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SILVER-BASE ALLOY FOR MAKING ELECTRICAL CONTACTS

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FIG. 1.

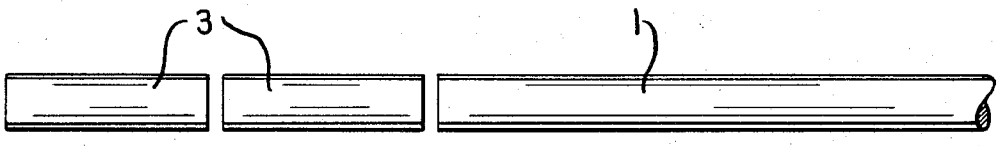


FIG. 2.

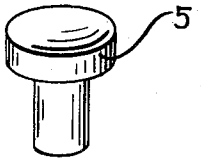
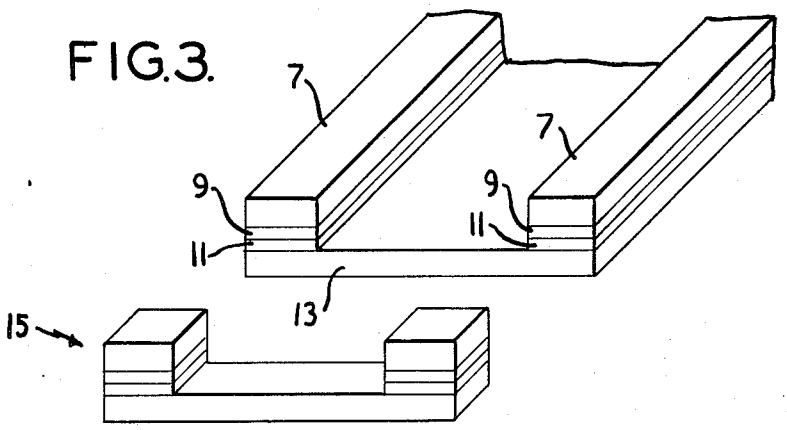


FIG. 3.



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SILVER-BASE ALLOY FOR MAKING ELECTRICAL CONTACTS

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U.S. Cl. 75—173 2 Claims

ABSTRACT OF THE DISCLOSURE

Improved alloys of cadmium oxide and silver are produced by incorporating therein between 0.001% and 5.0% by weight of sodium, beryllium or palladium as an additive. Electrical contacts formed from such alloys exhibit less arc-erosion and contact-sticking with lower contact-resistance than do electrical contacts formed from cadmium oxide-silver alloys having cobalt incorporated therein as an additive.

This invention relates to an improved silver-base alloy for making electrical contacts and to electrical contacts made therefrom.

Among the several objects of the invention may be noted the provision of an improved silver-base alloy for making improved electrical contacts, said contacts having equal or lower contact resistances than heretofore while at the same time having reduced arc erosion and sticking; and the provision of an alloy of the class described which may be more rapidly processed. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the ingredients, combinations of ingredients, the proportions thereof and features of composition, the steps and sequence of steps, and features of operation, which will be exemplified in the product and methods hereinafter described, and the scope of the applicability of which will be indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated:

FIG. 1 is a view of stock in rod form of the improved alloy of the invention and showing two blanks as cut from the stock;

FIG. 2 is a view of electrical contact formed by one of the blanks shown in FIG. 1; and

FIG. 3 is a perspective view of an alternate form of the invention.

The invention is an improvement upon alloys and electrical contacts such as described in U.S. Pat. 2,932,595. As is known in the art and from said patent, silver has been alloyed with cadmium with the addition of cobalt for making electrical contacts. In general, the silver, cadmium and the additive cobalt were melted together and poured into suitable molds to form billets or ingots from which stocks bars, rods and the like were made by rolling, drawing or the like and from which contacts of desired shapes were formed. The stock was heated in a suitable atmosphere such as an oxygen bearing atmosphere for a sufficient time to oxidize the cadmium to cadmium oxide. This produced a material with a reduced tendency toward arc erosion. This results from the strengthening of the molten silver by the dispersed particles of cadmium oxide. This strengthening effect is increased with decreasing particle size. The cobalt additive functions to decrease particle size thereby reducing contact arc erosion and contact sticking.

