

Description

The present invention relates to selective plating, i.e., electroplating selectively on the electrical contact surfaces of electrical terminals to the exclusion of other surfaces of the terminals.

The invention relates to the electroplating of the electrical contact surfaces of loose piece terminals with noble metal or noble metal alloys. These metals are characterized by good electrical conductivity and little or no formation of oxides that reduce the conductivity. Therefore, these metals, when applied as plating, will enhance conductivity of the terminals. The high cost of these metals has necessitated precision deposition on the contact surfaces of the terminals, and not on surfaces of the terminals on which plating is unnecessary.

Apparatus for plating is called a plating cell and includes an electrical anode, an electrical cathode comprised of terminals in strip form or loose piece terminals in contact with a separate electrical conducting member, and a plating solution, i.e., an electrolyte of metal ions. The plating solution is fluidic and is placed in contact with the anode and the terminals. The apparatus operates by passing electrical current from the anode, through the plating solution to the terminals. The metal ions deposit as metal plating on those terminal surfaces in contact with the plating solution.

Heretofore, plating of loose piece terminals was accomplished by immersing all or a portion of the terminals in a plating apparatus such as that disclosed in U.S. Patent No. 4,321,124. Immersing the terminal in plating solution, however, results in a layer of plating on the outside as well as the inside of the terminal. Masking of loose piece terminals requires at least one more manufacturing operation. Even if the terminals could be masked after they are stamped and formed and prior to their removal from a carrier strip, the process would be time consuming. Some immersed surfaces are difficult to mask, particularly the surfaces of small size electrical terminals.

The present invention accomplishes selective plating according to a rapid automatic process and apparatus without a need for masking immersed terminal surfaces on which plating is unnecessary. The present invention is particularly adapted for plating on the interior surfaces of the loose piece terminals, and not the external surfaces, despite contact of the external surfaces with plating solution.

US Patent No. 4 384 926 issued 24 May 1983, and US Patent No. 4 427 498 issued 24 January 1984, owned by this Assignee, disclose plating cells for selectively plating the interior surfaces of electrical terminals that are in strip form. The disclosures in the above-mentioned documents are hereby incorporated by reference. The disclosures in the two documents are the subject matter of published European Patent Application 83301271.9 published 12 October 1983 under Publication No. 0091209.

EP-A-0 091 209 discloses apparatus for continuously plating interior surfaces of electrical terminals comprising means for feeding the terminals to a continuously rotating mandrel, means for retaining the terminals against a portion of the mandrel, the mandrel having a plurality of anode extensions and associated nozzles therein, the anode extensions being reciprocally mounted for movement into and from the interior of receptacle portions of the terminals that are against the mandrel, a conduit for supplying plating solution under pressure through the nozzles and upon the anode extensions and into the interior of the terminals in which the anode extensions are received, and a source of electrical potential for supplying electrical current from the anode extensions, through the plating solution to the interiors of the terminals.

EP-A-0 091 209 also discloses a process for continuously plating interior surfaces of electrical terminals comprising the steps of

a) feeding a series of formed electrical terminals onto an alignment surface of a continuously rotatable plating cell mandrel,

b) aligning the interiors of the formed terminals with anode extensions shaped to enter the formed terminals, said anode extensions being mounted for reciprocating movement with respect to the nozzles of the plating cell mandrel,

c) projecting portions of the anode extensions into the interiors of the formed terminals,

d) jetting streams of plating solution through the nozzles and over the anode extensions,

e) supplying electrical potential between the terminals and the anode extensions so that plating is applied to the interior surfaces of the formed terminals that are in proximity of the advanced anode extensions,

f) retracting the anode extensions from the interior of the formed terminals, and

g) releasing the formed terminals from the mandrel.

It is an object to provide for the plating of loose piece terminals in an apparatus and a process having the features acknowledged to be disclosed in EP-A-0 091 209.

Accordingly apparatus according to the invention is characterised in that the means for feeding electrical terminals comprises loose-piece terminal feeding means and the means for retaining the terminals against a portion of the mandrel comprise an elongate resiliently mounted retaining member surrounding a portion of the mandrel between a first end support proximate the feeding means and a second end spaced therefrom around the mandrel whereby terminals are held against the mandrel by said retaining member as the mandrel rotates between the feeding means and said second end.

