

Description

The invention relates to a method for electroplating a metallic deposit on interconnected or banded elongate metallic and/or metallized products, according to the pre-characterising part of claim 1.

Modern electronics and particularly telecommunication and computer technology require vast numbers of electrical contacts or connection systems comprising female and male contacts.

To ensure a maximum reliability for current passage between the female and male contacts such contacts are provided with a coating of precious metal, usually gold or palladium or alloys thereof, at least in those areas of the components which come into engagement when contact is made. Frequently such metallic coatings are applied by electroplating the contacts.

For practical use it will be sufficient to electrodeposit precious metal only in those areas of female and male contacts which mate together when contact is established. The technology for plating select areas of components only is commonly called selective or functional plating.

The male parts of a connection system usually have the form of elongate objects, such as square or round pins, blades, and the like. Existing technologies provide the capability to more or less accurately selectively electroplate precious metal onto such elongate components on all sides, however, in the majority of all connection systems, precious metal is only required on two opposite sides of a male contact which mate with the female contact.

In a complete connection system, that is an assembly of several male and female contacts, in which gold is used as the contact coating material, the costs of the precious metal represents approx. 28% of the total connector system of which the largest part is required for coating the male parts of the system. As stated above a large part of the gold presently applied to male connectors is plated in non-functional areas which are not used in the mating of the male contacts with their female counterparts.

The present invention aims an improved method and apparatus with the capability to, electroplate a precious metal coating on elongate objects, such as square and round pins, blades and the like on those opposite sides of the components only which truly require such a precious metal coating to ensure proper functioning of a connecting system. It will be evident that realizing such a method and apparatus will result in an appreciable saving of the consumption of metal, usually precious metal and hence will produce an important saving in the total costs of connection systems in which such elongate

gate contact components are used.

Several methods and apparatus have been proposed for the deposition of metals on elongate components such as square or round pins, blades and the like. One method is to submerge only those parts of such components which require a metal coating into an electrolyte. This method is known as "controlled depth plating" and results in metal deposition on all sides of the submerged components, including those areas where no metal coating is required. Moreover, it is difficult to control the level of the electrolyte in which the components are submerged, accurately, since in order to obtain an acceptable metal deposition rate, solution agitation is necessary, which will disturb the solution level. The metal deposited in such a controlled depth system will further show an uneven distribution resulting in an additional loss of metal, usually precious metal. Complicated shielding systems may overcome this disadvantage somewhat, but it will make controlled depth plating more expensive and critical.

From US-A- 4.374.004 there is known a method and apparatus wherein a bandolier with pins is advanced stepwise with respect to an inflatable masking member having a front face which has a plurality of folds therein to create a plurality of V-shaped protrusions when the inflatable masking member is inflated. In operation a gas is fed to the inflatable member when the bandolier is stationary and the front face of the inflatable member moves towards the products with the V-shaped protrusions moving in between the pins.

EP-A-0107417 discloses a method wherein a strip with interconnected products is displaced stepwise with respect to a deformable plate shaped mask. When in operation the bandolier is stationary the mask is pressed against the products so that said mask deforms under pressure so as to protrude between the products.

British Patent 1.562.179 shows a method whereby those areas of elongate contact components that require a precious metal coating are first covered by a removable non-conductive mask. In a next step the components are electropainted and cured at elevated temperature. The electropaint does not cover the area protected by a removable mask, which in a subsequent step can be removed. The now exposed metal area can then be plated by conventional means with metal, usually precious metal.

Not only is this known method very elaborate, but several disadvantages are inherent to this method. In practice residues of the removable mask appear to reduce the quality of the subsequent metal deposit. Further the curing operation at elevated temperatures can influence the mechanical properties of the base material of which the

components were manufactured. Finally it is difficult to accurately apply the removable mask and hence to obtain the desired accuracy, and since it is extremely difficult to remove the coating of electropaint it makes subsequent timplating of other areas of the contact components very expensive and almost impossible.

U.S. Patent 4,064,019 describes a method whereby interconnected metal components are guided along a porous material wetted with an electrolyte of the metal that must be plated. The porous material is applied to the outside of a cylindrical roller, the inside of which is acting as an anode. During the transport along the roller surface the cathodically connected components will be plated in the area which is in contact with the porous outside of the roller. The electrolyte in the porous material is continuously renewed.

This method is suitable for plating formed areas of female contacts which require a metal coating, usually precious metal, over a very limited area on one side only. Should a double sided plating be required then a second operation is necessary.

Further, during transport of the components along the porous material on the roller, a small electrolyte wave will be formed in the direction of travel which will result in undesired metal deposition on the forward side of the components. If a second plating treatment of the opposite side of the contact is required the same phenomena will happen and result into a metal deposit on all sides in practice. The small contact area between component and cylindrical porous material makes an even deposition of metal over a larger area such as required on square or round pins or blades and the like for male connector virtually impossible.

