

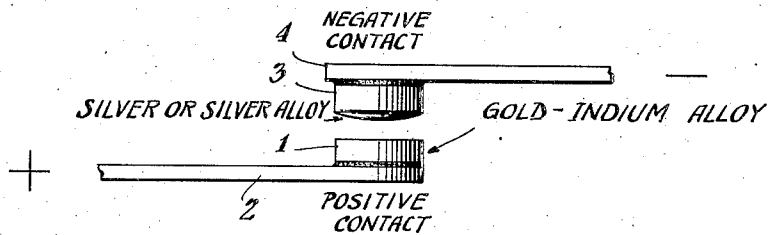
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2,400,003

ELECTRIC CONTACT

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ELECTRIC CONTACT

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This invention relates to electric contacts and the composition thereof.

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

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

The present invention contemplates an electrical contact combination or set in which the positive contact is formed from gold or a gold base alloy containing indium and the negative contact is formed predominately from silver or from silver base alloys. Such contact sets are characterized by high corrosion resistance and can be used in industrial atmospheres without the formation of a tarnish film thereon which would increase the electrical resistance of the contacts. The contact combination is useful for such applications as pressure exerting welding electrodes and as well as electric make-and-break contacts since such contacts have good tensile and compressive strength as well as a high degree of hardness.

The wear resistant properties of the contact, along with its other properties render it useful also in high speed relays where the frequency of make and break operations is extremely high.

In the drawing the figure shows a pair of co-operating contacts embodying features of the present invention.

The contacts of the present invention may contain

|        |           |
|--------|-----------|
|        | Per cent  |
| Indium | 0.5 to 25 |
| Gold   | Balance   |

The preferred range of composition is

|        |            |
|--------|------------|
|        | Per cent   |
| Indium | 0.5 to 8.5 |
| Gold   | Balance    |

The gold used may be either pure gold or one of the carat golds. These consist of gold-base alloys containing additions of silver, copper or other metals such as nickel, zinc, palladium, platinum or manganese. A table of typical carat golds is given in Metals Handbook (American Society for Metals, Cleveland, Ohio), 1939 edition, page 1507. It is contemplated that silver or copper may be present in the metal composition from traces to 20%, and hence are sometimes present in proportions still higher than if the higher carat golds were used in making the compositions.

Up to a few percent of iron group metals, particularly nickel or cobalt may be added to the compositions in some cases to further improve

their properties. Likewise, up to a few percent of platinum or palladium may be present.

Other ingredients which are commonly alloyed with gold, copper and silver may also be present, such as tin, manganese and silicon. In any case the percentage of gold will exceed 50% by weight and the elements other than indium may be present up to about 30%. Manganese, if present, is used in proportions up to 2% by weight.

Examples of electric contact and welding electrode compositions which are suitable are:

|            |          |
|------------|----------|
|            | Per cent |
| (a) Indium | 2.5      |
| Gold       | 97.5     |
| (b) Indium | 5        |
| Gold       | 95       |
| (c) Indium | 8        |
| Gold       | 92       |
| (d) Indium | 5        |
| Gold       | 71       |
| Silver     | 24       |
| (e) Indium | 5        |
| Gold       | 70       |
| Silver     | 12.5     |
| Copper     | 12.5     |
| (f) Indium | 5        |
| Gold       | 70       |
| Copper     | 25       |
| (g) Indium | 8        |
| Gold       | 69       |
| Copper     | 3        |
| Nickel     | 15       |
| Zinc       | 5        |

One of the problems encountered in make-and-break contacts is the tendency of material to transfer from the face of one contact to the other contact and thereby build up a projection on the second contact leaving a pitted or eroded area on the first contact. The contact compositions of the present invention are remarkably free of such tendency to transfer in both A. C. and D. C. circuits where either one or both contacts is formed of this material.

While the alloy of this invention may be used for contacts of either polarity they are most useful for the positive contact.

Suitable compositions or alloys for the negative side of the contact pair are pure silver and silver alloys, for example

|                       |          |
|-----------------------|----------|
|                       | Per cent |
| Palladium or platinum | 0.5 to 5 |
| Silver                | Balance  |

The gold base alloys containing indium can be manufactured by standard procedures such as melting, casting and then rolling or drawing, according to the type of contact or welding electrode tip to be fabricated.

The alloys of gold and indium form a solid solution up to about 8.5% indium by weight. The solid solubility of indium in gold decreases with temperature and therefore alloys may be heat treated in order to increase the electrical conductivity or the physical properties. Such a heat treating may consist in quenching from 400 to 700° C., depending upon the composition, and the subsequent aging temperature may vary from 150 to 400° C. The aging time may vary from several minutes up to several hours, depending upon the ageing temperature and weight of the piece.

Referring to the drawing a pair of co-operating contacts for D. C. operation are shown comprising a positive contact 1 formed of a gold-indium alloy cooperating with a negative contact 3 formed of silver or silver alloy. The contacts are

mounted on operating arms 2 and 4 respectively, which are arranged in a relay, switch or similar device to open and close the contacts in order to make and break a D. C. circuit, the positive terminal of which is connected to contact 1.

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.

1. An electric contact combination wherein the positive contact is formed of a gold base alloy containing indium and the negative contact is formed of a material from the group comprising pure silver and silver alloys.

2. An electric contact combination wherein the positive contact is formed of a gold base alloy containing indium, and the negative contact is formed predominantly of silver.

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