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(54) Removing drag-out solutions from barrel and load after electroplating or chemical surface treatment

(57) The barrel 5, after immersion in a container 1, containing treatment solution is hoisted to a position above the container, concentric with a semi-cylindrical shell 2', 2" which partially embraces the upper part of the barrel, and blower fan 9 is arranged to supply a stream of air under pressure to an upper part of the shell, so that the air enters the upper part of the barrel and flows downwardly through the load and out of said barrel, so removing the adhering drag-out solution from the barrel and its load and the removed solution then directly flows back to the container 1.

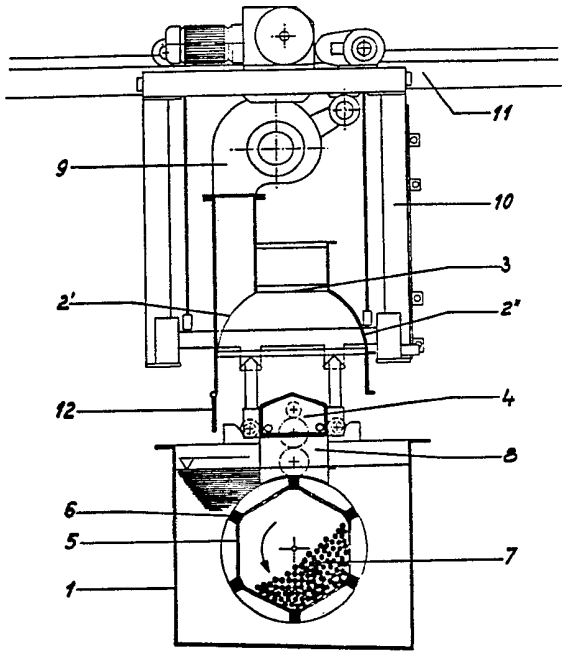

Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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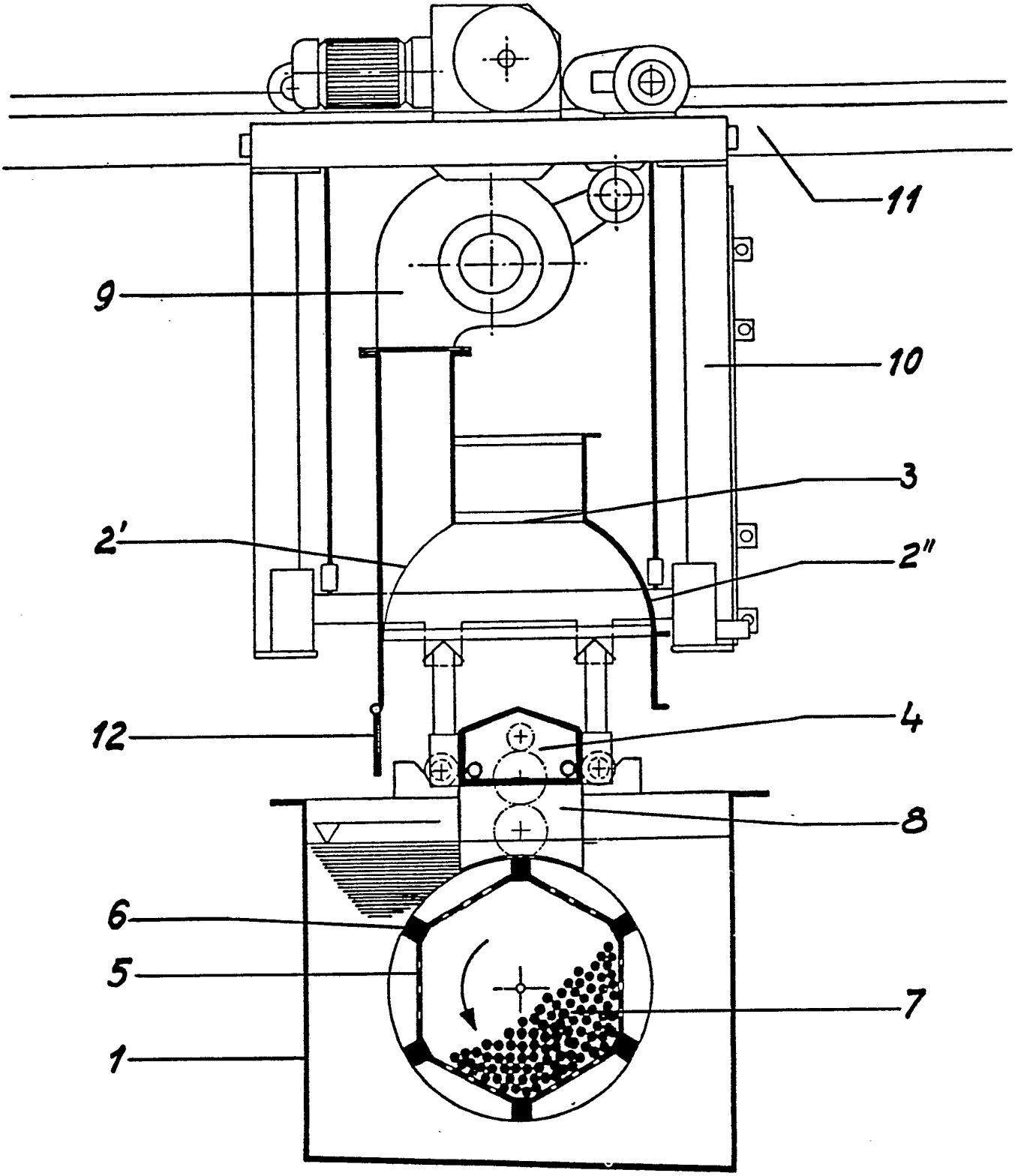