The process according to the invention is characterised by feeding successive loose piece terminals to the mandrel at a loading station, providing retaining means extending around a portion of the mandrel from the loading station to a location spaced therefrom around the mandrel

from the loading station, said retaining means being arranged to hold the terminals to the mandrel alignment surface in alignment with the anode extensions, and carrying out the steps b) to g) as terminals move between the loading station to said location spaced therefrom.

The invention will now be described, by way of example, with reference to the accompanying partly diagrammatic drawings, in which:-

Figure 1 is a cross-sectional view of a plating system which uses the disclosed invention;

Figure 2 is a three-dimensional view of an embodiment of the invention;

Figure 3 is a cross-sectional view taken along line 3-3 of Figure 2;

Figure 4 is a three-dimensional view of an alternative embodiment of the invention;

Figure 5 is a cross-sectional view taken along line 5-5 of Figure 4;

Figure 6 is an enlarged fragmentary view of a terminal of the type that can be plated with the apparatus of Figure 3;

Figure 7 is an enlarged fragmentary view of a terminal of the type that can be plated with the apparatus of Figure 5.

Figure 1 illustrates the use of the loose piece plating apparatus 110 in a typical plating system. In the preferred embodiment, feeding means 111 is comprised of a vibratory bowl 112, a feeding tube 114 and a loading head 115. The feeding means 111 feeds the terminals 15 to a continuously rotating mandrel 3 which is mounted to the wall 144 of the plating tank, the mandrel 3 being driven by the motor 123. During the plating process, the terminals 15 are held against the mandrel 3 by retaining means 132. After the terminals 15 have been plated, they are dropped onto a conveyor belt 146 where they are carried through series of rinse solutions 150 and dropped into collection box 152. This Figure further illustrates the use of mesh walls 148 to surround the conveyor belt to prevent the loss of the plated pieces from the moving belt.

Referring now to Figure 2, retaining means 132 is comprised of a first support member 135, a second support member 135' and an elongated resiliently mounted member 134, the ends of which are held by spaced apart support members 135, 135'. The support members 135, 135' are attached to the wall 144 of the plating tank adjacent the mandrel 3. The elongated member 134 is attached to the support members 135, 135' so that the elongated member 134 wraps around a portion 126 of the mandrel 3. The first end of the elongated member 134 is proximate the loading head 115 so that the elongated member 134 will retain the terminals 15 against the mandrel 3 as they are loaded into the continuously rotating mandrel 3.

In the preferred embodiment, the elongated member 134 is a wire whose tension can be adjusted so that the terminals 15 are held securely against the rotating mandrel 3. In addition to retaining the terminal 15, the wire also conducts electricity to the terminals 15. It is to be under-

stood that materials other than metal can be used as elongated member 134. If such materials are used, a means for conducting electrical current to the terminals would also need to be used.

As is illustrated in Figure 2, mandrel 3 is mounted to rotate in a counterclockwise direction. Elongated member 134 extends in a counterclockwise direction from the first support member 135 to the second support member 135'. The terminals 15 are fed one at a time from feeding tube 114 into the loading head 115. In the preferred embodiment, a loading piston 115' moves the loaded terminals 15 from the head 115 onto the aligning surface 124 when the terminal 15 is in proper alignment with a nozzle 26. The terminals 15 are carried by the rotating mandrel 3 under the elongated member 134.

Referring now to Figures 2 and 3, mandrel 3 has a plurality of nozzles 26 distributed about the mandrel's axis of rotation. These nozzles contain anode extensions 29. The anode extensions 29 are mounted for reciprocation within the nozzles 26 so that the anode extensions 29 can be moved into and out of the terminals 15 as mandrel 3 rotates. Mandrel 3 is designed to be used with barrel or sleeve type terminals such as the terminal 15 illustrated in Figure 6 wherein the anode extension 29 enters one end of the terminal.

As terminals 15 enter the mandrel 3, they are aligned with nozzles 26. Anode extensions 29 are moved into the receptacle portion 117 of the terminals 15 as the mandrel 3 rotates. Plating solution 48 is pumped under pressure through conduit 36 in the mandrel 3 to the nozzles 26 and over the anode extensions 29 when the anode extensions are in the terminals 15. Electric current is passed from the anode extensions 29 through the plating solution 48 to the terminals 15 which are the cathodes. The anode extensions 29 are retracted from the internal portion 118 of the terminals 15 prior to reaching retaining support member 135'.

