(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 099 944**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **82303877.3**

(22) Date of filing: **22.07.82**

(51) Int. Cl.³: **H 01 R 43/10**

(43) Date of publication of application: **08.02.84**
Bulletin 84/6

(84) Designated Contracting States: **CH DE FR GB LI SE**

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(54) **Method of manufacturing RF slip rings.**

(57) A method of manufacturing an RF slip ring consisting of an outer ring of epoxy resin plastics material wherein the epoxy resin includes a filler of alkali material, e.g. calcium carbonate such that when the plastics material is machined to expose the alkali particles and subsequently immersed in an etchant containing acid, e.g. hydrochloric acid, a violent reaction occurs between the alkali and the acid to cause micro-pitting of the surface of the plastics material thereby providing a keying surface for an electro-less plating e.g. copper to adhere to the surface and be effectively retained thereon, the electro-less plating being overlaid with a noble metal, e.g. gold.

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DESCRIPTION

This invention relates to a method of manufacturing RF slip rings particularly of the co-axial type.

Such RF slip rings comprise an outer ring having a pair of parallel grooves formed on the peripheral surface thereof and provided with a noble metal coating extending within the grooves, and an inner core ring having a groove formed in the periphery thereof and also provided with a noble metal coating extending within the groove, sets of brushes engaging in the grooves in the outer and inner ring members.

In the past, it has been necessary to construct the whole of the outer ring of non-ferrous metal, but to reduce raw material costs and to eliminate machining of the non-ferrous metal, and to considerably reduce the weight of the outer ring, it would be advantageous to mould the outer ring of plastics material.

However in order to achieve such advantages, it is necessary to ensure that the plastics material can be plated satisfactorily, for instance with an electro-less plating of copper, and that the electro-less plating will adhere to and be retained on the plastics ring.

Thus, an object of the present invention is to provide a method of manufacturing an RF slip ring having an outer ring of plastics material, wherein the plastics material is capable of receiving an electro-less plating which adheres to and is retained effectively on the plastics material.

According to the present invention there is provided a method of manufacturing an RF slip ring including the steps of forming an outer ring of plastics material consisting of an epoxy resin containing an alkali filler, e.g. calcium carbonate, machining the ring to expose particles of the alkali filler on at least the outer peripheral surface of the ring, immersing the plastics ring in an etchant containing acid, e.g. hydrochloric acid, such that a reaction occurs between the alkali filler and the acid etchant to cause the peripheral surface of the ring to become pitted, and subjecting the pitted surface of the ring to an electro-less plating step such that the plating keys to the pitted surface of the ring.

In a preferred embodiment of the invention, the outer ring of the RF slip ring is formed in two halves each having a semi-circular recess and formed of an alkali-filled epoxy resin. Preferably the filler is calcium carbonate ($CaCO_3$).

It is required to coat the inner surface of the two halves of the outer ring and also the peripheral surface of the outer ring with an electro-less plating of copper overlaid with a noble metal, e.g. gold. The peripheral surface of the outer ring is provided with a pair of parallel V-grooves, formed one in each half of the outer ring and the copper/gold coating is required to extend within the grooves.

Accordingly, the two halves of the outer ring are machined to expose particles of the calcium carbonate filler. The two halves of the outer ring are then immersed in an etchant preferably comprising 10% hydrochloric acid (HCl) solution with 5% hydrogen peroxide (H_2O_2) added to increase the efficiency.

The immersion of the plastics material in the etchant causes the calcium carbonate and the hydrochloric acid to react violently, the reaction being as follows:-

$$CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O.$$

The result of the reaction is that a micro pitted surface is formed on the plastics material, the pitting of the surface providing an excellent keying for the electro-less plating material.

Thus, after the pitting of the surface, the two halves are subjected to an electro-less plating operation in which a layer of copper is deposited on the pitted

surface, the copper keying to the plastics material by virtue of the micro pitted surface. A layer of a noble metal, e.g. gold is deposited on the copper plating and is deposited on the inner surface of the outer ring, the exposed portion between the two halves of the ring, the outer peripheral surface and the V-shaped grooves formed in the peripheral surface.

Preferably a support bung is embedded in the plastics material of the outer ring and extends within the circular air space dielectric formed by the semi-circular recess of the two halves of the outer ring.

A support wire is carried by the support bung and contacts the base of the inner core ring which is of square cross section. The inner core ring is of square cross section and provided with the copper/gold plating of the outer ring and a V-groove.

Although reference has been made to calcium carbonate as the filler material of the epoxy resin, it will be appreciated that any suitable alkali filler material may be used provided the filler is capable of supporting a violent reaction with the acid of the etchant sufficient to effect micro pitting of the surface of the epoxy resin to provide for keying of the electro-less plating to the plastics material.

CLAIMS

1. A method of manufacturing an RF slip ring including the steps of forming an outer ring of plastics material consisting of an epoxy resin containing an alkali filler, e.g. calcium carbonate, machining the ring to expose particles of the alkali filler on at least the outer peripheral surface of the ring, immersing the plastics ring in an etchant containing acid, e.g. hydrochloric acid, such that a reaction occurs between the alkali filler and the acid etchant to cause the peripheral surface of the ring to become pitted, and subjecting the pitted surface of the ring to an electro-less plating step such that the plating keys to the pitted surface of the ring.

2. A method of manufacturing an RF slip ring as claimed in claim 1 wherein the alkali filler material is calcium carbonate and the etchant material includes hydrochloric acid to provide pitting of the surface of the plastics material in response to the following reaction:-

$CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O$.

3. A method as claimed in claim 1 or 2 wherein the electro-less plating material is copper.

4. A method as claimed in any preceding claim wherein the electro-less plating is overlaid with a noble metal, e.g. gold.

5. An RF slip ring including an outer ring of plastics material plated with an electro-less plating by the method claimed in claim 1.

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EUROPEAN SEARCH REPORT

Application number
0099944

EP 82 30 3877

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. ³)
Y	EP-A-0 034 232 (I.D.M.ELECTRONICS) *Complete document*	1-5	H 01 R 43/10
Y	EP-A-0 039 248 (POLYPLASTICS) *Pages 2-4*	1-5	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

H 01 R 43/00
C 23 C 18/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11-04-1983	MOBOUCK G.C.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503. 03.82