Fig. 1

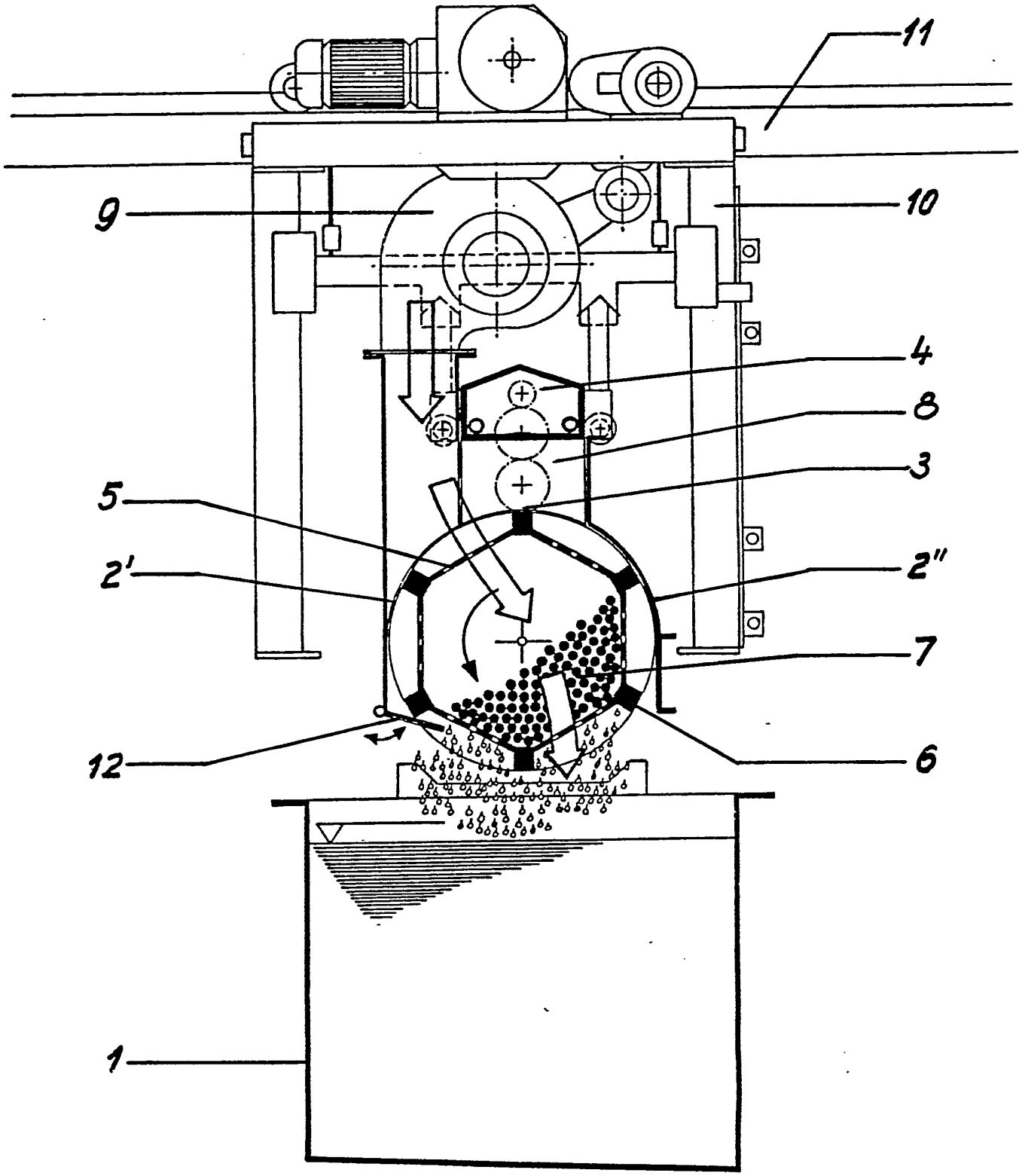

Fig.2

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RECOVERING DRAG-OUT SOLUTIONS

The present invention relates to a system for and a method of removing and recovering adhering surface-treating solutions from a treatment barrel and its bulk load of articles, following an electro-plating and/or chemical surface treatment.

Systems and methods for removing and recovering adhering surface treating media, such as aqueous solutions, from objects are known. Such recovery is particularly required in connection with surface treatment procedures for bulk loads of articles processed in so-called plating barrels. These barrels and their loads drag out considerable quantities of treatment solutions which are greatly diluted in subsequent water rinsing steps (up to ratios of 1:1000 or more), and so are wholly unsuitable for re-use as a chemical solution. Further, the contaminated rinsing water has to be supplied to a decontaminating waste water treatment system, which thus gives rise to additional high expenses.

Conventional stand rinse baths may be used to compensate evaporation losses of high temperature treatment solutions. Even in such exceptional cases the greater part of the drag-out solution has to be

decontaminated in a waste water treatment system. The object of the system described in German Offenlegungsschrift No. 2,758.550 has a different proposal for reducing the previously mentioned disadvantages. This system partially removes the drag-out quantity of treatment solution by aspiration. The aspiration process has to be separately performed at an additional station of the plating plant directly attached to the tank containing the treatment solution, and it must be arranged with means resupplying continuously via conduits the aspirated liquid solution to its original container.