As the mandrel 3 rotates, the terminals 15 reach the second support member 135' and the end of the elongated member 134. The terminals 15 are thereby released from the mandrel 3. The terminals 15 drop against a released terminal guide 127 which directs the terminals 15 to the conveyor belt 146. Figures 4 and 5 are a three-dimensional and cross-sectional view of an alternative embodiment of the mandrel 3'. In this embodiment, the mandrel 3' is designed to be used with slot type terminals 15' of the type illustrated in Figure 7. Terminals 15' are fed to the mandrel 3' through the feeding tube 114 to the loading head 115 where they are aligned with nozzles 26' and are moved against aligning surface 124'.

In this embodiment, the nozzles 26' are distributed about the mandrel's axis of rotation so that the anode extensions 29' will enter the side of the terminals 15'. As the terminals 15' are carried around the mandrel 3', anode extensions 29' enter the receptacle 118'. Plating solution 48' is pumped under pressure through conduit 36', through the nozzles 26', and over the anode

extensions 29' to the interior surfaces 120' of the terminals 15'. The anode extensions 29' are retracted from the terminals 15' prior to the terminals 15' reaching the support member 135'. The released terminals 15' drop onto the guide 127 and thence to the conveyor belt 146.

Figure 6 shows the plated surface 76 of a typical barrel or sleeve type terminal 15. The interior surface 120 of the receptacle portion 118 of the terminal 15 has a layer of plating 76 thereon.

Figure 7 illustrates the plated layer 76' of a typical slot type terminal 15' as plated by the mandrel 31. The receptacle portion 118' has a slot 119 which has a plated layer 76' on its interior surfaces 120'.

Claims

1. Apparatus for continuously plating interior surfaces (120, 120') of electrical terminals (15, 15') comprising means (111) for feeding the terminals (15, 15') to a continuously rotating mandrel (3, 3'), means (132) for retaining the terminals (15, 15') against a portion (126, 126') of the mandrel (3, 3'), the mandrel (3, 3') having a plurality of anode extensions (29, 29') and associated nozzles (26, 26') therein, the anode extensions (29, 29') being reciprocally mounted for movement into and from the interior of receptacle portions (118, 118') of the terminals (15, 15') that are against the mandrel, a conduit (36, 36') for supplying plating solution (48, 48') under pressure through the nozzles (26, 26') and upon the anode extensions (29, 29') and into the interiors (118, 118') of the terminals (15, 15') in which the anode extensions (29, 29') are received, and a source of electrical potential for supplying electrical current from the anode extensions (29, 29'), through the plating solution (48, 48') to the interiors (118, 118') of the terminals (15, 15'), characterised in that the means (111) for feeding electrical terminals comprises loose-piece terminal feeding means (111) and the means (132) for retaining the terminals (15, 15') against a portion of the mandrel (3, 3') comprise an elongate resiliently mounted retaining member (134) surrounding a portion of the mandrel (3, 3') between a first end support (135) proximate the feeding means (111) and a second end (135') spaced therefrom around the mandrel (3, 3') whereby terminals (15, 15') are held against the mandrel (3, 3') by said retaining member (134) as the mandrel rotates between the feeding means (111) and said second end (135').

2. The apparatus (110) as recited in claim 1, further characterised in that the resiliently mounted member (134) is metal and provides electrical connection to the terminals (15, 15') during the plating process.

3. The apparatus (110) as recited in claim 1 further characterised in that the feeding means (111) includes a loading head (115) having a loading piston (115') therein whereby the loading

piston (115') moves the terminals (15, 15') onto the mandrel surface (124, 124') as the terminals (15, 15') become aligned with their corresponding nozzles (26, 26').