A similar method is published in U.S. Patent 4,452,684 in which the interconnected components are guided along a device provided with an outer surface of porous material and whereby the device can have a flat surface. This method enables plating of elongate components over a certain length, but does not prevent the formation of an electrolyte wave in front of the components seen in direction of travel. This is the more so in the proposed method of this patent, since electrolyte is introduced from the inside of the device into the outer layer of porous material. Moreover, if, as usually in plating elongate components such as square or round pins, blades and the like, two sided metal deposition is required, two operations are required and the loss of metal, usually precious metal on non-functional areas will be considerable.

U.S. Patent 4,364,801 describes a method for the selective deposition of metal on interconnected contact pins, whereby the interconnected pins are transported through a cell in which they are on one

side exposed to a gas or air stream and on the other side to an electrolyte stream. It is the object of this method to plate the components on one side only, however, due to turbulence of gas and electrolyte streams, wetting with electrolyte and hence metal deposition on the sides of the pins can not be prevented. Further, the turbulences of the gas stream will cause irregular electrolyte supply to the areas of the pins to be plated which will lead to uneven metal distribution on the plated area. Finally, if two sided plating is required, which is common for connector pins, double treatment is necessary.

U.S. Patent 3,340,162 shows a method in which interconnected contact pins are guided around a wheel which is provided with spring loaded retractable pins which engage with holes in the strip of interconnected contact pins in order to precisely position the pins in relation to the wheel. During the rotation of the wheel with interconnected contact pins electrolyte is jetted from small tubes radically in outward direction on those areas of the contact pins which require plating.

Due to slight variations in distance between the interconnected contact pins and variability of the diameter of the pilot holes in the strip of interconnected contact pins, there will be a variation of distance between areas of pins to be plated and the exit of the small tubes which jet the electrolyte. This will result in an uneven thickness of the plated metal, usually precious metal on the contact pins.

Moreover, the solution jetted onto the area to be plated will spray droplets onto areas not requiring plating and cause metal deposition on these areas. Finally, for double sided plating two operations are necessary.

European Patent 0,060,591 describes a method for selective plating of strip material or interconnected components by guiding the strip over a wheel shaped masking device which is subdivided into segments and has apertures on its circumference corresponding with the desired pattern to be plated on the strip material or interconnected components. Electrolyte is jetted from the inside of the masking device onto the exposed areas of the products in the apertures. Although this method provides the possibility to accurately apply material on a strip or on interconnected components, two operations are required for plating metal on both sides of interconnected square or round pins, blades and the like.

US-A-4.405.410 discloses a device wherein there is used a masking member for each five products of terminal pins. The masking members are shifted on the terminal pins in a direction parallel to the longitudinal direction of the pins.

US-A-4.376.017 discloses a method according to the pre-characterizing part of claim 1 wherein

there are used flat masking belts provided with passages or holes for obtaining the required resiliency.

Now the present invention is characterized in that at the beginning of said coinciding parts of said tracks the masking devices comprising solid non flexible pins surrounded by a resilient tube like material are arranged between the products and at the end of said coinciding parts of said tracks the masking devices are removed from between said products and in between said beginning and said end the products are exposed to the electrolyte.

By the invention there is obtained a method for fast and accurately plating a metal on two opposite sides of a component or on one side only at choice, resulting in a considerable saving in metal, usually precious metal compared with prior art technology. In most cases of double sided plating the saving in precious metal is appr. 50%.

A further aspect of the present invention relates to an apparatus in which the method can be used to its greatest advantage. The apparatus comprises means for continuously guiding and displacing the interconnected or bandoliered products along said first predetermined track, means for continuously displacing said masking devices along said further predetermined continuous track and means for contacting electrolyte with the products and the masking devices, whereby according to the invention said masking devices comprise solid non flexible pins surrounded by a resilient material in the shape of a tube.

A more detailed description of the invention will be given with reference to the figures.

Fig. 1 shows an example of an elongate product in the form of a male contact pin.

Fig. 2 shows a female contact spring suitable for mating with the contact pin of fig. 1.

Fig. 3 shows the male contact pin and female contact spring in mated position.

Fig. 4 shows an example of interconnected elongate products formed by loose pins assembled in a bandolier.

Fig. 5 shows a side view of fig. 4.

Fig. 6 shows another example of interconnected elongate products formed by pins, producing by stamping, leaving them interconnected by a strip of the original material.

Fig. 7 shows a few masking devices placed in between elongate products on a carrier.

Fig. 8 shows a cross section of an embodiment of a masking device.

Fig. 9 shows a cross section of a second embodiment of a masking device.

Fig. 10 shows a cross section of a third embodiment of a masking device.

Fig. 11 shows a few masking devices placed in between some elongate products.

Fig. 12 shows a cross section of some masking devices placed in between elongate products.

Fig. 13 shows a cross section of masking devices placed in between round elongate products.

Fig. 14 shows a cross section of a round pin plated with the apparatus of this invention whereby the thickness of the plated metal has been exaggerated.

Fig. 15 shows schematically a plan view of an apparatus for performing the method according to the invention.