The object of the system described in United States Patent No. 4,469,526 is another proposal to solve the above-mentioned problem. The barrel containing the bulk load of articles is lifted above the container filled with the treatment solution. Two semi-circular shells supported on a travelling carriage move horizontally and embrace completely the barrel forming a closed circular chamber wholly surrounding the barrel. A narrow gap remains open at the bottom between the two semi-circular shell. Pressurised gas (air) and rinsing water are alternately and periodically supplied to the chamber, the gas stream being blown through the narrow gap so that adhering treatment solution is removed from the load and the barrel areas which are mainly around the gap and flows

directly back to the container through said gap.

The disadvantages of the above system are obvious. The restricted zone around the gap from which the treatment solution is withdrawn results in a low efficiency of the system. The movement sequence of both semi-circular chamber halves has to be program-controlled in accordance with the barrel hoisting and lowering as well as with the alternately and periodically pressurised gas blowing and water rinsing steps. The guiding and supporting mechanism mounted on the carriage for the programmed movements of both semi-circular chamber halves is complicated heavy, difficult to maintain and, consequently, expensive. Furthermore, during the blowing and rinsing steps, the lower inside regions of both chamber halves become covered with partially-diluted treatment solutions. Any remaining solution on the lower parts of the chamber halves will drip during the carriage movement along the plating plant, possibly into different containers with different treatment solutions, so contaminating or destabilising them.

A principal object of the present invention is to improve the known systems for removing adhering surface-treating solutions from a barrel and its bulk load of articles, and to eliminate the disadvantages of those systems as discussed above. This invention thus offers a system for and a method of removing the

adhering treatment solutions from a barrel and its load of bulk articles, and for the direct recovery of those solutions by returning them into their original containers.

