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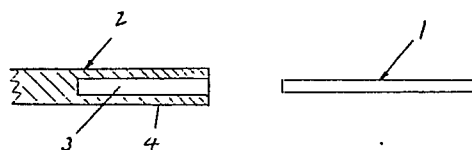
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⑤④ **Electro-plating process and products therefrom.**

⑤⑦ A process for electro-plating a selected surface area of an electrical connector contact element (2), e.g. of copper alloy, comprising electro-plating the connector in the absence of a masking (1) element to give the required thickness of plating material in the selected area, (3) applying a masking element, such as a pin or sheath, to the selected area of the connector where the plating material is to be retained, and stripping the plating material from the unmasked parts of the connector so that the connector remains plated in the selected area only. The process is especially applicable to connectors suitable for use in the assembly of computers.



ELECTRO-PLATING PROCESS AND PRODUCTS THEREFROM

The present invention relates to a process for electro-plating and in particular to a process for electro-plating selected surface areas of electrical connector contacts, as may be used in the assembly of computers and other electrical and electronic systems, and to the products of that process.

In order to ensure good electrical contact, incurring the minimum of electrical resistance between connector contacts, such as those produced by Swiss-sliding head machines, it is customary to electro-plate the contacts, which are usually of copper alloy (e.g. brass, bronze or monel) with a thin layer of, for example, gold, silver, palladium or rhodium, or possibly some other precious metal. Typically, the electrical contact area of male/female <sup>connector</sup> contacts may require a layer of plated material of from 1.25 to 5 microns thick, depending upon the end use of the connector. In practice such thicknesses have generally been found to give satisfactory electrical contact while at the same time providing sufficient plating material to meet the normal wear and tear to which the contact is subjected. However, in order to achieve a satisfactory thickness of plating material on the electrical contact area, it has been found necessary, from a practical standpoint, to plate the whole of the connector contact (i.e. both electrical contact and non-contact

surface areas) to a similar thickness, and in the case of a female connector contact where there is an internal contact area to be plated, to plate the non-contact area of the connector to a greater thickness than that required for the contact area, in order to achieve the required thickness on the internal contact area. Thus, female electrical connector contacts require, in practice, to be plated with an excess of plating material having regard to the need to provide only a thin layer of material in the electrical contact area. For example, it may be necessary, depending upon the relative dimensions of a female connector contact, to plate the external surfaces of the contact with a layer of gold 2 microns thick in order to achieve a layer 1.25 microns thick on the internal contact area. In other instances the difference may be more pronounced, in some cases female parts requiring an 8 micron layer of gold on the external surface to give a 5 micron layer on the internal contact area.

Thus, there can be a significant wastage of plating material arising from (1) the presence of plating on non-contact external parts of a connector, and (2) the presence of excess plating on non-contact external parts of a connector where the contact area is internal.

Attempts have been made to minimize the plating of unnecessary material, for example, by partial plating using controlled depth plating methods and/or, in the

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case of female connectors, jetting methods where a stream of electrolyte is directed against the internal contact surface of the connector. However, such remedies have not proved particularly successful.

In the present invention a selected surface area electro-plating process is provided, which significantly reduces the use of unnecessary plating material.

Accordingly, the present invention provides a process for electro-plating a selected surface area of an electrical connector contact element comprising electro-plating the connector element in the absence of a masking element to give the required thickness of plating material in the selected area, applying a masking element to the selected area of the connector element where the plating material is to be retained, and removing the plating material from the unmasked parts of the connector element, so that the connector element remains plated in the selected area only.

The present invention also provides an electrical connector contact element which has been selectively electro-plated according to the above process.

Although reference has been made above to the manufacture of connector contacts by Swiss-sliding head machining, such contacts may also be produced by e.g. rotary table transfer machining, cold heading techniques or high speed stamping machines.

The masking element, which is usually in the form of an elongate pin (female connector) or tubular sheath (male connector) must clearly make a good fit with the connector contact to minimize the risk of loss of plating material from the contact area, and such a fit may, if necessary, be improved by the presence of an inert sealing substance, such as a silicone grease.

The masking element is preferably of inert material as regards the process of the invention and in practice, materials such as stainless steel or plastics, for example, silicone rubbers, may be employed. Alternatively, a masking ink or wax may also be used, if appropriate.

The accompanying figure illustrates diagrammatically the positioning of a cylindrical masking element 1 in relation to a female connector contact 2 in which the cylindrical internal electrical contact surface area 3 of the female connector is to be masked. Reference to the figure is also made in the following example of a process embodying the present invention, where appropriate.

For convenience such a process will be described in respect of a single female connector contact in leaded bronze made by Swiss-sliding head machining, though it will be appreciated that the present invention may be exploited in an appropriate barrel plating or other mass plating process where relatively large numbers

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of connector contacts may be treated simultaneously. The thickness of the plated material may conveniently be measured by established "back-scattering" or micro cross-sectional methods.

After conventional degreasing and electro-cleaning and polishing processes, the connector contact 2 is optionally electro-plated with copper (employing, for example, copper gleam PC or cupral B solution)\* to give a 1 micron thick layer in the contact area 3, and/or nickel (employing, for example, LCT semi-bright nickel solution)\* to give a 2 to 4 micron layer in the same area. These processes may be described as pre-treatments, the presence of copper and/or nickel depending upon the end use of the connector.

