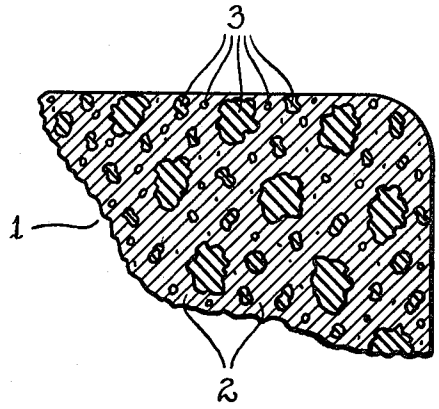
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ELECTRICAL CONTACTS

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ELECTRICAL CONTACTS

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Continuation of abandoned application Serial No. 129,816, November 28, 1949. This application February 11, 1953, Serial No. 336,292

10 Claims. (Cl. 29—182.5)

This invention relates to improvements in powder composition electrical contacts and more particularly to contacts composed of silver, cadmium oxide and cobalt sulphate.

The present application is in continuation of our application Ser. No. 129,816, filed November 28, 1949, now abandoned.

As is well known to those skilled in the art, electrical contact elements heretofore have been subject to many limitations. Excessive arcing, pitting of the contact surfaces, tarnishing, transfer of metal between contacts, welding and sticking are but a few of the difficulties encountered. One or more of these difficulties may become troublesome accordingly as the contacts are subjected to various conditions of use. A particular likelihood of difficulty has been the fact that contacts which operated satisfactorily at low currents completely broke down or were considerably damaged when used to make and break circuits carrying relatively large currents. This difficulty has been even more pronounced when it was desired that a set of contacts retain their usefulness for a large number of operations. Although various attempts have been made to overcome these shortcomings, none of them has been completely successful.

An object of this invention is to provide improved electrical contacts which are capable of making and breaking circuit a large number of times while carrying relatively high currents.

Another and more specific object of this invention is to provide improved electrical contacts which will make and break 2000 amperes of a 28 volt D. C. resistance load at least 12,000 times before failure.

Another object is to provide electrical contacts of novel composition which will make and break 2200 amperes of a 250 volt, 60 cycle, 50% lagging power factor load, at least 100 times.

A further object is to provide electrical contacts of the aforementioned character which have a high resistance to pitting and bonding or welding.

Other objects and advantages of the invention will hereinafter appear.

The single figure of the accompanying drawing is a highly magnified fragmentary sectional view of an electrical contact embodying our invention.

As a result of extensive experiments we have found that the desirable characteristics of a contact formed of a bonded mass of powdered silver and cadmium oxide can be greatly improved by incorporating therein a quantity of cobalt sulphate. Cobalt sulphate when added in varying amounts to a mixture of powdered silver and cadmium oxide, the whole of which is then compressed and sintered, produces contacts which are capable of repeatedly making and breaking circuits carrying relatively high currents and which further are particularly characterized by their resistance to pitting and their ability to maintain a smooth contact surface.

The relative proportions of the powdered silver, cadmium oxide and cobalt sulphate may be varied within

certain ranges for the purpose of adapting the contacts to suit certain requirements. For example, a pair of electrical contacts, three-fourths of an inch in diameter, formed of a bonded mass of 87.5 percent by weight of powdered silver, 10 percent by weight of cadmium oxide and 2.5 percent by weight of cobalt sulphate, were found to be capable of making and breaking a 2000 ampere, 28 volt, direct current 12,600 times before they failed by adhering to each other. Another pair of contacts of the composition just mentioned, after making and breaking 200 amperes, 28 volt, direct current 50,000 times, showed no signs of failure and were further found to have retained a smooth contact surface with no evidence of pitting or sticking.

When used in alternating current circuits, contacts formed of a bonded mass of 75 percent by weight of powdered silver, 21.25 percent by weight of cadmium oxide and 3.75 percent by weight of cobalt sulphate were found to be highly satisfactory. A pair of these contacts, three-fourths of an inch in diameter, were found capable of making and breaking 2200 amperes of a 250 volt, 60 cycle, 50% lagging power factor alternating current load at least 100 times. After testing, these contacts showed no signs of failure and were found to have retained a smooth contact surface without evidence of pitting or sticking. Another pair of contacts of the composition last mentioned, one-half of an inch in diameter, when used to make 300 amperes and break 50 amperes of a single phase, 230 volt, alternating current resistance load, were found capable of withstanding at least 250,000 operations.

As hereinbefore mentioned, the relative proportions of powdered silver, cadmium oxide and cobalt sulphate may be varied over a certain range. Although less than 1.25 percent by weight of cobalt sulphate will substantially improve the desirable characteristics of silver-cadmium oxide contacts, its addition in the amount of from 1.25 percent by weight up to 5 percent by weight of the entire mass of the contact composition has been found to be most desirable. The silver content may vary from 75 to 93 per cent by weight, and the cadmium oxide content may vary from 5.75 to 23.75 per cent by weight.