Fig. 16 shows schematically on a larger scale a cross section of the apparatus of fig. 15 along the line XVI - XVI.

Fig. 17 shows a top view of a disc shaped member, carrying the masking devices, of the apparatus of fig. 15 - 16.

Fig. 18 shows partly in plan view and partly in section a guide wheel of the apparatus of fig. 15 - 16, along which the interconnected or bandoliered elongate products are guided during processing.

Fig. 19 shows a cross section of part of the guide wheel of fig. 18.

Fig. 20 shows a cross section of part of the guide wheel of fig. 18 with an alternative form.

Fig. 21 shows a further example of an apparatus for performing the method according to this invention in which for simplicity the bandolier for the elongate components has been omitted.

Fig. 22 shows a view of the apparatus of fig. 21 in the direction of arrow XXI.

In fig. 1 an elongate product in the form of a square contact pin 1 is partially shown. The pin 1 has been plated with precious metal 2 - 3 on two opposite sides, the other two sides have not been plated. This contact pin is suitable for mating with a female contact, for instance the U-shaped contact spring 4 of fig. 2. Both sides of the contact spring entry side have been bent and provided with a precious metal coating 5 - 6 on the opposite sides of the bend areas.

When contact pin 1 is mated with spring 4, as shown in fig. 3, the precious metal layers 2 and 3 of pin 1 will mate with precious metal layers 5 and 6 of spring 4 and insure reliable contact and current passage.

It will be evident from these figures that any precious metal on the non-plated sides of pin 1 would be spillage, since these sides do not contribute in any form in making contact between pin 1 and spring 4. To guarantee perfect contact however, the precious metal must cover a certain length, usually 3 - 5 mm on pin 1, the travel length during insertion. Female contacts usually require much more restricted areas to be covered with precious metal.

Elongate products requiring a precious metal coating, such as contact pins and blades described

earlier, are frequently produced as separate loose parts, such as the elongate parts 7 in fig. 4, and subsequently interconnected by a bandolier 8 of fig. 4 and 5 which bandolier is usually U-shaped as indicated in fig. 5. Parallel limbs of the bandolier 8 serve to fix elongate products 7 as indicated in fig. 4 - 5 in such a way that they are spaced on a pitch "b" with an in between free distance "a".

An alternative possibility is to stamp the elongate products and interconnection from stock material as indicated in fig. 6 for the pins 7, still attached to be interconnection 9. Also here the pitch is indicated with "b" and the free distance in between the parts with "a".

Fig. 7 shows a support 10 carrying a number of masking devices 11, each comprising a non-flexible pin 12 surrounded by resilient material 13 in this case consisting of pieces of resilient or elastic tube.

The pitch "b" of the pins of the masking devices is equal to the pitch of the elongate products to be plated at opposite sides with precious metal.

The tubes 13 surrounding the pins 12 are made of resilient non-conductive material, such as rubber, silicon rubber, polyethelene, soft PVC or similar materials and can be closed on the open top side with silicon paste 14 or similar material. The outside diameter "c" of the tubes is larger than the free distance "a" between the elongate products 7.

Preferably the cross-section of the pins 12 is not round, but such that in a first direction of a line interconnecting adjacent pins 12 the dimension of the pins 12 is smaller than the internal diameter of tubes 13 and the dimension perpendicular on said first direction the pin 12 at least over a certain length of the pin is appr. equal to the internal diameter of the tubes 13.

The pins 12 may have an elliptical shape, as shown in fig. 8 or be provided with two flat sides, as shown in fig. 9. A third form with flat sides is indicated in fig. 10.

It is evident that the possible shapes of the pins 12 are not limited to the ones shown in fig. 8 - 9 - 10. However, it will also be clear that preferably the tubes 13 can be freely compressed somewhat upon engagement with the elongate products to be plated, without interference of the non-flexible pins 12.

When the masking devices consisting of pins 12 and tubes 13 are introduced in the open spaces "a" (fig. 4 and 6) in between the elongate products 7 as shown in fig. 11, the tubes 13 will be compressed by the facing sides of products 7, very clearly illustrated in fig. 12, resulting in perfect masking under light pressure of the facing sides of elongate products 7 by the tubes 13.

When the areas of the elongate components

not masked by the tubes are immersed into an electrolyte, or if electrolyte is jetted onto these areas, electrodeposition of metal, usually precious metal on said areas on the two opposite sides of the elongate products 7 is obtained.

Although elongated products 7 shown in fig. 12 have a rectangular or square cross section, the invention is equally applicable for processing elongate products 7' with a round cross section as shown in fig. 13 and 14. Also here use of masking devices according to this invention result in considerable precious metal savings. Also oval, polygon or other cross sections could be processed according to the present invention.

After processing elongate products in the manner outlined above, metal deposition will be obtained on masked elongate pins 7' on two opposite sides, indicated with 2' - 3' in fig. 14, whereby the thickness of the metal deposit has been exaggerated for better illustration.