4. A process for continuously plating interior surfaces of electrical terminals (15, 15') comprising the steps of

a) feeding a series of formed electrical terminals (15, 15') onto an alignment surface (124, 124') of a continuously rotatable plating cell mandrel (3, 3'),

b) aligning the interiors (118, 118') of the formed terminals (15, 15') with anode extensions (29, 29') shaped to enter the formed terminals (15, 15'), said anode extensions (29, 29') being mounted for reciprocating movement with respect to the nozzles (26, 26') of the plating cell mandrel (3, 3'),

c) projecting portions of the anode extensions (29, 29') into the interiors (118, 118') of the formed terminals (15, 15'),

d) jetting streams of plating solution (48, 48') through the nozzles (26, 26') and over the anode extensions (29, 29'),

e) supplying electrical potential between the terminals (15, 15') and the anode extensions (29, 29') so that plating is applied to the interior surfaces (120, 120') of the formed terminals (15, 15') that are in proximity of the advanced anode extensions (29, 29'),

f) retracting the anode extensions (29, 29') from the interior (118, 118') of the formed terminals (15, 15'), and

g) releasing the formed terminals (15, 15') from the mandrel (3, 3'), characterised by feeding successive loose piece terminals to the mandrel (3, 3') at a loading station (135), providing retaining means (132) extending around a portion of the mandrel from the loading station (135) to a location spaced (135') therefrom around the mandrel (3, 3') from the loading station (135), said retaining means (132) being arranged to hold the terminals (15, 15') to the mandrel (3, 3') alignment surface (124, 124') in alignment with the anode extensions (29, 29'), and carrying out the steps b) to g) as terminals (15, 15') move between the loading station (135) to said location (135') spaced therefrom.

Patentansprüche

1. Vorrichtung zur kontinuierlichen Plattierung von Innenoberflächen (120, 120') elektrischer Anschlüsse (15, 15'), mit Einrichtungen (111) zur Zuführung der Anschlüsse (15, 15') an einen kontinuierlich rotierenden Dorn (3, 3'), Einrichtungen (132) zum Halten der Anschlüsse (15, 15') gegen einen Abschnitt (126, 126') des Dorns (3, 3'), wobei der Dorn (3, 3') eine Vielzahl von Anodenverlängerungen (29, 29') und zugeordnete Düsen (26, 26') darin besitzt, wobei die Anodenverlängerungen (29, 29') hin und hergehend montiert sind, und zwar zur Bewegung in das Innere von Buchsenabschnitten (118, 118') der auf dem Dorn befindlichen Anschlüsse (15,

extensions 29' to the interior surfaces 120' of the terminals 15'. The anode extensions 29' are retracted from the terminals 15' prior to the terminals 15' reaching the support member 135'. The released terminals 15' drop onto the guide 127 and thence to the conveyor belt 146.

Figure 6 shows the plated surface 76 of a typical barrel or sleeve type terminal 15. The interior surface 120 of the receptacle portion 118 of the terminal 15 has a layer of plating 76 thereon.

Figure 7 illustrates the plated layer 76' of a typical slot type terminal 15' as plated by the mandrel 31. The receptacle portion 118' has a slot 119 which has a plated layer 76' on its interior surfaces 120'.

Claims

1. Apparatus for continuously plating interior surfaces (120, 120') of electrical terminals (15, 15') comprising means (111) for feeding the terminals (15, 15') to a continuously rotating mandrel (3, 3'), means (132) for retaining the terminals (15, 15') against a portion (126, 126') of the mandrel (3, 3'), the mandrel (3, 3') having a plurality of anode extensions (29, 29') and associated nozzles (26, 26') therein, the anode extensions (29, 29') being reciprocally mounted for movement into and from the interior of receptacle portions (118, 118') of the terminals (15, 15') that are against the mandrel, a conduit (36, 36') for supplying plating solution (48, 48') under pressure through the nozzles (26, 26') and upon the anode extensions (29, 29') and into the interiors (118, 118') of the terminals (15, 15') in which the anode extensions (29, 29') are received, and a source of electrical potential for supplying electrical current from the anode extensions (29, 29'), through the plating solution (48, 48') to the interiors (118, 118') of the terminals (15, 15'), characterised in that the means (111) for feeding electrical terminals comprises loose-piece terminal feeding means (111) and the means (132) for retaining the terminals (15, 15') against a portion of the mandrel (3, 3') comprise an elongate resiliently mounted retaining member (134) surrounding a portion of the mandrel (3, 3') between a first end support (135) proximate the feeding means (111) and a second end (135') spaced therefrom around the mandrel (3, 3') whereby terminals (15, 15') are held against the mandrel (3, 3') by said retaining member (134) as the mandrel rotates between the feeding means (111) and said second end (135').