The drawing illustrates the manner in which the cobalt sulphate is intermixed with the silver and cadmium oxide of our contacts. Numeral 1 designates a highly magnified fragment of one of our improved contacts. A base or matrix material 2 consisting of compressed and sintered powdered silver has intermixed therethrough particles 3 which are composed of a compressed and sintered mixture of cobalt sulphate and cadmium oxide.

The following is a preferred method of making our improved contacts. However, it is to be understood that this method is set forth by way of example only, it being assumed that other methods of producing contacts having a similar structure and composition will be readily suggested to those skilled in the art.

An intimate mixture of the desired or required proportions of cobalt sulphate and cadmium oxide (each ingredient being in the form of a powder of such fineness that the mixture will pass through a 325 mesh screen) is densified by applying a molding pressure of the order of 100,000 pounds per square inch. The slugs produced in this manner are then subjected to a temperature of 1600 degrees F. for a period of one hour, after which they are ground in such a manner, or to such an extent, that all of the particles thereof will pass through a 100 mesh screen and approximately one-half of the total quantity of said particles will be retained on a 300 mesh screen.

The particles produced in the above-described manner are then intimately mixed with a given quantity of precipitated silver powder. This mixture is subjected to

that degree of cold molding pressure which will result in the maximum sintered density for the particular type and lot of silver powder being used, the pressure usually ranging from 25,000 to 40,000 pounds per square inch. This molding operation produces preforms which are then subjected to a temperature of approximately 1600 degrees F. for about twenty minutes. After such heat treatment, the preforms are subjected to a final molding pressure of approximately 100,000 pounds per square inch to produce the completed electrical contacts.

We claim:

1. An electrical contact in the form of a bonded mass of powders composed of a mixture of from seventy-five to ninety-three percent by weight of silver powder, from five and three-fourths to twenty-three and three-fourths percent by weight of cadmium oxide, and from approximately one and one-fourth percent up to five percent by weight of cobalt sulphate.

2. An electrical contact in the form of a bonded mass of powders composed of a mixture of from seventy-five to eighty-seven and one-half percent by weight of silver powder, from ten to twenty-three and three-fourths percent by weight of cadmium oxide, and from approximately one and one-fourth percent up to five percent by weight of cobalt sulphate.

3. An electrical contact in the form of a bonded mass of powders composed of a mixture of from eighty-seven and one-half to ninety-three percent by weight of silver powder, from five and three-fourths to ten percent by weight of cadmium oxide, and from one and one-fourth percent up to two and one-half percent by weight of cobalt sulphate.

4. An electrical contact in the form of a bonded mass of powders composed of a mixture of from eighty-seven and one-half to ninety-three percent by weight of silver powder, from five and three-fourths to twenty-one and one-fourth percent by weight of cadmium oxide, and from one and one-fourth percent up to five percent by weight of cobalt sulphate.

5. An electrical contact in the form of a bonded mass of powders composed of a mixture of from eighty-seven and one-half to ninety-three percent by weight of silver powder, from five and three-fourths to ten percent by weight of cadmium oxide, and from one and one-fourth percent up to three and three-fourths percent by weight of cobalt sulphate.

6. An electrical contact for making and breaking electric current, formed of from seventy-five to ninety-three percent by weight of silver powder, five and three-fourths to twenty-three and three-fourths percent by weight of cadmium oxide, and from three and three-fourths up to five percent by weight of cobalt sulphate.

7. An electrical contact for making and breaking electric current, formed of at least seventy-five parts by weight of silver powder, at least five and three-fourths parts by weight of cadmium oxide, and an amount up to five parts of weight of cobalt sulphate.

8. An electrical contact for making and breaking electric current, formed of at least seventy-one and one-fourth percent by weight of silver powder, at least five and three-fourths percent by weight of cadmium oxide, and an amount from one and one-fourth percent up to five percent by weight of cobalt sulphate, said cadmium oxide and cobalt sulphate being in mixture form and said mixture being distributed in the form of discrete particles throughout the mass of silver.

9. An electrical contact in the form of a bonded mass of powders composed of a mixture of from seventy-five to ninety-three percent by weight of silver powder, from five and three-fourths to twenty-three and three-fourths percent by weight of cadmium oxide, and from one and one-fourth percent to five percent by weight of cobalt sulphate.

10. An electrical contact in the form of a bonded mass of powders composed of from seventy-five to ninety-three percent by weight of silver powder, from five and three-fourths to twenty-three and three-fourths percent by weight of cadmium oxide, and from one and one-fourth to five percent by weight of cobalt suphate, said cadmium oxide and cobalt sulphate being in mixture form and said mixture being distributed in the form of discrete particles throughout the mass of silver.

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