An apparatus particularly suitable for applying the method of this invention is shown in fig. 15 - 16. This apparatus comprises a guide wheel 14 freely rotatable on bearings on a preferably vertical hollow shaft 15, the upper side of which is closed by plug 16.

The guide wheel 14 serves to conduct the interconnected or bandoliered elongate products, indicated in fig. 15 schematically by a stripe-dot line 17. The interconnected or bandoliered elongate products 17 are brought into engagement with guide wheel 14 by two auxiliary rollers 18 and 19 over an angle in this figure of appr. 160° and is transported during processing in the direction of arrow A in fig. 15.

In case the bandoliered products are assembled as indicated in fig. 4 and 5, a slot 20 will be required to accommodate the U-shaped section of bandolier 8 as indicated in fig. 19. However, if a configuration of interconnection and elongate components as shown in fig. 6 must be processed the circumference of guide wheel 14 can be smooth as shown in fig. 20.

In both examples the interconnected or bandoliered elongate products are pressed against a part of the circumference of guide wheel 14 by a masking belt 21 of non-conductive material which is further guided over four rollers 22 of which at least one can be driven by a motor 23.

As can be seen most clearly from fig. 19 and 20 the interconnected or bandoliered elongate products are masked by masking belt 21 in such a manner that only those areas protruding below guide wheel 14 are exposed to the electrolytic process.

Underneath guide wheel 14 is positioned a wheel 24 also rotatable about hollow shaft 15. This wheel 24 serves as a carrier for the masking de-

vices 11 which are mounted on a regular pitch distance "b" along the outside of the wheel as indicated in fig. 17 for some of said masking devices.

In a chamber 25 provided for between the wheels 14 and 24 a disc-shaped reservoir 26 is mounted. This reservoir is covered on top with a circular plate 27 which serves also as an insoluble anode and which defines over part of its circumference in combination with the reservoir 26 a slot shaped exit or sparger 28. Both cover plate 27 and reservoir 26 are stationary. The exit slot or sparger 28 is positioned on a height whereby solution jetted from slot 28 will hit that area of the interconnected or bandoliered elongate products extending below the guide wheel 14.

Opposite the exit slot or sparger 28 another sparger is positioned comprising a stationary reservoir 29 closed on its upper side by the insoluble anode plate 30. Between the anode plate 30 and the upper side of reservoir 29 is a slot shaped exit or sparger 31 exactly opposite slot 28 and which, as is shown in fig. 15, is positioned concentric around the centerline of guide wheel 14 and extends over substantially the larger part of the arc in which the interconnected or bandoliered elongate products are engaged on guide wheel 14. During operation electrolyte is jetted from slot 31 of reservoir 29 and from slot 28 of reservoir 26 onto the opposite sides of those areas of the interconnected or bandoliered elongate products which extend below masking belt 21 and guide wheel 14.

The interior of hollow shaft 15 is in communication with a pump 32 which extracts electrolyte from a storage tank 33. By means of a second pump 34 electrolyte can be pumped under pressure from storage tank 33 into reservoir 29. The electrolyte extracted from storage tank 33 by pump 32 is fed through the hollow shaft 15 and the apertures 36 under pressure into reservoir 26.

During operation the interconnected or bandoliered elongate products are transported in the direction of arrow A, fig. 15, through the apparatus described above whereby masking belt 21 can be driven by motor 23 to avoid drag between the belt and the interconnected or bandoliered products.

During the transport of the interconnected or bandoliered elongate products, the parts of these products extending below guide wheel 14 will automatically engage with the masking devices mounted on carrier 24, which extend upwards, and by this action cause carrier wheel 24 to rotate in synchronisation with guide wheel 14 and products.

The masking devices will eliminate all metal deposition on the facing sides of the interconnected or bandoliered products, when electrolyte is jetted from slots 28 and 31 on the interior and exterior exposed areas of the products and in this

way electroplate the desired functional areas only. It will be obvious that it is necessary to connect the interconnected or bandoliered products with the negative pole of one or more rectifiers, whereas the insoluble anode plates 27 and 30 must be connected to the positive pole(s) of this(these) rectifier(s). It is advantageous to connect both anodes to the positive poles of two individual rectifiers, with a common negative contact to the products to be plated. This permits complete flexibility from plating one sides only, both sides with the same thickness or with different thicknesses.

If desirable guide wheel 14 and/or carrier wheel 24 can be connected to a drive motor, however, in most cases it is sufficient to pull product strip 17 lengthwise through the apparatus and produce rotation of wheels 14 and 24 simultaneously.

Possible variations in pitch of the interconnected or bandoliered elongate products can be easily absorbed by the resilience of the masking devices.

As an example, in fig. 21 and 22 an apparatus is shown comprising an endless belt 37 assembled from segments 37', which is guided over guide wheels 38 rotatable around horizontal shafts, each of the segments carrying a number of masking devices 11 of the above described configuration.