2. The apparatus (110) as recited in claim 1, further characterised in that the resiliently mounted member (134) is metal and provides electrical connection to the terminals (15, 15') during the plating process.

3. The apparatus (110) as recited in claim 1 further characterised in that the feeding means (111) includes a loading head (115) having a loading piston (115') therein whereby the loading

piston (115') moves the terminals (15, 15') onto the mandrel surface (124, 124') as the terminals (15, 15') become aligned with their corresponding nozzles (26, 26').

4. A process for continuously plating interior surfaces of electrical terminals (15, 15') comprising the steps of

a) feeding a series of formed electrical terminals (15, 15') onto an alignment surface (124, 124') of a continuously rotatable plating cell mandrel (3, 3'),

b) aligning the interiors (118, 118') of the formed terminals (15, 15') with anode extensions (29, 29') shaped to enter the formed terminals (15, 15'), said anode extensions (29, 29') being mounted for reciprocating movement with respect to the nozzles (26, 26') of the plating cell mandrel (3, 3'),

c) projecting portions of the anode extensions (29, 29') into the interiors (118, 118') of the formed terminals (15, 15'),

d) jetting streams of plating solution (48, 48') through the nozzles (26, 26') and over the anode extensions (29, 29'),

e) supplying electrical potential between the terminals (15, 15') and the anode extensions (29, 29') so that plating is applied to the interior surfaces (120, 120') of the formed terminals (15, 15') that are in proximity of the advanced anode extensions (29, 29'),

f) retracting the anode extensions (29, 29') from the interior (118, 118') of the formed terminals (15, 15'), and

g) releasing the formed terminals (15, 15') from the mandrel (3, 3'), characterised by feeding successive loose piece terminals to the mandrel (3, 3') at a loading station (135), providing retaining means (132) extending around a portion of the mandrel from the loading station (135) to a location spaced (135') therefrom around the mandrel (3, 3') from the loading station (135), said retaining means (132) being arranged to hold the terminals (15, 15') to the mandrel (3, 3') alignment surface (124, 124') in alignment with the anode extensions (29, 29'), and carrying out the steps b) to g) as terminals (15, 15') move between the loading station (135) to said location (135') spaced therefrom.

Patentansprüche

1. Vorrichtung zur kontinuierlichen Plattierung von Innenoberflächen (120, 120') elektrischer Anschlüsse (15, 15'), mit Einrichtungen (111) zur Zuführung der Anschlüsse (15, 15') an einen kontinuierlich rotierenden Dorn (3, 3'), Einrichtungen (132) zum Halten der Anschlüsse (15, 15') gegen einen Abschnitt (126, 126') des Dorns (3, 3'), wobei der Dorn (3, 3') eine Vielzahl von Anodenverlängerungen (29, 29') und zugeordnete Düsen (26, 26') darin besitzt, wobei die Anodenverlängerungen (29, 29') hin und hergehend montiert sind, und zwar zur Bewegung in das Innere von Buchsenabschnitten (118, 118') der auf dem Dorn befindlichen Anschlüsse (15,



15') hinein und heraus, ferner mit einer Leitung (36, 36') zur Zufuhr von Plattierungslösung (48, 48') unter Druck durch die Düsen (26, 26') und auf die Anodenverlängerungen (29, 29') und in die Innenräume (118, 118') der Anschlüsse (15, 15') hinein, in denen die Anodenverlängerungen (29, 29') aufgenommen sind, und mit einer Quelle elektrischen Potentials zur Zufuhr elektrischen Stroms von den Anodenverlängerungen (29, 29') durch die Plattierungslösung (48, 48') in die Innenräume (118, 118') der Anschlüsse (15, 15'), dadurch gekennzeichnet, daß die Einrichtungen (111) zur Zufuhr elektrischer Anschlüsse eine Einzelstück-Anschlußzufuhreinrichtung (111) umfassen und die Einrichtungen (132) zum Halten der Anschlüsse (15, 15') gegen einen Abschnitt des Dorns (3, 3') ein langgestrecktes elastisch montiertes Halteelement (134) umfassen, welches einen Abschnitt des Dorns (3, 3') umgibt, und zwar zwischen einer ersten Endhalterung (135) in der Nähe der Zufuhreinrichtungen (111) und einem zweiten Ende (135'), das davon um den Dorn (3, 3') herum im Abstand angeordnet ist, wodurch Anschlüsse (15, 15') durch das Halteelement (134) gegen den Dorn (3, 3') gehalten werden, während der Dorn zwischen der Zufuhreinrichtung (111) und dem zweiten Ende (135') rotiert.

