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ELECTRICAL CONTACT MEMBER

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This invention relates to electrical make and break contact members.

Contact members formed from refractory metal powders and a metal having a good conductivity such as copper or silver have been employed heretofore. Such metals having high conductivity are, however, not of themselves entirely satisfactory for this purpose, since the resulting contact member does not have as high physical properties as are required in certain applications.

Carbon has been so added to the composition of the contact members that when heat treated it will combine with the refractory metal and form a refractory carbide, thereby increasing the hardness of the contact member. Such refractory carbides are undesirable in the contact member since they increase the resistivity of the metal and lower the melting point of the refractory with which the carbon combines.

Other alloying metals have been added in addition to the copper or silver in making the contact member in an effort to enhance the physical properties of the resulting contact member, but such additions have the disadvantage that they affect the oxidation rate of the contact members, introduce impurities therein, or detrimentally affect the conductivity without appreciably increasing the physical properties of the contact member.

An object of this invention is to provide a contact member having high physical properties, wear characteristics and good conductivity.

Another object of this invention is to provide a composite contact member formed from refractory metal powders and an alloy of silver and copper.

A further object of this invention is to provide a contact member formed from refractory metal powders and an alloy which is susceptible to an age hardening heat treatment to give high physical properties, good conductive and corrosion resistance properties to the contact member.

Other objects of this invention will become apparent from the following description and the appended claims.

In practicing this invention, a contact member is formed from a plurality of metals which have been found to cooperate to give certain desired characteristics. A base body of refractory metal selected from the group consisting of tungsten and molybdeum and which has a relatively high melting point so formed as to have interstices therein and which of itself does not possess the desired characteristics is impregnated with a silver base alloy of lower melting point, as will be disclosed more fully hereinafter to give a resulting product having the desired characteristics.

In forming the metal base here employed, refractory metal powders of predetermined size, ranging from 150 to 250 mesh are mixed with sufficient organic bond to form a plastic putty-like mass which is moldable or which may be rolled or cast to a desired shape. Any suitable organic bond which can be removed by drying or sintering the shaped mass to leave a porous structure may be employed. It is desirable to employ a bond which can be substantially completely removed so as not to leave a carbon residue which may combine with the refractory metal in the form of a carbide, since such carbides are undesirable. An organic bond composed of about 75% of shellac and 25% of alcohol is entirely satisfactory in forming the putty-like mass, and when the mass is heated at a temperature of about 1000° C. in a reducing atmosphere, is substantially completely removed leaving the desired porous base of refractory metal.

In order to impart the desired electrical characteristics to the contact member, the porous refractory metal base or body is then filled with the impregnating silver base alloy. The alloy employed for imparting the desired characteristics is composed of from 90% to 98% silver with the balance copper, a preferred alloy being composed of about 92.5% of silver and about 7.5% of copper. This alloy is susceptible to precipitation hardening and when heat treated, as by quenching it from a temperature of between 600° C. and 775° C. and aged at a temperature of between 175° C. and 300° C. has a high conductivity of 80%, or greater, and a hardness approximating 90 Rockwell B, or greater.

Although the silver base alloy disclosed herein has a melting point of about 800° C., it has been found necessary to subject the alloy and the porous refractory metal body to a temperature of between 1100° C. and 1125° C. in order to effect the impregnation of the porous base. It is thought that this is because the surface tension of the alloy is too great to permit successful wetting of the refractory metal at lower temperatures. At these temperatures, the alloy melts, wets and completely impregnates the porous refractory metal base, giving a very uniform structure in which the refractory metal is se-

curely bonded by the silver base alloy to produce a strong homogeneous article.

For general applications, contact members of from 45% to 75% by weight of the refractory metal powders impregnated with from 55% to 25% by weight of the silver base alloy having a copper content of from 2% to 10% by weight are satisfactory. The silver base alloy having a copper content of 7.5% by weight is particularly effective as the impregnating alloy giving a contact member which is resistant to corrosion and which has high physical properties, that is, a high hardness, high tensile strength and resistance to wear or deformation and good conductivity.

In a contact member formed from 50% of tungsten powders of 200 mesh size and impregnated, as described hereinbefore, with the silver base alloy having a copper content of 7.5%, the contact member is found to have a hardness of 76 Rockwell B, as quenched in water from 750° C. In such annealed condition, the contact member having a tungsten content of about 50%, a silver content of about 46.2% and a copper content of about 3.8% can be readily machined to any predetermined shape. When subjected to a further treatment consisting of aging the contact member for 18 hours at a temperature of 200° C., the contact member is found to have a hardness of 92 Rockwell B or greater.

By practicing this invention, contact members are produced having an extremely high hardness and good conductivity which are free from the carbon contamination sometimes employed heretofore for improving the wearing characteristics of contact members. With the combination of metals employed, a contact member is produced which may be machined to shape and which afterwards can be so hardened as to substantially prevent deformation of the contact member when subjected to repeated blows, such as are encountered in service. A micro-examination of the contact members embodying the teachings of this invention reveals that the silver copper alloy is distributed very uniformly throughout the matrix of refractory metal in a very finely divided state of sub-division. Such contact members whether in the form of contactor tips, electrodes, or other forms, are resistant to corrosion and are successful in service where it is necessary to interrupt heavy currents without danger of contact failure.

Although this invention has been described with reference to a particular embodiment thereof, it is, of course, not to be limited thereto except insofar as is necessary in accordance with the teachings of the prior art and the scope of the appended claims.

I claim as my invention:

1. An electrical contact member comprising from 45% to 75% by weight of refractory metal powders substantially free from carbides and bonded together with from 55% to 25% by weight of an alloy of uniform composition of silver and copper, the silver being present in the alloy in an amount ranging from 90% to 98% by weight.

2. An electrical contact member comprising from 45% to 75% by weight of refractory metal powders substantially free from carbides and formed to a predetermined shape and impregnated with a silver-copper alloy of uniform composition having a silver content of from 90% to 97.5% by weight and which has been precipitation hardened subsequent to the impregnation to give high physical strength and good conductivity.

3. An electrical contact member comprising about 50% by weight of tungsten substantially free from carbides, about 46.2% by weight of silver and about 3.8% by weight of copper, the silver and copper being present in the form of an alloy of uniform composition capable of being precipitation hardened.

4. An electrical contact member comprising about 45% to 75% by weight of tungsten substantially free from carbides impregnated with from 55% to 25% by weight of a silver copper alloy of uniform composition having a silver content of from 90% to 97.5% by weight, formed to a predetermined shape and precipitation hardened to give high physical strength and high conductivity.

5. An electrical contact member as in claim 1 which has been quenched from a temperature of between 600° C. to 775° C. and aged at a temperature of between 175° C. and 300° C.

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