The interconnected or bandoliered elongate products are guided between two masking belts 39 and 40, positioned on top of each other and guided around wheels 41. It will be clear that in this application of the invention the areas of the products which do not require any plating at all will be captured between the masking belts 39 and 40, whereas the areas of the interconnected or bandoliered elongate products that require the two-sided plating extend beyond these masking belts and will engage into the masking devices carried by belt 37. Once these components are engaged and masked in the way described they are transported along sparger-anodes which are not shown in fig. 21, but which jet electrolyte in a similar fashion on the products as described for the circular arrangement.

Claims

1. Method for electroplating a metallic deposit on interconnected or bandoliered elongate metallic and/or metallized products (7) whereby non-conductive masking devices (11) are introduced between said products (7), said non-conductive masking devices consisting of at least for the parts (13) which come in contact with the products (7) of resilient material whereby said products are continuously displaced along a first predetermined track and said masking devices are displaced along a

vices 11 which are mounted on a regular pitch distance "b" along the outside of the wheel as indicated in fig. 17 for some of said masking devices.

In a chamber 25 provided for between the wheels 14 and 24 a disc-shaped reservoir 26 is mounted. This reservoir is covered on top with a circular plate 27 which serves also as an insoluble anode and which defines over part of its circumference in combination with the reservoir 26 a slot shaped exit or sparger 28. Both cover plate 27 and reservoir 26 are stationary. The exit slot or sparger 28 is positioned on a height whereby solution jetted from slot 28 will hit that area of the interconnected or bandoliered elongate products extending below the guide wheel 14.

Opposite the exit slot or sparger 28 another sparger is positioned comprising a stationary reservoir 29 closed on its upper side by the insoluble anode plate 30. Between the anode plate 30 and the upper side of reservoir 29 is a slot shaped exit or sparger 31 exactly opposite slot 28 and which, as is shown in fig. 15, is positioned concentric around the centerline of guide wheel 14 and extends over substantially the larger part of the arc in which the interconnected or bandoliered elongate products are engaged on guide wheel 14. During operation electrolyte is jetted from slot 31 of reservoir 29 and from slot 28 of reservoir 26 onto the opposite sides of those areas of the interconnected or bandoliered elongate products which extend below masking belt 21 and guide wheel 14.

The interior of hollow shaft 15 is in communication with a pump 32 which extracts electrolyte from a storage tank 33. By means of a second pump 34 electrolyte can be pumped under pressure from storage tank 33 into reservoir 29. The electrolyte extracted from storage tank 33 by pump 32 is fed through the hollow shaft 15 and the apertures 36 under pressure into reservoir 26.

During operation the interconnected or bandoliered elongate products are transported in the direction of arrow A, fig. 15, through the apparatus described above whereby masking belt 21 can be driven by motor 23 to avoid drag between the belt and the interconnected or bandoliered products.

During the transport of the interconnected or bandoliered elongate products, the parts of these products extending below guide wheel 14 will automatically engage with the masking devices mounted on carrier 24, which extend upwards, and by this action cause carrier wheel 24 to rotate in synchronisation with guide wheel 14 and products.

The masking devices will eliminate all metal deposition on the facing sides of the interconnected or bandoliered products, when electrolyte is jetted from slots 28 and 31 on the interior and exterior exposed areas of the products and in this

way electroplate the desired functional areas only. It will be obvious that it is necessary to connect the interconnected or bandoliered products with the negative pole of one or more rectifiers, whereas the insoluble anode plates 27 and 30 must be connected to the positive pole(s) of this(these) rectifier(s). It is advantageous to connect both anodes to the positive poles of two individual rectifiers, with a common negative contact to the products to be plated. This permits complete flexibility from plating one sides only, both sides with the same thickness or with different thicknesses.

If desirable guide wheel 14 and/or carrier wheel 24 can be connected to a drive motor, however, in most cases it is sufficient to pull product strip 17 lengthwise through the apparatus and produce rotation of wheels 14 and 24 simultaneously.

Possible variations in pitch of the interconnected or bandoliered elongate products can be easily absorbed by the resilience of the masking devices.

As an example, in fig. 21 and 22 an apparatus is shown comprising an endless belt 37 assembled from segments 37', which is guided over guide wheels 38 rotatable around horizontal shafts, each of the segments carrying a number of masking devices 11 of the above described configuration.

The interconnected or bandoliered elongate products are guided between two masking belts 39 and 40, positioned on top of each other and guided around wheels 41. It will be clear that in this application of the invention the areas of the products which do not require any plating at all will be captured between the masking belts 39 and 40, whereas the areas of the interconnected or bandoliered elongate products that require the two-sided plating extend beyond these masking belts and will engage into the masking devices carried by belt 37. Once these components are engaged and masked in the way described they are transported along sparger-anodes which are not shown in fig. 21, but which jet electrolyte in a similar fashion on the products as described for the circular arrangement.