2. Vorrichtung (110) nach Anspruch 1, dadurch gekennzeichnet, daß das elastisch montierte Element (134) aus Metall besteht und eine elektrische Verbindung mit den Anschlüssen (15, 15') während des Plattierungsvorgangs herstellt.

3. Vorrichtung (110) nach Anspruch 1, dadurch gekennzeichnet, daß die Zufuhreinrichtung (111) einen Ladekopf (115) umfaßt, welcher einen Ladekolben (115') darin besitzt, wodurch der Ladekolben (115') die Anschlüsse (15, 15') auf die Dornoberfläche (124, 124') bewegt, während die Anschlüsse (15, 15') mit ihren entsprechenden Düsen (26, 26') ausgerichtet werden.

4. Verfahren zur kontinuierlichen Plattierung von Innenoberflächen elektrischer Anschlüsse (15, 15') mit den folgenden Schritten:

a) Zufuhr einer Reihe von geformten elektrischen Anschlüssen (15, 15') auf eine Ausrichtoberfläche (124, 124') eines kontinuierlich drehbaren Plattierungszellendorns (3, 3'),

b) Ausrichten der Innenräume (118, 118') der geformten Anschlüsse (15, 15') mit Anodenverlängerungen (29, 29'), die derart gestaltet sind, daß sie in die geformten Anschlüsse (15, 15') eindringen, wobei die Anodenverlängerungen (29, 29') zur hin und hergehenden Bewegung bezüglich der Düsen (26, 26') des Plattierungszellendorns (3, 3') montiert sind,

c) Einführen von Teilen der Anodenverlängerungen (29, 29') in die Innenräume (118, 118') der geformten Anschlüsse (15, 15'),

d) Aufspritzen von Strömen von Plattierungslösung (48, 48') durch Düsen (26, 26') und über die Anodenverlängerungen (29, 29'),

e) Zufuhr eines elektrischen Potentials zwischen den Anschlüssen (15, 15') und den Anodenverlängerungen (29, 29'), so daß eine Plattierung auf die

Innenoberflächen (120, 120') der geformten Anschlüsse (15, 15') aufgebracht wird, die sich in der Nähe der vorgeschobenen Anodenverlängerungen (29, 29') befinden.

f) Zurückziehen der Anodenverlängerungen (29, 29') aus den Innenräumen (118, 118) der geformten Anschlüsse (15, 15'), und

g) Lösen der geformten Anschlüsse (15, 15') von dem Dorn (3, 3'), dadurch gekennzeichnet, daß nacheinander Anschlüsse als lose Stücke an den Dorn (3, 3') an einer Ladestation (135) geführt werden, daß Halteeinrichtungen (132) sich um einen Abschnitt des Dorns von der Ladestation (135) zu einer Stelle erstrecken, die im Abstand (135') davon um den Dorn (3, 3') herum von der Ladestation (135) angeordnet ist, und daß die Halteeinrichtungen (132) derart angeordnet und ausgebildet sind, daß sie die Anschlüsse (15, 15') an die Ausrichtoberfläche (124, 124') des Dorns (3, 3') ausgerichtet mit den Anodenverlängerungen (29, 29') halten, und daß ferner die Schritte b) bis g) ausgeführt werden, während sich die Anschlüsse (15, 15') sich von der Ladestation (135) bis zu der im Abstand dazu befindlichen Stelle (135') bewegen.