We have discovered that even less arc-erosion and contact-sticking with lower contact-resistance can be obtained

by use of the additive set out below and which are not of excessive cost.

One form of our invention consists in melting cadmium (Cd), silver (Ag) and sodium (Na) as an additive, and then pouring the melt to form an ingot. The ingot is then reduced by rolling, drawing or the like to form suitable stock, one form of which may be a rod **1** as illustrated in FIG. 1.

The stock is subjected to heating from one to several hours in a suitable oxygen bearing atmosphere at an elevated temperature, for example 1500° F. The time and the temperature are subject to variation, except that they should be sufficient to oxidize the cadmium in a reasonable time taking into account such factors as the thickness of the stock, the melting temperature and the like. The cadmium then takes the form of a multiplicity of cadmium oxide particles dispersed throughout the matrix of silver containing the sodium additive. The sodium additive acts in a manner similar to but improved over that of cobalt and effects improved arc erosion characteristics with improved or equal contact resistances. From segments **3** of the stock contacts are formed such as shown at **5** in FIG. 2, for example. Contacts may be formed by a heading machine or other suitable apparatus. In an alternate preferred procedure, the contacts **5** may be formed from the stock **1** prior to oxidation so that the oxidation step is performed on the contacts **5** themselves. In the alternate embodiment shown in FIG. 3, the ingot of alloy is formed into strips **7** which are bonded to layers of fine silver **9** and thereafter the strip is heated in an oxygen bearing atmosphere to internally oxidize layer **7**. Thereafter the strip **7** is liquid phase bonded or soldered through soldered layers **11** to a base metal strip **13** formed for example of brass, beryllium copper, Phosphor bronze or the like. Finally individual contact assemblies **15** may be formed from this strip.

A preferred formulation of the stock **1** in proportions by weight is approximately:

	Percent
Cadmium oxide	15
Sodium	0.003
Silver	Balance

A suitable range for the cadmium oxide component is approximately 1–20% and for the sodium component approximately 0.001%–.25%, the balance in all cases being silver. A contact such as shown at **5** in FIG. 2 made from a workpiece such as **3** in FIG. 1 exhibits less arc-erosion, less sticking than the alloy of said patent made with the cobalt additive therein referred to.

We have found that two other additives are superior to cobalt in the respects mentioned, namely beryllium (Be) and palladium (Pd). A preferred essential formulation of the stock **1** employing the beryllium additive is by weight approximately:

	Percent
Cadmium oxide	15
Beryllium	0.005
Silver	Balance

A suitable range for the cadmium oxide component is approximately 1%–20% and for the beryllium component approximately 0.001%–1.0%, the balance in all cases being silver.

A preferred essential formulation employing the palladium additive is approximately:

	Percent
Cadmium oxide	15
Palladium	1.0
Silver	Balance

A suitable range of the cadmium oxide is 1.0%–20% and a suitable range of the palladium is approximately .001%–5.0%, the balance in all cases being silver.

While the beryllium and palladium additives do not provide quite as good results as does the sodium additive, all are superior to the results obtained by use of the cobalt set forth in said patent. Why the additives referred to herein have effects superior to cobalt is unknown to us, nevertheless the improvements are factual. In an alternate form of the invention the silver and cadmium are mixed in the form of silver and cadmium oxide or powder form with powdered additive (sodium, beryllium or palladium). In this form of the invention, no oxidization step is required. It will be understood that the silver, cadmium and sodium, beryllium or palladium may contain a degree of impurities such as is found in "commercial" or "reagent" grades of these materials. The impurities are not the additives described herein.

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

As various changes could be made in the above composition, articles and methods without departing from the scope of the invention, it is intended that all matters contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An alloy consisting essentially of between approximately 1% and 20% by weight of cadmium oxide, between approximately 0.001% and 0.25% by weight of sodium and the balance silver.

2. An alloy consisting essentially of approximately 15% by weight of cadmium oxide, 0.003% sodium and the balance silver.

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CHARLES N. LOVELL, Primary Examiner

U.S. Cl. X.R.

148—32; 200—166