Claims

1. Method for electroplating a metallic deposit on interconnected or bandoliered elongate metallic and/or metallized products (7) whereby non-conductive masking devices (11) are introduced between said products (7), said non-conductive masking devices consisting of at least for the parts (13) which come in contact with the products (7) of resilient material whereby said products are continuously displaced along a first predetermined track and said masking devices are displaced along a



further predetermined track partly coinciding with said first track and after arranging said masking devices (11) between the products said products (7) are submitted to contact with an electrolyte, characterized in that at the beginning of said coinciding parts of said tracks the masking devices comprising solid non flexible pins surrounded by a resilient tube like material are arranged between the products and at the end of said coinciding parts of said tracks the masking devices are removed from between said products and in between said beginning and said end the products are exposed to the electrolyte.

2. Method according to claim 1 characterized by jetting electrolyte onto one or both side(s) of the elongate products (7) in the area where the masking devices (11) are arranged between the elongate components.
3. Apparatus for performing the method according to claim 1 or 2, comprising means (14, 18, 19) for continuously guiding and displacing the interconnected or bandoliered products (7) along said first predetermined track, means (24, 37) for continuously displacing said masking devices along said further predetermined continuous track and means (29-31) for contacting electrolyte with the products and the masking devices (11) characterized in that said masking devices comprise solid non-flexible pins (12) surrounded by a resilient material in the shape of a tube (13).
4. Apparatus according claim 3 characterized in that the apparatus comprises an endless member (24; 37) to which said pins (12) are attached in a regular pattern and which during operation can move along said continuous track.
5. Apparatus according to claim 3 or 4 characterized in that the apparatus comprises a main guide wheel (14) and auxiliary guide wheels (18,19) to provide guidance for the interconnected or bandoliered elongate products (7) along at least a part of the circumference of the main guide wheel (14) whilst a support means (24) carrying the pins (12) is rotatable mounted on the same axis of rotation as the main guide wheel (14).
6. Apparatus according to claim 5 characterized in that at least one masking belt (21) of non-conductive material is cooperating with the main guide wheel (14) to prevent metal deposition on those areas of the products (7) where

no deposit is desired at all.

7. Apparatus according to claim 5 or 6 characterized by a space (26) between the main guide wheel (14) and the support means (24) carrying the pins (12), said space (26) being in communication with supply means (32) for electrolyte under pressure and having a slot shaped exit (28) for jetting electrolyte outwardly towards the products and masking devices.
8. Apparatus according to claims 4-6 characterized by a reservoir (29), placed outside said guide wheel (14) and in communication with supply means (34) for supply of electrolyte under pressure and a slot shaped exit (31) concentric to the axis of the main guide wheel (14) for jetting electrolyte inwardly towards the products (7) and masking devices (11) guided by the main guide wheel (14).
9. Apparatus according to claims 7 or 8, characterized by a stationary anode (27,30) in each means for jetting electrolyte.
10. Apparatus according to claim 9 characterized by the anodes (27,30) being part of the slot shaped electrolyte jetting exit (28,31).
11. Apparatus according to any preceding claim 3-10 characterized in that in the position whereby no products (7) are inserted in between the masking devices (11) there is some open space between the inner wall of the resilient tube (13) and the outer wall of the solid non-flexible pin (12), as seen in the direction of movement of the interconnected or bandoliered elongate products (7).
12. Apparatus according to one of the preceding claims 3-11 characterized in that the apparatus comprises two cooperating masking belts (39,40) of non-conductive material in between which, during operation, the area of the interconnected or bandoliered elongate products (7) requiring no metal deposition at all, are clamped whilst in close vicinity to these belts another belt (37) is positioned carrying the masking devices (11) for arranging in between the products (7).

Revendications

1. Procédé destiné à l'électroplacage d'un dépôt métallique sur des produits métalliques et/ou métallisés allongés, reliés entre eux ou se présentant sous la forme d'une cartoucière (7), des dispositifs de masquage non conducteurs