According to one aspect of the present invention, there is provided a system for removing and recovering adhering surface-treatment solution from a barrel and a bulk load of articles contained therein, following an electro-plating and/or chemical surface treatment on the articles, which system comprises a container for said solution, a barrel for accommodating said load, means for moving the barrel between a first position where the barrel is inside the solution container and a second position where the barrel is above the container, a rigid semi-cylindrical shell for partially embracing the barrel when in its second position so that the semi-cylindrical shell embraces only the upper part of said barrel which normally contains no articles, and means for supplying to the interior of the semi-cylindrical shell a stream of pressurised air in such a manner that the stream flows first through the upper part of the barrel, downwardly through the load and out of the barrel, so as to remove the adhering treatment solution from the barrel and its load, the solution flowing directly into the container.

The semi-cylindrical shell employed in this invention may be mounted on a travelling hoisting

carriage of the plant, which plant incorporates several containers filled with different treatment solutions and rinsing water, in accordance with the required surface treatment process. The rigid semi-cylindrical shell should be fixed on the mechanical structure of the carriage, so that, relative to the carriage, the semi-cylindrical shell does not change its position neither in a vertical nor in a horizontal direction. This condition of mechanical immobility, with respect to the carriage, does not alter, even if the semi-cylindrical shell consists of one, two or more assembled constructional elements.

An additional, and particularly advantageous, feature of the invention comprises an elongate substantially rectangular plate which is pivotally mounted along one of its longitudinal edges on a longitudinal bottom edge of the rigid semi-cylindrical shell, which plate may pivot from a generally vertical position when the barrel is in its first position to a diagonally-inclined position towards the barrel when said barrel is in its second position, inside said shell. The inclined pivotal plate touches the barrel along one side, to direct the main air stream through the central portion of the barrel load and, therefore, substantially improves the efficiency of the solution removing action.

The barrel is an integral part of the system and

principally comprises a prismatic or cylindrical perforated shell with longitudinal reinforcing ribs, a door with a locking device to permit loading or unloading of articles in bulk which are to be treated, and two attached end walls. The barrel and the rigid semi-cylindrical shell are provided with rotationally-symmetrical cross sections which, when arranged concentrically, are in contact with one another. The barrel periphery (especially its longitudinal reinforcing ribs) will slide over the internal surface of the semi-cylindrical shell, directing the stream of pressurised air to pass through the barrel and its load.

In the above case, the pivotal rectangular plate attached to one of the longitudinal bottom edges of the semi-cylindrical shell can be provided with an arcute cross-section adapted to the rotational symmetrical periphery of the barrel, to produce an additional improvement in the system's efficiency by constraining the stream of pressurised air to flow entirely through the barrel and its load.

A method of removing and recovering of adhering drag-out solution from the barrel and this load is also within the scope of the present invention. Said method comprises the steps of accommodating a bulk load of articles after electro-plating and/or chemical surface treatment in a container, comprising the steps of

accommodating a bulk load of articles in a barrel, lowering the barrel into a container of said solution so as to contact the load with said solution, lifting the barrel out of said container after treating the load in the solution positioning the barrel substantially concentrically within a semi-cylindrical shell so that the barrel touches said shell, and blowing a stream of pressurised air downwardly thrcugh the upper part of said barrel not containing any load so that the stream continues downwardly through said load and out of said barrel so as to remove the solution which solution may flow directly back to the container.

Preferably, the barrel is rotated either continuously or intermittently during the period when a stream of pressurised air is blown through the barrel and its load.

The main constructional elements of the system - that is, the barrel and the rigid semi-cylindrical shell - are preferably made of a synthetic plastics material, for example, polypropylene.

By way of example only, one specific embodiment of a system of this invention for recovery adhering surface treatment solutions from a barrel and its load will now be described in detail, reference being made to the accompanying drawings in which:-

Figure 1 is and axial sectional view of the system,

with the barrel shown submerged in an aqueous solution within a container located below a travelling hoisting carriage; and

Figure 2 is a sectional view through the same system shown in Figure 1, but with the barrel lifted to an operative position within a semi-cylindrical shell mounted on the carriage.

The embodiment of a system for removing the dragged-out adhering solution from a barrel and its load shown in the drawings has a working container 1 filled with the solution, which may serve as one bath in a line of several process-related different surface treatment solution baths.

The system includes a semi-cylindrical shell marked by the reference numbers 2' and 2", which is made of a synthetic plastics material and can be additionally reinforced by appropriately-shaped elements if required for greater mechanical stability. The shown semi-cylindrical shell has two components, 2' and 2", in the shape of which approximates to a quarter of a cylinder. The components 2' and 2" are separated by a gap 3 which provides the space needed to accommodate the super-structure 4 of the hexagonal barrel 5 when positioned between the two components.

