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ELECTRIC CONTACT

Franz R. Hensel and Kenneth L. Emmert, Indianapolis, Ind., assignors to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware

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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 a silver base contact material which is highly resistant to tarnishing, and therefore will not form a layer of high contact resistance.

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

It is a further object of the invention to provide a contact capable of operating a 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 the 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 base electric contact elements. According to the invention, the contacts are improved by the addition of tellurium.

The contacts may be composed of silver and tellurium accordingly. The ingredients may be present in approximately the following proportions:

	Per cent
Tellurium	.05 to 6
Silver	Balance

It is likewise possible to improve the characteristics of silver alloys containing additional ingredients, by the addition of tellurium; thus, silver alloys containing beryllium, magnesium, zinc, cadmium, copper, gold, nickel, manganese, thorium, palladium group elements, platinum group elements, silicon, titanium, zirconium, tin, indium, can be improved by the addition of tellurium, in substantially the proportions indicated above.

We have found that silver and tellurium, up to 6% tellurium, alloy readily, and can be cast into ingots of desirable shape. The tellurium forms eutectic compositions with the silver.

Above about 9% tellurium, two liquids exist in the molten state and it is difficult to obtain a uniform and homogeneous structure in cooling. We have, therefore, limited ourselves to 6% tellurium. The new and improved alloys consist of a fine mixture of silver and silver telluride, possibly of the composition Ag_2Te.

The alloys are solid at temperatures below 870 degrees C. It is difficult to work alloys of higher tellurium content, either hot or cold. The alloys of lower tellurium contents, however, can be swaged and rolled into shapes from which contacts may be prepared.

The tellurium is preferably added in the form of a master alloy, which is prepared by mixing tellurium powder and silver powder in suitable proportions, pressing same to a high density and then adding such pressed body to the silver melt. By using this procedure, a high tellurium recovery is obtained.

In a number of contact applications, silver is mixed with refractory materials, taken from the group of tungsten and molybdenum, or their compounds, and with metals taken from the iron group, such as nickel, cobalt and iron. These materials are prepared either by mixing the powders together, pressing same, and hot and cold working same into suitable forms from which contacts can be prepared. It is also possible to produce such materials by first pressing the refractory or iron group metals, and then impregnating same with a silver-tellurium alloy. Since tellurium is easily available in powder form, it can be readily incorporated into the powder mix, and under elevated temperatures, will alloy with and diffuse into the silver, resulting in a homogeneous silver-tellurium alloy. Certain care has to be taken in producing these products, in order to avoid vaporization of tellurium.

Contact tests have been made to compare the performance of fine silver contacts with the behavior of contacts containing tellurium, under identical conditions of voltage, current, type of load, contact pressure and frequency of operation wherein the current was gradually increased at intervals of 4 minutes until failure by welding took place.

It was found that the above described cheap silver-tellurium alloy had performance values equalling those of fine silver.

More particularly, however, it was found that where an alloy containing 2.5% tellurium was operated as the positive contact on low voltage

direct current against fine silver, and in certain cases against silver-copper or silver-magnesium alloy contacts, as the negative contact in inductive circuits, material transfer was reduced to a minimum of .001" in 50,000 operations, which is impossible to attain when fine silver is operated in both polarities. Therefore, the use of these improved silver-tellurium contacts in the proper polarity on differential contact combinations prolongs the life of the contact-employing device.

The above mentioned low voltage is of the same order of magnitude as those employed in automotive electrical control and safety circuits.

The alloys of the present invention have a very satisfactory hardness. As a matter of fact, the alloys cold work very readily by applying very light cold reductions, and hardness values such as 90–95 Rockwell F, can be readily obtained. With such hardness values, the contacts will show not only good electrical erosion resistance, but also mechanical wear resistance. In many cases, these contacts are used for relays where mechanical wear in the order of a very small fraction of an inch, will mean failure.

The alloys were also tested for tarnish resistance by placing same in a chamber through which hydrogen sulphide was passed. For comparison, fine silver and some of the standard silver alloys were tested. It was found that while fine silver would show a very heavy sulphide coat, within a period of 24 hours, the alloys of the present invention maintained a bright surface for the same length of time, and showed only a slight tarnish film at the end of 72 hours. When testing the contact resistance, it was found that the improved alloys of the present invention showed contact resistance values of the same order, after the sulphiding test, as were obtained before sulphiding.

The present alloy has been found particularly useful for such applications as sensitive relays, thermostatic control contacts, overload relay contacts, differential contacts in general, etc.

Because of their lower specific gravity and decreased proportion of silver, alloys of the present invention are lower in cost per given contact shape, than contacts fabricated from fine silver.

While the present invention as to its objects and advantages has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby, but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. An electric contact member formed of an alloy containing as an essential ingredient, silver, to which has been added tellurium in quantities ranging from .05 to 6.0%.

2. An electric contact member formed of an alloy of .05 to 6.0% tellurium, balance substantially all silver.

3. An electric contact member formed of a refractory metal base and a silver alloy, containing .05 to 6.0% tellurium.

4. An electric contact member formed of an iron group metal base, and a silver alloy, containing .05 to 6.0% tellurium.

FRANZ R. HENSEL.
KENNETH L. EMMERT.