- (11) étant introduits entre ces produits (7), les dispositifs de masquage non conducteurs étant constitués par au moins les parties (13) qui viennent en contact avec les produits (7) d'un matériau élastique, ces produits étant déplacés en continu le long d'une première voie prédéterminée et les dispositifs de masquage étant déplacés le long d'une voie prédéterminée supplémentaire coïncidant partiellement avec la première voie et après avoir disposé les dispositifs de masquage (11) entre les produits (7), ces derniers sont soumis à un contact avec un électrolyte, caractérisé en ce qu'au début des parties coïncidentes des voies les dispositifs de masquage comprenant des broches pleines non flexibles entourées d'un matériau tubulaire élastique sont disposés entre les produits et sur l'extrémité des parties coïncidentes des voies, les dispositifs de masquage sont enlevés d'entre ces produits et entre le début et l'extrémité les produits sont exposés à l'électrolyte.
2. Procédé selon la revendication 1, caractérisé en ce que l'on projette de l'électrolyte sur un ou sur les deux côtés des produits allongés (7) dans la zone où les dispositifs de masquage (11) sont disposés entre les composants allongés.
 3. Appareil destiné à réaliser le procédé selon la revendication 1 ou 2, comprenant des moyens (14, 18, 19) servant à guider et à déplacer en continu les produits reliés entre eux ou se présentant sous la forme d'une cartouillère (7) le long de la première voie prédéterminée (24, 37) pour le déplacement en continu des dispositifs de masquage le long de la voie continue prédéterminée supplémentaire et des moyens (29-31) destinés à mettre l'électrolyte en contact avec les produits et les dispositifs de masquage (11), caractérisé en ce que les dispositifs de masquage sont constitués par des broches pleines non flexibles (12) entourées d'un matériau élastique ayant la forme d'un tube (13).
 4. Appareil selon la revendication 3, caractérisé en ce que l'appareil est constitué d'un élément sans fin (24 ; 37) sur lequel sont fixées des broches (12) selon une configuration régulière et qui lors du fonctionnement peuvent se déplacer le long de la voie continue.
 5. Appareil selon la revendication 3 ou 4 caractérisé en ce que l'appareil est constitué par une roue de guidage principale (14) et des roues de guidage auxiliaires (18, 19) destinées à diriger les produits allongés reliés entre eux ou se présentant sous la forme d'une cartouillère (7) le long au moins d'une partie de la circonférence de la roue de guidage principale (14) tandis qu'un support (24) portant les broches (12) est monté de façon rotative sur le même axe de rotation que la roue de guidage principale.
 6. Appareil selon la revendication 5, caractérisé en ce qu'au moins une courroie de masquage (21) en matériau non conducteur coopère avec la roue de guidage principale (14) pour empêcher le métal de se déposer sur les zones des produits (7) où l'on ne souhaite avoir aucun dépôt.
 7. Appareil selon la revendication 5 ou 6, caractérisé par un espace (26) situé entre la roue de guidage principale (14) et le support (24) portant les broches (12), l'espace (26) étant en communication avec les moyens d'alimentation (32) pour l'électrolyte sous pression et comportant une sortie en forme de fente (28) destinée à la projection de l'électrolyte vers l'extérieur en direction des produits et des dispositifs de masquage.
 8. Appareil selon les revendications 4-6, caractérisé par un réservoir (29) placé à l'extérieur de la roue de guidage (14) et en communication avec les moyens d'alimentation (34) pour l'alimentation de l'électrolyte sous pression et une sortie en forme de fente (31) concentrique par rapport à l'axe de la roue de guidage principale (14) destinée à la projection de l'électrolyte à l'intérieur en direction des produits (7) et des dispositifs de masquage (11) guidés par la roue de guidage principale (14).
 9. Appareil selon les revendications 7 ou 8, caractérisé par une anode fixe (27, 30) dans chaque moyen destiné à projeter l'électrolyte.
 10. Appareil selon la revendication 9, caractérisé en ce que les anodes (27, 30) font partie de la sortie de projection d'électrolyte en forme de fente (28, 31).
 11. Appareil selon l'une quelconque des revendications précédentes 3-10, caractérisé en ce que dans la position où aucun produit (7) n'est introduit entre les dispositifs de masquage (11), il existe un certain espace ouvert entre la paroi intérieure du tube élastique (13) et la paroi extérieure de la broche pleine non souple (12), comme cela est vu dans le sens de déplacement des produits allongés reliés entre



eux, ou se présentant sous la forme d'une cartouchiere (7).

12. Appareil selon l'une des revendications précédentes 3-11, caractérisé en ce que l'appareil comprend deux bandes ou courroies de masquage coopérantes (39, 40) en matériau non conducteur entre lesquelles, pendant le fonctionnement, les surfaces des produits allongés reliés entre eux ou se présentant sous la forme d'une cartouchiere (7) ne nécessitant aucun dépôt de métal, sont bridées entre elles tandis qu'à proximité immédiate de ces courroies une autre courroie (37) est positionnée et supporte les dispositifs de masquage (11) pour l'agencement entre les produits (7).

Patentansprüche

1. Verfahren zum Aufbringen eines metallischen Überzugs durch Elektroplattieren auf miteinander verbundene oder gegurtete längliche metallische und/oder metallisierte Produkte (7), wobei zwischen diese Produkte (7) nicht leitende Masken (11) eingeführt werden, die mindestens für die Teile (13), die in Kontakt mit den Produkten (7) kommen, aus nachgiebigem Material bestehen, wobei diese Produkte fortlaufend längs einer ersten vorgegebenen Bahn verschoben werden und die Masken längs einer weiteren vorgegebenen Bahn verschoben werden, die teilweise mit der ersten Bahn zusammenfällt, und wobei nach dem Anordnen der Masken (11) zwischen den Produkten diese Produkte (7) in Kontakt mit einem Elektrolyten gebracht werden, **dadurch gekennzeichnet**, daß am Anfang der zusammenfallenden Abschnitte der Bahnen die Masken, die feste nicht flexible Stifte aufweisen, die von einem nachgiebigen röhrenförmigen Material umgeben sind, zwischen den Produkten angeordnet werden, und daß am Ende der zusammenfallenden Abschnitte der Bahnen die Masken von ihrer Position zwischen den Produkten entfernt werden, und daß zwischen Anfang und Ende die Produkte dem Elektrolyten ausgesetzt werden.
2. Verfahren nach Anspruch 1, **gekennzeichnet durch** Einspritzen des Elektrolyten auf eine Seite oder beide Seiten der länglichen Produkte (7) in dem Bereich, wo die Masken (11) zwischen den länglichen Komponenten angeordnet sind.
3. Einrichtung zum Durchführen des Verfahrens nach Anspruch 1 oder 2, umfassend Mittel (14, 18, 19) zum fortlaufenden Führen und Ver-

