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ELECTRICAL CONTACTING ELEMENT

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*ELECTRIC CONTACT
OF A CARBONATE
OF Ca, Sr, OR Ba PLUS
Ag, Cu, OR Au*

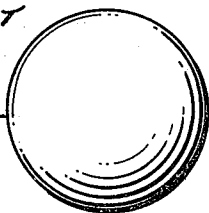


FIG. 1.



FIG. 2.

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ELECTRICAL CONTACTING ELEMENT

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3 Claims. (Cl. 75-22)

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This invention relates to electrical contacting elements subject to arcing.

An object of the invention is to improve electric contacts and electrodes.

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

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

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

Fig. 2 is a side elevation of the structure of Fig. 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 weld together. Such deleterious effects are often accompanied by the formation of undesirable compounds which increases the contact resistance and causes an undesirable temperature rise resulting ultimately in complete failure of the contacts.

In our copending application Serial No. 463,118 filed October 23, 1942, now Patent No. 2,396,101, issued March 5, 1946, we have disclosed a contact material 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.

We have now discovered that excellent results may be obtained by incorporating the carbonates of one of the elements of the second group of the periodic tables instead of the oxides.

The carbonates which are particularly useful

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are calcium carbonate, barium carbonate and strontium carbonate because their decomposition temperatures are above the temperatures which are encountered in making sintered compacts containing such carbonates.

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 carbonate is not melted and hence, when an arc is drawn and a high temperature is reached, carbonates prevent the flowing together of the silver to form a molten pool which would cause contact sticking, and at the same time, the gases released by the decomposition of the carbonates to oxides have arc extinguishing character. These oxides, as derived from initially inserted carbonates, are very stable at high temperatures and will not decompose and form alloys at the temperature of contact arcing.

When using the carbonates, they are initially inserted as part of the original composition. These carbonates decompose to form oxides during the contact operation and particularly during arcing.

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

The oxides of these metals, as derived from initially inserted carbonates 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:

	°C.
Calcium oxide -----	2572
Strontium oxide -----	2430
Barium oxide -----	1923

It can, therefore, be stated that the oxides resulting from decomposing carbonates which this invention includes are characterized by a melting point exceeding 1800° C. The oxides and carbonates are, for all practical purposes, non-conductors, and 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 carbonates, mixtures of oxides and carbonates may be used.

The following are examples of compositions of this invention which have very high resistance

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to welding or sticking, the respective proportions being given in per cent by weight.

Original compositions:	Per cent
Calcium carbonate -----	3
Silver -----	97
Barium carbonate -----	10
Silver -----	90
Strontium carbonate -----	5
Silver -----	95
Calcium carbonate -----	3
Copper -----	97
Barium carbonate -----	10
Copper -----	90
Strontium carbonate -----	2
Copper -----	98

Intermediate compositions, in which part of the carbonates have decomposed to oxides:

	Percent
Calcium carbonate and calcium oxide -----	3
Silver -----	97
Barium carbonate and barium oxide -----	10
Silver -----	90
Strontium carbonate and strontium oxide -----	5
Silver -----	95
Calcium carbonate and calcium oxide -----	3
Copper -----	97
Barium carbonate and barium oxide -----	10
Copper -----	90
Strontium carbonate and strontium oxide -----	2
Copper -----	98

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 carbonate material or a mixture of oxides and carbonates. The mixed particles or powders are subject 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. It is possible to carry out the sintering operation so that the carbonates will partly decompose and the resulting compact consists of contact metal having interspersed therein a mixture of carbonates and oxides.

(2) The mixed refractory and metal powders may be hot pressed, as for example, onto copper or a silver-plated copper backing at a temperatures 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 .01 to 2% of chlorides, bromides and iodides of silver and copper.

In using carbonates in the initial composition care is preferably taken to avoid decomposition of the carbonates to oxides during the forming of the contact. Sintering is carried out below the decomposition point of the particular car-

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bonate being used and processing decomposition thus held to a negligible minimum.

For this purpose, carbonates of calcium, strontium and barium are preferred. Calcium carbonate decomposes at 825° C., strontium carbonate and barium carbonate at 1400° C. These figures represent the decomposition points in the absence of water.

In use, the walls of contacts of carbonate compositions as described decompose in arcing to create a vapor phase which provides the contact with improved non-sticking characteristics while retaining low contact resistance.

While specific embodiments of the invention have been described, for example, electrical make and break contacts, it is intended to cover the invention broadly within the spirit and scope of the appended claims, for example, to include any electrical contacting element and particularly those which are subject to arcing.

We claim:

1. An electrical make and break contact formed of a solid body having uniform composition throughout consisting of 1% to 10% by weight of alkaline earth metal carbonates selected from the group consisting of the carbonates of calcium, strontium and barium, the balance being all silver, said contact having a very high resistance to welding and sticking and said alkaline earth metal carbonate minimizing arc formation through gases released by the decomposition thereof at contact operating temperatures.

2. An electrical make and break contact formed of a solid body having uniform composition throughout consisting of 1% to 10% by weight of calcium carbonate, the balance being all silver, said contact having a very high resistance to welding and sticking and said calcium carbonate minimizing arc formation through gases released by the decomposition thereof at contact operating temperatures.

3. An electrical make and break contact formed of a solid body having uniform composition throughout consisting of 3% by weight of calcium carbonate and 97% by weight of silver, said contact having a very high resistance to welding and sticking and said calcium carbonate minimizing arc formation through gases released by the decomposition thereof at contact operating temperatures.

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