

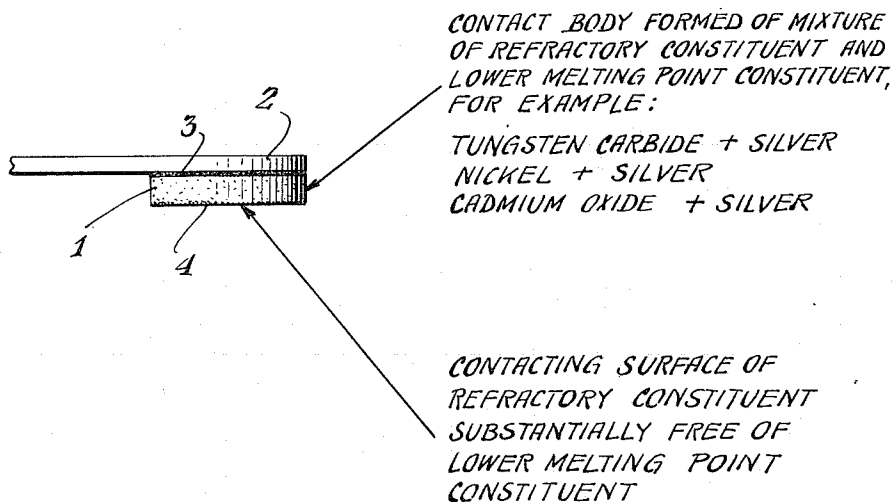
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2,390,595

ELECTRICAL CONTACT

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ELECTRICAL CONTACT

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This invention relates to electric contacts and method of making the same.

An object of the invention is to improve electric contacts.

Other objects of the invention will be apparent from the description and claims.

The drawing shows an electric contact embodying features of the invention.

Many electric contacts are produced from metal compositions of a powder component such as a refractory metal or refractory metal compound or other material of a non-fusing nature interspersed with a lower melting point high conductivity metal such as silver or copper or their alloys. For many operations such contacts of the prior art are very satisfactory and give excellent performance. However, in some applications, especially where high current circuits are made and broken by the contacts or the circuits are subject to high overload currents or transients, it has been found that sticking together or welding of such contacts often occurs during the first few operations.

We have discovered that such contacts can be improved and the occurrence of sticking or welding practically eliminated by etching the surface of such contacts before they are put into operation. It is believed that the sticking or welding takes place as a result of the presence of a film of the high conductivity metal such as silver or copper on the contact face. These metals and their alloys are of comparatively low melting point and if they form the actual contacting layers a high current surge may cause momentary fusion of these metals on the contact surfaces resulting in welding the contacts together.

The process of the present invention comprises etching the contact surfaces in a suitable acid or other etching bath which will selectively dissolve or etch out the high conductivity metal such as silver or copper to a depth sufficient to expose the more refractory contact constituent such as the refractory metal or refractory metal compound or other less fusible constituents which may be present.

The invention has application to contacts of various compositions such as those wherein the more refractory constituents are tungsten, molybdenum, tungsten carbide, molybdenum carbide and the refractory carbides, borides and nitrides of the metals of the 4th, 5th and 6th groups of the periodic table combined with silver, copper, silver-copper alloys, silver base alloys and copper base alloys. The invention is also applicable to electric contacts containing cadmium oxide as the

more refractory constituent such as the contacts described in Hensel Patent 2,145,690. One such composition comprises cadmium oxide 10%, silver 90%. The invention is also applicable to an electric contact containing an iron group metal such as iron, nickel or cobalt, as the more refractory component. A typical example being one containing 85% silver and 15% nickel.

The refractory constituent may be predominating or the high conductivity metal may predominate. Thus the invention is applicable to contacts of tungsten carbide 65%, silver 35%, as well as the contacts of tungsten carbide 50%, silver 50% and contacts of tungsten carbide 35%, silver 65%.

Electric contacts of the type described are manufactured by various processes such as by mixing all the constituents together as powders and pressing them or mixing and pressing them and subsequently sintering them. They can also be produced, especially where higher proportions of the refractory constituents are used, by pressing the refractory powders together and sintering them and subsequently impregnating the sintered compact with the lower melting point high conductivity metal. The contacts may also be fabricated by mixing the powders, pressing and heating to a sufficiently high temperature to cause impregnation of all or a portion of the lower melting point high conductivity material and co-incident sintering of the refractory metal. In any event, it will be apparent that some of the lower melting point metal will appear on the contact surface.

In preparing such contacts for use it is sometimes necessary to perform machining operations on them and in this case it is believed that some of the lower melting point metal such as silver becomes smeared over the contact surface. Also during the machining operation the refractory component may be pulled out of the contact surface leaving the lower melting point metal exposed.

In practicing the present invention, the etching is performed by placing the contacts in a suitable etching bath and allowing them to remain for a period of time sufficient to dissolve the high conductivity metal from the contact surface and expose the more refractory particles.

One suitable etching bath for dissolving silver is produced by adding 30 cc. of a saturated solution of potassium dichromate to 100 cc. of 5% sulfuric acid. The contacts are placed in this solution and are allowed to remain therein for approximately one minute at room temperature.

Another etching solution that is satisfactory is one composed of 50% nitric acid and 50% water. Concentrated nitric acid may be used although it attacks the silver very rapidly and is difficult to control.

The above solutions are suitable for etching any of the described contact compositions containing silver.

Contacts containing copper as the high conductivity metal may be etched in a solution of 15% of 30% hydrogen peroxide solution and 8% ammonium hydroxide.

In one instance contacts formed of 10% cadmium oxide and 90% silver were used on a heavy duty relay. Prior to applicants' invention, there were occurrences where the contacts stuck together the first time they were operated. On relays fitted with contacts of the same composition which had been etched as described herein, no sticking was encountered for the same service. Further tests were made under even more rigorous conditions, including operations of the contacts for controlling currents of 2,000 amperes without sticking. Extended-life tests were made on the contacts operating at 200 amperes at the rate of one operation per second without failure in a test extending to 50,000 operations. Moreover, during this test the contact resistance was found to be appreciably less than 100 millivolts at 200 amperes throughout the entire run.

Similar results were obtained with contacts formed of 50% tungsten carbide and 50% silver.

Referring to the drawing, the contact body 1 comprises a disc formed of a mixture of refractory constituent and a lower melting point constituent. The contact disc 1 is secured to a contact support arm 2 by a layer 3 of brazing material. The contacting surface 4 of the contact has been treated, as by etching, to remove the lower melting point constituent so that the

surface 4 comprises the refractory constituent substantially free of lower melting point constituent.

While specific embodiments of the invention have been described, it is intended to cover the invention broadly within the spirit and scope of the appended claims.

The method of making electric contacts described herein is described and claimed in our copending application Serial No. 533,952, filed May 2, 1944.

What is claimed is:

1. An electric contact formed of a metal composition comprising a mixture of a refractory constituent and a more fusible metal constituent, the contact face thereof being substantially free of said more fusible metal constituent and comprising said refractory constituent of the same microstructure as exists throughout the rest of the contact.

2. An electric contact formed of a metal composition of tungsten carbide and silver, the contact face thereof being substantially pure tungsten carbide free of silver and having the same microstructure as exists throughout the rest of the contact.

3. An electric contact formed of a metal composition of nickel and silver, the contact face thereof being substantially pure nickel free of silver and having the same microstructure as exists throughout the rest of the contact.

4. An electric contact formed of a composition of cadmium oxide and silver, the contact face thereof being substantially pure cadmium oxide free of silver and having the same microstructure as exists throughout the rest of the contact.

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