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schieben der miteinander verbundenen oder gegurteten Produkte (7) längs einer ersten vorgegebenen Bahn, Mittel (24, 37) zum fortlaufenden Verschieben der Masken längs der weiteren vorgegebenen fortlaufenden Bahn und Mittel (29-31), um den Elektrolyten mit den Produkten und den Masken (11) in Kontakt zu bringen, **dadurch gekennzeichnet**, daß die Masken mit festen nicht flexiblen Stiften (12) versehen sind, die von einem nachgiebigen Material in Form einer Röhre (13) umgeben sind.

4. Einrichtung nach Anspruch 3, **dadurch gekennzeichnet**, daß die Einrichtung ein Endlosband (24, 37) umfaßt, an dem die Stifte (12) nach einem regulären Muster befestigt sind und das während des Betriebs sich längs der fortlaufenden Bahn bewegen kann.

5. Einrichtung nach Anspruch 3 oder 4, **dadurch gekennzeichnet**, daß die Einrichtung ein Hauptführungsrad (14) und Hilfsführungsräder (18, 19) umfaßt, die die miteinander verbundenen oder gegurteten länglichen Produkte (7) längs mindestens eines Teils des Umfangs des Hauptführungsrades (14) führen, während ein die Stifte (12) tragendes Haltemittel (24) drehbar auf derselben Drehachse wie das Hauptführungsrad (14) gelagert ist.

6. Einrichtung nach Anspruch 5, **dadurch gekennzeichnet**, daß mindestens ein Masken-Transportband (21) aus nicht leitendem Material mit dem Hauptführungsrad (14) zusammenwirkt, um den Niederschlag von Metall auf den Abschnitten der Produkte (7) zu verhindern, wo keinesfalls ein Überzug erwünscht ist.

7. Einrichtung nach Anspruch 5 oder 6, **gekennzeichnet durch** einen zwischen dem Hauptführungsrad (14) und dem die Stifte (12) tragenden Haltemittel (24) vorgesehenen Raum (26), der in Verbindung mit Zuführungsmitteln (32) zum Zuführen des mit Druck beaufschlagten Elektrolyten steht und eine schlitzförmige Austrittsöffnung (28) hat, um den Elektrolyten nach außen hin zu den Produkten und Masken zu spritzen.

8. Einrichtung nach den Ansprüchen 4-6, **gekennzeichnet durch** ein Reservoir (29), das außerhalb des Hauptführungsrades (14) angeordnet ist und in Verbindung mit den Zuführungsmitteln (34) steht, die den mit Druck beaufschlagten Elektrolyten zuführen, und durch eine zur Achse des Hauptführungsrades (14) konzentrische schlitzförmige Austrittsöffnung



(31), um Elektrolyt nach innen in Richtung auf die durch das Hauptführungsrad (14) geführten Produkte (7) und Masken (11) abzustrahlen.

9. Einrichtung nach den Ansprüchen 7 oder 8, **gekennzeichnet durch** eine stationäre Anode (27, 30) in jedem Mittel zum Einstrahlen des Elektrolyten. 5
10. Einrichtung nach Anspruch 9, **dadurch gekennzeichnet**, daß die Anoden (27, 30) Teil der schlitzförmigen, den Elektrolyten einspritzenden Austrittsöffnung (28, 31) sind. 10
11. Einrichtung nach jedem vorhergehenden Anspruch 3-10, **dadurch gekennzeichnet**, daß in der Position, bei der keine Produkte (7) zwischen den Masken (11) eingeführt sind, etwas Freiraum zwischen der Innenwand der nachgiebigen Röhre (13) und der Außenwand des festen nicht flexiblen Stiftes (12) ist, in Bewegungsrichtung der miteinander verbundenen oder gegurteten länglichen Produkte (7) betrachtet. 15
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12. Einrichtung nach einem der vorhergehenden Ansprüche 3-11, **dadurch gekennzeichnet**, daß die Einrichtung zwei zusammenwirkende Masken-Transportbänder (39, 40) aus nicht leitendem Material umfaßt, zwischen denen während des Betriebs die Bereiche der miteinander verbundenen oder gegurteten länglichen Produkte (7), die überhaupt keinen Metallüberzug benötigen, eingeklemmt werden, während in enger Nachbarschaft zu diesen Transportbändern ein weiteres Transportband (37) angeordnet ist, das die zwischen den Produkten (7) anzuordnenden Masken (11) trägt. 25
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