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ELECTRICAL CONTACT ELEMENTS

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This invention relates to electrical contact elements, and more particularly to electrical contact elements formed of improved compositions.

An object of this invention is to provide electrical contact elements formed of improved compositions. A further object of this invention is to provide such contact elements which exhibit less inherent electrical resistance rise and which resist tarnishing due to the circumambient atmospheres in which these contact elements are ordinarily disposed.

A further object of this invention is to provide electrical contact elements formed of silver-base or copper-base compositions, each of which includes cadmium oxide and minor percentages of a modifying agent, which modifying agent so affects the resulting composition that unexpectedly beneficial characteristics are exhibited thereby.

A further object of this invention is to provide electrical contact elements formed of improved compositions, which contact elements are economical and reliable in operation.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements, combinations of elements, the ingredients, combinations of ingredients, the proportions thereof, and features of composition which will be exemplified in the products hereinafter described, and the scope of the application of which will be indicated in the following claims.

The efficacy of silver-cadmium oxide and copper-cadmium oxide as contact element compositions is well known in the art. The advantageous operational characteristics of contact elements formed of such compositions have been more or less limited heretofore to applications in which the voltage across and the current through the contact elements were of comparatively high magnitude. When the voltage across such electrical contact elements is comparatively low, regardless of whether the current therethrough is comparatively low or high, the capability of such contacts to resist electrical surface resistance rise is deleteriously affected. For example, silver-cadmium oxide contact elements ordinarily function satisfactorily at 120 volts, 15 amperes, alternating or direct current. However, such contact elements do not function equally well at 6 volts, 15 amperes, are extremely erratic at 1 or 2 volts, 15 amperes, and are also extremely erratic at 1 or 2 volts and currents of less than 1 ampere.

According to this invention, minor percentages of hafnium, vanadium or zirconium or mixtures thereof are

added to silver and/or copper base compositions. More particularly, the contact element compositions according to this invention are formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of a modifying agent and the remainder a metal selected from the group consisting of silver and copper, all of these percentages being by weight of the whole. The modifying agent of these compositions consists essentially of a material selected from the group consisting of hafnium, vanadium and zirconium and mixtures thereof.

The efficacy of the contact element compositions of this invention are demonstrated, in part, by the following table. Although this tables does not include a composition in which the modifying agent consisted essentially of vanadium or a mixture of two or all three of hafnium, vanadium and zirconium (within the above stated range), it has been found that these compositions provide substantially the same unexpectedly good results. It will be understood that in the table below, each of the compositions identified by the respective modifying agents and their percentages consists essentially of 10% cadmium oxide particles dispersed in an alloy consisting essentially of the stated percentage of modifying agent and the remainder silver, all by weight of the whole. It will further be understood that the first figure in each of the columns of the table below represents the test results for a composition which consisted essentially of 10% by weight of cadmium oxide particles dispersed in silver without any modifying agent. To obtain these test results, two of the respective cooperating contact elements, both of which were formed of the stated composition, were operated through 10,000 make and break cycles and the resulting increase in voltage drop across these cooperating contact elements was determined. This determination was accomplished by measuring, both before and after the 10,000 make and break cycles, the millivolt drop across these respective two contact elements when closed under a pressure of 30 grams and while 10 amperes of direct current flowed therethrough. The figures listed under "A" are the average millivolt drop across the respective pairs of contact elements before the 10,000 cycles, and under "B" the average millivolt drop across the same pairs of contact elements after the 10,000 cycles. In this table, "X" indicates that the circuit remained open after 1100 making and breaking cycles, "XX" indicates that the circuit remained open after 2980 making and breaking cycles, and "XXX" indicated that the operation of the respective contact elements became so erratic after 5100 making and breaking cycles as to render the contact elements unfit for operation.

Modifying Agent	1 ampere, 2 volts D. C.		1 ampere, 6 volts D. C.		1 ampere, 12 volts A. C.		1 ampere, 120 volts A. C.		10 amperes, 120 volts A. C.		25 amperes, 230 volts A. C.	
	A	B	A	B	A	B	A	B	A	B	A	B
none	70	X	73	XX	71	XXX	73	130	73	170	73	155
Hf, 1%	70	100	70	102	70	100	70	97	70	109	70	110
Zr, 1%	71	97	71	97	71	89	71	104	71	118	71	112
Zr, 3%	71	99	71	99	71	97	71	99	71	109	71	102

In the above table it will be noted that whereas the silver-cadmium oxide contacts went open circuit after only 1100 making and breaking cycles at 1 ampere, 2 volts, direct current, such did not occur with the improved electrical contact elements of this invention. Also, as 1 ampere, 6 volts, direct current and at 1 ampere, 12 volts, alternating current, the circuit remained open after substantially less than 10,000 make and break cycles. Furthermore, even in the comparatively moderate current and voltage ranges such as 10 amperes, 120 volts, alternating current and 25 amperes, 230 volts, alternating

current, the resistance drop across the contacts as a result of 10,000 make and break cycles was substantially less with the contact element compositions of this invention.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

I claim:

1. An electrical contact element formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of a modifying agent and the remainder selected from the group consisting of silver and copper, said modifying agent being selected from the group consisting of hafnium, vanadium and zirconium and mixtures thereof, and said percentages being by weight of the whole.

2. An electrical contact element formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of hafnium as a modifying agent and the remainder selected from the group consisting of silver and copper, said percentages being by weight of the whole.

3. An electrical contact element formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of zirconium as a modifying agent and the remainder selected from the group consisting of silver and copper, said percentages being by weight of the whole.

4. An electrical contact element formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of vanadium as a modifying agent and the remainder selected from the group consisting of silver and copper, said percentages being by weight of the whole.

5. An electrical contact element formed of 1% to 25% of cadmium oxide particles dispersed in an alloy consisting essentially of 0.25% to 15% of a mixture of at least two of hafnium, vanadium and zirconium as a modifying agent and the remainder selected from the group consisting of silver and copper, said percentages being by weight of the whole.

References Cited in the file of this patent

UNITED STATES PATENTS

2,145,690	Hensel	Jan. 31, 1939
2,180,984	Hensel	Nov. 21, 1939
2,545,438	Stumbock	Mar. 20, 1951