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ELECTRICAL CONTACT

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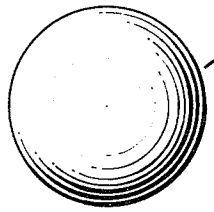


Fig. 1.



Fig. 2.

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ELECTRICAL CONTACT

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3 Claims. (Cl. 200—166)

This invention relates to electrical make and break contacts.

An object of the invention is to improve electric contacts.

Another object of the invention is to improve electrical make and break contacts, and produce, due to the structural composition thereof, a reduced contact resistance, less tendency for arcing, pitting, transferring or tendency to weld or fuse during operation, and which are less susceptible to tarnishing and oxidation, and operate in an improved manner as compared with electrical contacts commonly used in the same fields of application.

Other objects of the invention will be apparent from the description and claims.

Figure 1 is a plan view of an electrical terminal member embodying this invention; and

Figure 2 is a side elevation of the structure of Figure 1.

Heretofore, electrical make and break contacts have been used in various applications, of which the use as contactor contacts in an electrical system may be taken as representative. Such contacts have been commonly made from various metals and alloys thereof, such as, for example, copper, silver, copper-tungsten mixtures, silver-tungsten mixtures, and the like. Upon breaking an electrical circuit by separating two contact points, arcing occurs between these contacts, which often gives rise to serious conditions materially affecting efficient operation thereof. Under the action of the rapid recurrence of the arcing, the faces of the contacts pit, fuse and frequently transfer from one contact face to the other. Such deleterious effects are often accompanied by the formation of undesirable compounds which increase the contact resistance, the localization of the arc, which increases the tendency to pit, stick and volatilize, and a building up of fused and spattered materials, on one or both of the contact faces, which often results in complete failure of operation, due to a short circuiting.

In carrying out our present invention, a contact material is formed from an alloy or mixture, containing a metal or an alloy, having a relatively high electrical conductivity and a refractory oxide of one of the elements of the second group of the periodic table.

While we do not wish to be limited thereby, it is believed that the improved results obtained with the material of the present invention is due in part at least to the fact that the refractory oxide particles separate the contact metal particles, such as silver. The refractory oxide is not wetted by the silver or other metal and, hence, when an arc is drawn and a high temperature is reached the oxides prevent the flowing together of the silver to form a molten pool which would cause contact sticking. These oxides are very stable at high temperature and will not decompose and form alloys at the temperature of contact arcing.

The relatively high electrical conducting metal may be copper, silver, gold or copper, silver or gold base alloys and an oxide of one of the alkaline earth metals, selected from the group consisting of beryllium, magnesium, calcium, strontium and barium.

The oxides of these metals are characterized by extremely high melting points, and a very high electrical resistivity. The oxides are furthermore very stable. The melting points of the principal oxides contemplated are as follows:

Magnesium oxide	2,800
Beryllium oxide	2,570
Calcium oxide	2,572
Strontium oxide	2,430
Barium oxide	1,923

It can, therefore, be stated that the oxides which we intend to cover are characterized by a melting point exceeding 1800° C. The oxides are, for all practical purposes, non-conductors. The oxides are preferably used in proportions from 1 to 10%, with the balance of the contact composition formed of contact metal.

In addition to the straight oxides, the mixtures and compounds of oxides and silica may be used, such as kaolin which is an aluminum silicate.

The following are examples of compositions produced in accordance with the present invention, which have shown very high resistance to welding or sticking, the respective proportions being given in the per cent by weight:

Beryllium oxide, 2%; silver, 98%
Magnesium oxide, 5%; silver, 95%
Calcium oxide, 3%; silver, 97%
Barium oxide, 10%; silver, 90%
Beryllium oxide, 2%; copper, 98%
Magnesium oxide, 5%; copper, 95%
Calcium oxide, 3%; copper, 97%
Barium oxide, 10%; copper, 90%

The contact material may be formed by several different methods, for example:

(1) Finely divided particles of the relatively high electrical conductivity material are intimately mixed with finely divided particles of the oxide material. The mixed particles or powders

are subjected to pressure to form the desired contact. The pressure may be increased to such a degree that porosity in the pressed contact is materially reduced. The pressed piece may then be sintered in a suitable atmosphere, so as to bring about a bonding or fritting of the metallic particles, to increase the strength of the contact. After this sintering operation, the contact may be re-pressed or hot worked or cold worked, to further increase the density, strength or other physical properties, after which it may again be subjected to a further sintering operation.

(2) Certain percentages of the relatively high electrical conductivity material in a finely divided state, may be mixed with certain percentages of the oxide material and pressed to form a somewhat relatively porous slug or bar, although, with the application of sufficient pressure, such slug or bar may be made to appear substantially homogeneous to the naked eye. Such slugs or bars may have, however, as high as 40% of voids.

The porous slug or bar is next filled with the impregnating material, which is of a character that imparts the desired characteristics. Metals which are adapted to impart the characteristics may be copper or copper alloys, or silver or silver alloys. To impregnate the aforementioned slugs or bars, with these materials, advantage is taken of the retentivity or capillary attraction of the voids or pores in the bars or slugs for the impregnating material. To utilize this effect, such materials must be liquified; to this end, the slugs or bars are placed in a suitable vessel, surrounded with sheets or bodies in other form, of the impregnating material and heated to a temperature at or above the melting point of the impregnating material, but below that of the oxide material.

(3) The relatively high electrical conductivity material, for example, copper or silver, may be melted in a furnace by any of the well known methods and into the molten high electrical conductivity material may be introduced the oxide material. In most cases, the oxide material will not dissolve into the molten metal, but the melt may be stirred vigorously, so as to bring about a more or less uniform distribution of the oxide particles within the melt. The melt may then be cast into chill molds or cooled very rapidly so as to hold the oxide particles in suspension and accomplish the same result as cited in Example 1.

(4) The mixed refractory oxide and metal powders may be hot pressed at a temperature sufficiently high to produce a bonded contact body.

In any of the above processes and particularly that described under (2) above, it may be desirable in some cases to add a small proportion such as 1 to 2% of a material which has the ability to dissolve both the refractory oxide and the metal of the contact so as to act as a cementing agent. One such material is sodium silicate.

While specific embodiments of the invention have been described, 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 formed of 1 to 10% of refractory oxide selected from the group consisting of the oxides of beryllium, magnesium, calcium, strontium and barium and the balance substantially all contact metal selected from the group consisting of silver, copper and gold.

2. An electric contact formed of 1 to 10% of calcium oxide and the balance substantially all silver.

3. An electrical contacting element subject to arcing comprising an electrically conductive metal composition formed of 1 to 10% of refractory insulating oxide material comprising at least one of the oxides selected from the group consisting of oxides of beryllium, magnesium, calcium, strontium and barium and the balance substantially all metal selected from the group consisting of silver, copper, and gold.

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