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ELECTRICAL CONTACTING ELEMENT

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This invention relates to electric contacts.

An object of the invention is to improve the characteristics of electric contact elements containing silver.

Another object of the invention is to provide an improved silver base contact material consisting of silver plus more refractory constituents.

A still further object is to provide a new and improved contact material which can be used under severe electrical conditions without welding.

It is the further object of the invention to provide contacts capable of operating on high frequency at heavy current values without objectionable contact metal transfer.

Other objects of the invention will be apparent from the following description taken in connection with the appended claims.

The present invention comprises a combination of elements, methods of manufacture and the product thereof, brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claims.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure, and the combination of elements without departing from the spirit of the invention.

The present invention comprises an improvement in silver-refractory metal contact elements and especially in contact elements formed of at least 60% silver.

In a number of contact applications silver is mixed with refractory metals taken from the tungsten-molybdenum group. These materials are usually prepared by mixing the powdered materials together, pressing the mixture and hot or cold working the pressed product into suitable forms, from which contacts can be prepared.

It has been found that binary combinations of silver with members of the group mentioned above, especially when prepared by treating at temperatures below the melting point of silver have a definite tendency toward a preponderance of metal transfer from the anode to the cathode.

We have discovered that the addition of a third element having the alloying characteristics of manganese to compositions of silver-tungsten or silver-molybdenum or silver-tungsten-molybdenum greatly improves the alloying and decreases noticeably the transfer tendency.

Elements such as tin, zinc, cadmium, and copper will alloy with silver only but not with the refractory constituents, such as tungsten and molybdenum. Metals such as cobalt and iron alloy with the molybdenum and tungsten, but not with the silver. For this reason they do not perform the same function as a metal such as man-

ganese. While manganese is essential, the other metals mentioned may be present as dilution elements.

It has been found that it is possible to incorporate further additional elements such as iron, cobalt, nickel, silicon, which also improve the alloys and reduce the transfer tendency.

It is possible to produce a much stronger combination that way because the third constituent will form an alloy with both silver and refractory metals, cementing not only the silver particles but the refractory particles as well to a greater degree than is possible in the binary combinations.

The contacts covered by the present invention may be composed of the ingredients in approximately the following proportion.

	Per cent
Manganese.....	0.1 to 30
Tungsten and/or molybdenum.....	1 to 40
Balance.....	Substantially all silver

While it has been noted that the improvement in interparticle wetting increases with increased manganese content to a maximum of approximately 30%, it has been found that the greater improvement is accomplished within the range of the constituents as listed below:

	Per cent
Manganese.....	0.1 to 20
Tungsten and/or molybdenum.....	1 to 30
Balance.....	Substantially all silver

As a specific example of our new and preferred compositions, we have found the following to give complete satisfaction:

	Per cent
A.—Manganese.....	5
Tungsten.....	5
Silver.....	Balance
B.—Manganese.....	10
Tungsten.....	20
Silver.....	Balance
C.—Manganese.....	15
Molybdenum.....	15
Silver.....	Balance
D.—Manganese.....	10
Molybdenum.....	10
Tungsten.....	10
Silver.....	Balance

It has been noted by experimentation that refractory combinations consisting of mixtures of tungsten and molybdenum or their compounds with silver tend to produce what can be termed a peak type material transfer during operation which tendency is very much exaggerated as the

frequency of operation is increased. Microscopic examination of such material transfer shows that this material consists of a mixture of the oxides of the refractory and binding metal, together with particles of the pure constituent and a large percentage of voids.

It has been further noted that the operation of contacts under such conditions results in a limited and restricted life as the material decrease in active area rapidly increases the current density at the point of contact until failure results by early fusion.

As previously mentioned, manganese because of its characteristic of wetting both the refractory and non-refractory constituent limits this tendency, producing in operation a transfer of material whose height is greatly reduced and, at the same time, the diameter of the base is increased so as to produce what might be termed a dome or dome type transfer. This condition is highly desirable as it materially increases both the life of the contact and the current value at which fusion will occur.

Material of the present composition when tested on a resistive-inductive load at 12 volts D. C. operating at a frequency of approximately 400 times per minute was found to have a current figure value between 40 to 70% more than other commercial silver refractory combinations of the prior art. As has been mentioned, com-

binations of the present application are not as readily susceptible to material transfer producing values of .012" in comparison to .047" on equivalent tests.

What is claimed is:

1. An electrical contact member containing as essential ingredients, silver and at least one of the elements tungsten and molybdenum to which has been added manganese in the quantities ranging from 0.1 to 30%.

2. An electric contact member composed of a refractory metal base and silver alloy containing 0.1 to 30% manganese.

3. An electric contact member formed of a bonded mass of refractory metal powders selected from the group consisting of tungsten and molybdenum impregnated with a silver alloy containing 0.1 to 30% manganese.

4. An electric contact element formed of 1 to 40% of a material selected from the group consisting of tungsten and molybdenum, 0.1 to 30% manganese and the balance substantially all silver.

5. An electric contact element formed of 1 to 30% of a material selected from the group consisting of tungsten and molybdenum, 0.1 to 20% manganese and the balance silver.

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