The barrel 5 comprises a prismatic or cylindrical perforated shell with longitudinal reinforcing ribs 6, a door with a locking device to permit the loading or

unloading of articles which have to be treated, and two attached end walls. The load of articles 7 in bulk inside the barrel 5 takes up about one third of the internal volume of the barrel. During the treatment period, the barrel 5 rotates continuously while submerged in the solution in the container 1. The arrow shown in Figure 1 indicates the counter-clockwise direction of barrel rotation. The barrel 5 is arranged between and supported by two hanger arms 8 of the super-structure 4.

The cross section of the barrel 5, including the ribs 6 on its periphery, as well as the two attached end walls, are symmetrical about the axis of rotation.

Figure 2 shows the barrel 5 in its lifted operational position inside the rigid semi-cylindrical shell 2' and 2". The geometrical shape of the shell 2' and 2" is also symmetrical about the axis thereof. The barrel 5 is lifted to lie within semi-cylindrical shell 2' and 2", in a concentric relationship during the operational period of removing drag-out solution. The inner periphery of the rigid semi-cylindrical shell 2' and 2" corresponds exactly to the peripheral counter of the rotationally-symmetrical barrel 5, whereby sealing is realised by the closely touching arrangement between the barrel and shell.

A fan 9 is mounted together with the semi-cylindrical shell 2' and 2" on a hoisting carriage 10,

the fan supplying the pressurised air to the barrel 5. The row of three arrows in Figure 2 indicates the path of the air stream produced by the fan 9, to blow through the upper part of the barrel 5 which does not contain any articles, and to continue downwardly through the load of articles 7 and out of the barrel 5, so as thereby to remove drag-out treatment solution which may flow directly back into the container 1 below the barrel 5.

The removing step can be performed with continuous or intermittent rotation of the barrel 5, over a period of approximately 20 seconds. The air stream originating from the fan 9 has a relatively low pressure of about 0.3 bar, the fan having a corresponding blowing capacity of about 800 cubic meters per hour.

The travelling and hoisting carriage 10 is arranged for lowering the barrel 5 into the solution in container 1, and for lifting it to its operational position above the container. The carriage 10 also transfers the barrel 5 and its load of articles 7 from one treatment station represented by the container 1 to a variety of other stations of the same plant, by movement of the carriage 10 along a track 11.

The timing and sequencing of steps concerning the removal of drag-out solution from the barrel 5 and its load and the return of the drag-out to the appropriate

container represents, as a method, an integral part of the invention in operating the system in the most efficient way. The carriage 10 transfers the barrel 5 and its load from a preceding treatment station of the plant to the next station, and lowers the barrel 5 into the solution of the container 1. After completing the treatment step, the carriage 10 lifts the barrel 5 to a position within the rigid semi-cylindrical shell 2' and 2", mounted on the carriage. The fan 9 then blows a stream of pressurised air through the barrel 5 and its load. Subsequently, the carriage 10 moves the barrel to the next following treatment container 1 to repeat the same functional sequence of operational steps.

The rigid semi-cylindrical shell 2' and 2" is attached to the hoisting carriage 10 in a fixed position. Consequently, the semi-cylindrical shell 2' and 2" moves neither vertically nor horizontally with respect to the carriage during the whole sequence of the above-described operational steps. The two components 2' and 2" make up the semi-cylindrical shell as parts arrayed in a fixed deposition, without the width of the gap 3 therebetween changing.

The semi-cylindrical shell 2' and 2" closely embraces only the upper half-part of the barrel 5, which does not contain articles 7. The stream of air passing through the barrel 5 and its load in general is found to evacuate 80% of the drag-out treatment

solution during a normal blowing period of approximately 20 seconds.

Furthermore, the efficiency of the system may be enhanced by adding an elongate rectangular plate 12, which is pivotally mounted on one of its longitudinal edges along one of the longitudinal bottom edges of the rigid semi-cylindrical shell 2' and 2". The barrel 5 usually rotates at about 8 revolutions per minute and partially moves the load 7 upwardly, as shown in Figure 2. When the barrel 5 is not disposed within the semi-cylindrical shell 2' and 2", the additional pivotal plate 12 remains in a vertical position, as shown in Figure 1. As soon as the barrel 5 has been introduced into and is partially embraced by the semi-cylindrical shell 2' and 2", the pivotal plate 12 is swung from its vertical position to a diagonal one towards the barrel 5 and touches it, as shown in Figure 2. The laterally-disposed plate 12 serves to direct the air stream essentially through the entire load, maximising the efficiency of the system. The removal time of the treatment solution is in this way greatly reduced.

