparatus as claimed in any one of claims 11 to 14, wherein the container comprises a tumbling barrel rotatable about a substantially horizontal axis and provided

with a side opening extending longitudinally thereof, a first imperforate door securable to the barrel co-extensively with the side opening and having an access opening therein, a perforate door and a second imperforate door each smaller than the first door and each selectively securable to the first door co-extensively with the access opening therein, the perforations in the perforate door being adapted to retain metal parts and impacting medium within the barrel and to permit aqueous solutions to pass out of the barrel, and the first and second imperforate doors when secured to the barrel closing the side opening therein.

16. Apparatus as claimed in claim 15 when dependent on any one of claims 12 to 14, wherein the overhead hopper is positioned above the barrel and the bottom of the hopper is provided with a selectively operable valve, a venturi eductor communicates with the bottom of the bin in selectively operable relationship, the conduit means provides communication between the venturi eductor and the overhead hopper, an overflow strainer is in gravity feed communication between the top of the overhead hopper and the water storage tank, the strainer being sized to pass aqueous solutions and to block passage of impacting medium, make-up water supply means communicates with the water storage tank for maintaining the level of water therein substantially constant, and pumping means are provided for pumping water from the storage tank through the venturi eductor and to the overhead hopper.

17. Apparatus as claimed in claim 16, comprising means for controlling the temperature of the make-up water thereby to regulate the water temperature in the water storage tank.

18. Apparatus as claimed in any one of claims 12 to 17, comprising means for removing settled spent plating material from the water storage tank.

19. Apparatus as claimed in any one of claims 11 to 18, comprising a rinsing valve communicating with said end opening.

20. Apparatus for cleansing, rinsing and wet plating of metal parts, substantially as hereinbefore described with reference to the accompanying drawings.

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