Revendications

1. Appareil pour revêtir en continu des surfaces intérieures (120, 120') de bornes électriques (15, 15'), comprenant des moyens (111) destinés à faire avancer les bornes (15, 15') vers un mandrin (3, 3') tournant en continu, des moyens (132) destinés à retenir les bornes (15, 15') contre une partie (126, 126') du mandrin (3, 3'), le mandrin (3, 3') renfermant plusieurs appendices d'anode (29, 29') et des buses associées (26, 26'), les appendices d'anode (29, 29') étant montés de façon à exécuter un mouvement alternatif pour entrer à l'intérieur de parties femelles (118, 118') des bornes (15, 15') se trouvant contre le mandrin et en sortir, un conduit (36, 36') destiné à fournir une solution de revêtement (48, 48') sous pression par l'intermédiaire des buses (26, 26') et sur les appendices d'anode (29, 29') et dans les intérieurs (118, 118') des bornes (15, 15') dans lesquelles les appendices d'anode (29, 29') sont reçus, et une source de potentiel électrique destinée à faire passer un courant électrique à partir des appendices d'anode (29, 29'), à travers la solution de revêtement (48, 48'), jusqu'aux intérieurs (118, 118') des bornes (15, 15'), caractérisé en ce que les moyens (111) destinés à faire avancer des bornes électriques comprennent des moyens (111) d'avance de bornes en pièces libres, et les moyens (132) destinés à retenir les bornes (15, 15') contre une partie du mandrin (3, 3') comprennent un élément allongé (134) de retenue, monté élastiquement, entourant une partie du mandrin (3, 3') entre un premier support extrême (135) proche des moyens (111) d'avance et une seconde extrémité (135') qui en est espacée autour du mandrin (3, 3') afin que des bornes (15, 15') soient maintenues contre le mandrin (3, 3') par ledit élément de retenue (134) lorsque le



mandrin tourne entre les moyens d'avance (111) et ladite seconde extrémité (135').

2. Appareil (110) selon la revendication 1, caractérisé en outre en ce que l'élément (134) monté élastiquement est en métal et établit une connexion électrique avec les bornes (15, 15') pendant le processus de revêtement.

3. Appareil (110) selon la revendication 1, caractérisé en outre en ce que les moyens d'avance (111) comprennent une tête (115) de chargement renfermant un piston (115') de chargement de manière que le piston (115') de chargement amène les bornes (15, 15') sur la surface (124, 124') du mandrin pendant que les bornes (15, 15') viennent s'aligner avec les buses correspondantes (26, 26').

4. Procédé pour revêtir en continu des surfaces intérieures de bornes électriques (15, 15'), comprenant les étapes qui consistent

a) à faire avancer une série de bornes électriques formées (15, 15') jusque sur une surface d'alignement (124, 124') d'un mandrin (3, 3') de cellule de revêtement pouvant tourner en continu,

b) à aligner les intérieurs (118, 118') des bornes formées (15, 15') avec des appendices d'anode (29, 29') configurés pour entrer dans les bornes formées (15, 15'), lesdits appendices d'anode (29, 29') étant montés de façon à exécuter un mouvement alternatif par rapport aux buses (26, 26') du mandrin (3, 3') de la cellule de revêtement,

c) à faire avancer des parties des appendices

d'anode (29, 29') dans les intérieurs (118, 118') des bornes formées (15, 15'),

d) à projeter des courants de solution de revêtement (48, 48') au travers des buses (26, 26') et sur les appendices d'anode (29, 29'),

e) à appliquer un potentiel électrique entre les bornes (15, 15') et les appendices d'anode (29, 29') afin que le revêtement soit appliqué sur les surfaces intérieures (120, 120') des bornes formées (15, 15') qui sont à proximité des appendices d'anode avancés (29, 29'),

f) à rétracter les appendices d'anodes (29, 29') de l'intérieur (118, 118') des bornes formées (15, 15'), et

g) à libérer les bornes formées (15, 15') du mandrin (3, 3'), caractérisé en ce qu'il consiste à faire avancer des bornes en pièces libres successives vers le mandrin (3, 3') dans un poste (135) de chargement, à prévoir des moyens (132) de retenue s'étendant autour d'une partie du mandrin, du poste de chargement (135) jusqu'à un emplacement (135') qui en est espacé autour du mandrin (3, 3'), à partir du poste de chargement (135), lesdits moyens de retenue (132) étant agencés de façon à maintenir les bornes (15, 15') sur la surface d'alignement (124, 124') du mandrin (3, 3') en alignement avec les appendices d'anode (29, 29'), et à effectuer les étapes b) à g) pendant que les bornes (15, 15') se déplacent entre le poste de chargement (135) et ledit emplacement (135') qui en est espacé.

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