The connector is then conventionally electro-plated with gold (employing, for example, as appropriate Aurospeed E, Aural MRC, Aural MRN, Auro Vel HV, Aural 44, Auro Glo PN, or Auro Glo PC solutions)\* to give the required thickness in the contact area 3. In practice the thickness of plated material in the contact area may vary from 0.5 to 5 microns subject to end use. However, to achieve such a thickness in the contact area, it has been found necessary to deposit a corresponding layer of plating material 1 to 8 microns thick on the external surface <sup>4</sup> of the connector, depending on the surface characteristics of the connector, i.e. shape and dimensions.

After washing with de-ionized water (drag-out), the connector is cleaned in the usual manner and dried.

In the present invention a masking pin 1, for example, in stainless steel, is now carefully inserted into the female connector 2 to cover all of the electrical contact area 3 of the cylindrical internal surface of the connector where the gold plate is to be retained. It is important to ensure that the masking pin fits accurately and tightly over the whole of the selected contact area in order to minimize loss of gold plate therefrom in the next stage of the process, when the connector is placed in a gold stripping solution (for example, Super Strip 101 solution)\* until all unmasked areas of the connector have been stripped of gold-plated material. After stripping, the connector is washed and dried as before and the masking pin removed.

The connector contact may finally be flash-plated with, for example, a layer of 0.15 microns of gold (as measured on the external surface), for cosmetic purposes.

The application of the present invention to a male connector contact is identical to that outlined above in respect of female contacts, except that the masking device is placed on to the contact instead of inserted into the contact.

To assist in making a good mechanical fit

between either the connector contact and masking element or connector contacts themselves, the parts may be split or tapered or otherwise modified.

Thus, the present invention enables the use of plating material to be limited to the requisite thickness in the electrical contact area only of the connector contact, thereby resulting in a substantial saving of the plating material concerned.

When the present invention is carried out in conjunction with a barrel plating or similar mass plating process, the masking elements may be loaded, either into or on to the connector contacts, as the case may be, by an automatic assembly machine. Subsequently, the contacts may be stripped, cleaned, dried and unloaded where the process is fully automatic. The masking elements can, of course, be fitted manually when the number of connector contacts involved is small.

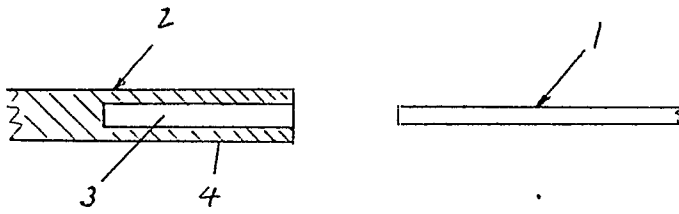
The recovery of gold from the saturated stripping solution, is carried out by the usual well established techniques, when the recovery of gold can be as high as 99%.

\* These solutions are available from Lea Ronal (UK) Limited, Ashbourne Road, Buxton, Derbyshire, England.

CLAIMS

1. A process for electro-plating a selected surface area of an electrical connector contact element characterised by electro-plating the connector element in the absence of a masking element to give the required thickness of plating material in the selected area, applying a masking element to the selected area of the connector element where the plating material is to be retained, and removing the plating material from the unmasked parts of the connector element, so that the connector element remains plated in the selected area only.
2. A process according to Claim 1 characterised in that the connector element is made from a copper alloy.
3. A process according to Claim 1 or 2 characterised in that the connector element is plated with a metal selected from the group consisting of gold, silver, palladium and rhodium.
4. A process according to any one of Claims 1 to 3 characterised in that the thickness of plated material in the selected area lies within the range 0.5 to 5 microns.
5. A process according to any one of Claims 1 to 4 characterised in that the masking element for a female connector element is in the form of an elongate pin.
6. A process according to any one of Claims 1 to 4 characterised in that the masking element for a male connector element is in the form of a tubular sheath.

7. A process according to Claim 5 or 6 characterised in that the masking element is made from stainless steel.
8. A process according to any one of Claims 1 to 7 characterised in that the connector element and/or masking element is split and/or tapered to improve its mechanical fit.
9. A process according to any one of Claims 1 to 8 characterised in that plated material applied to the unmasked areas of the connector element is removed by stripping.
10. A process according to any one of the preceding claims characterised in that the connector element is subsequently flash-plated.





European Patent  
Office

## EUROPEAN SEARCH REPORT

0063925  
Application number

EP 82 30 2060

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                               |                                                                                                                                                                                                                                                                                       |                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> ) |
| X                                                                                                                                                                                                                       | GB-A-1 485 083 (STANDARD TELEPHONES AND CABLES LTD.)<br>*Page 1, lines 37-95* | 1,3,9                                                                                                                                                                                                                                                                                 | C 25 D 5/02                                                |
| A                                                                                                                                                                                                                       | FR-A-1 287 563 (GIRODIN)<br><br>-----                                         |                                                                                                                                                                                                                                                                                       |                                                            |
|                                                                                                                                                                                                                         |                                                                               |                                                                                                                                                                                                                                                                                       | TECHNICAL FIELDS SEARCHED (Int. Cl. <sup>3</sup> )         |
|                                                                                                                                                                                                                         |                                                                               |                                                                                                                                                                                                                                                                                       | C 25 D<br>C 25 F<br>C 23 F                                 |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                               |                                                                                                                                                                                                                                                                                       |                                                            |
| Place of search<br>THE HAGUE                                                                                                                                                                                            |                                                                               | Date of completion of the search<br>12-07-1982                                                                                                                                                                                                                                        | Examiner<br>NGUYEN THE NGHIEP                              |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                      |                                                                               |                                                                                                                                                                                                                                                                                       |                                                            |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                               | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                                            |