The system as well as the method of the invention are suitable for all chemical and electrolytic surface treatment processes, such as acid dipping, alkaline cyanide processes, plating of zinc, bright nickel, and copper, and, especially, electro-plating of the so-called precious metals including gold, silver, rhodium,

cobalt, palladium and their alloys.

A particular advantage of the method concerns the recovery of the drag-out treatment solutions and their direct return (i.e. recycling) to their original containers, in an unchanged condition, both so far as the concentration and composition are concerned. The consumption of rinsing water is substantially reduced, and the extensive processes for the recycling of the drag-out treatment solutions are eliminated, as the processing of the discharge to a waste water plant; these provide economic advantages and have a favourable consequence for environmental protection.

CLAIMS

1. A system for removing and recovering adhering surface-treatment solution from a barrel and a bulk load of articles contained therein, following an electro-plating and/or chemical surface treatment on the articles, which system comprises a container for said solutions, a barrel for accommodating said load, means for moving the barrel between a first position where the barrel is inside the solution container and a second position where the barrel is above the container, a rigid semi-cylindrical shell for partially embracing the barrel when in its second position so that the semi-cylindrical shell embraces only the upper part of said barrel which normally contains no articles, and means for supplying to the interior of the semi-cylindrical shell a stream of pressurised air in such a manner that the stream flows first through the upper part of the barrel, downwardly through the load and out of the barrel, so as to remove the adhering treatment solution from the barrel and its load, the solution flowing directly into the container.

2. A system as claimed in claim 1, wherein means are provided for transferring said semi-cylindrical shell to a plurality of treatment stations, which means includes a travelling hoisting carriage.

3. A system as claimed in claim 1 or claim 2, wherein a substantially rectangular plate is pivoted along one

edge to a lateral edge of said semi-cylindrical shell, for pivoting movement from a generally vertical position when said barrel is not in the second position, to a diagonally-inclined position towards said barrel when the barrel is in its second position.

4. A system as claimed in claim 3, wherein said substantially rectangular plate has an arcuate cross-section adapted to the contours of said barrel.

5. A system as claimed in any of the preceding claims, wherein said semi-cylindrical shell comprises a two-piece assembly.

6. A system as claimed in any of the proceeding claims, wherein said barrel comprises a prismatic or cylindrical perforated shell with longitudinal reinforcing ribs, a door with a locking device and two attached end walls, the barrel having a rotationally symmetrical cross section.

7. A system as claimed in any of the preceding claims, wherein said semi-cylindrical shell and said barrel when in its second position are substantially concentric.

8. A system as claimed in claim 7, wherein said barrel when in its second position touches said shell.

9. A system as claimed in any of the preceding claims, wherein said semi-cylindrical shell and said barrel are both made of synthetic plastics material.

10. A system for removing and recovering surface-

treatment solutions from a barrel and its bulk load of articles, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

11. A method of removing and recovering an adhering surface-treatment solution from a barrel and its bulk load of articles after electro-plating and/or chemical surface treatment in a container, comprising the steps of accommodating a bulk load of articles in a barrel, lowering the barrel into a container so said solution so as to contact the load with said solution, lifting the barrel out of said container after treating the load in the solution positioning the barrel substantially concentrically within a semi-cylindrical shell so that the barrel touches said shell, and blowing a stream of pressurised air downwardly through the upper part of said barrel not containing any load so that the stream continues downwardly through said load and out of said barrel so as to remove the solution which solution may flow directly back to the container.

12. A method as claimed in claim 11, in which the barrel is rotated during the air-blowing step.

13. A method as claimed in claim 12, in which the rotation of the barrel is performed intermittently during said air-blowing step.

14. A method as claimed in any of claims 11 to 13, in

which a substantially rectangular plate disposed on a lower longitudinal edge of said semi-cylindrical shell is pivoted to a position where the plate is directed towards the barrel when the latter is positioned within the semi-cylindrical shell.

15. A method of removing and recovering an adhering surface treatment solution from a barrel and its bulk load of articles substantially as hereinbefore described with reference to the accompanying drawings.

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