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ELECTRIC CONTACT

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This invention relates to electric contacts of silver, copper and magnesium.

It is one of the objects of the invention to provide a silver base contact which has greatly increased tensile strength.

It is a further object of the invention to provide a contact which can be improved by heat treating.

It is a further object of the invention to provide a silver base material, which can be used for electrical make and break contacts, retaining a very low contact resistance and having negligible material transfer.

Other objects of the invention will be apparent from the following description, taken in connection with the appended claims.

The present invention comprises a combination of elements, methods of manufacture and the product thereof, brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claims.

While a preferred embodiment of the invention is described herein, it is contemplated that a considerable variation may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

The present invention relates to a contact of silver, magnesium and copper.

In the formation of the alloy, it is preferable to provide a composition of the materials specified in the following proportions:

	Per cent
Magnesium	.05 to 15
Copper	.1 to 30
Silver	Substantially the entire balance

The preferred range of magnesium is .05 to 8%, because up to that percentage, the magnesium is taken up in alpha solution in silver and we have found that silver and magnesium up to 8% can be alloyed very readily and the cast ingots can be rolled, swaged and drawn into desirable shapes, such as sheet, bar stock, wire, strips and the like. The range of magnesium from 1 to 4% is especially useful.

Copper is soluble in silver up to 8.8% in alpha solid solution, at a temperature of 779 degrees C., which is the eutectic temperature.

The alpha solid solubility decreases with temperature and this fact renders alloys of this type susceptible to heat treatment.

Alloys of copper and small percentages of magnesium also show a limited solid solubility range, the solubility of magnesium in copper being 2.8% at the eutectic temperature of 722 degrees C. The solid solubility changes also with temperature. By combining both the additions of magnesium and copper to silver, it is possible to obtain alloys which can be improved by suitable heat treatments. Such heat treatments may consist in a straight annealing operation or in a quenching operation followed by cold working and subsequent annealing.

We have investigated a series of compositions and have found that the following composition ranges, which are given by way of example, have shown very excellent physical properties and also good electrical properties, if used in the form of electrical contacts.

		Per cent
(1)	Magnesium	1 to 4
	Copper	.5 to 10
	Silver	Balance
(2)	Magnesium	.05 to 8
	Copper	1 to 10
	Silver	Balance
(3)	Magnesium	5 to 15
	Copper	5 to 30
	Silver	Balance
(4)	Magnesium	.05 to 4
	Copper	5 to 30
	Silver	Balance
(5)	Magnesium	3
	Copper	5
	Silver	Balance
(6)	Magnesium	6
	Copper	15
	Silver	Balance

The ingredients in the proportions named above are preferably prepared by melting together and pouring into a suitable mold. It is desirable to add the magnesium in the form of a magnesium master alloy of high magnesium concentration. Alloys of this type have a lower melting point and therefore will go readily into the silver melt. Since a silver-magnesium alloy has a tendency to oxidize and form a dross, it has been found desirable to melt such master alloys either in a reducing or neutral atmosphere, or use suitable fluxes which cover the melt. The addition of magnesium in the form of master alloy has also reduced the loss of magnesium and therefore has made it possible to hold closer tolerances in the chemical composition.

Our tests have shown that the tensile strength

of the materials described in the present invention is materially increased over that of the alloys of the prior art. This increase is obtained without any appreciable loss of ductility. Due to the fact that the alloys are age-hardenable, the annealing temperature of the alloys is quite high. In an alloy containing 5% copper and 3% magnesium, a Brinell hardness of 135 was developed by cold swaging only. This hardness could be raised another 20–25 points Brinell by applying a suitable heat treatment.

Alloys of the type disclosed show superior qualities, also if used for electrical purposes, such as electrical contacts.

A comparison test was conducted wherein contacts of similar physical dimensions were tested on a resistive inductive circuit at 470 cycles per minute and wherein current flowing in the circuit was increased periodically to obtain definite current values in the nature described above, in comparison with contact materials produced in the prior art. The amount of material transfer of one contact to another was found to be considerably less than materials of the prior art, not containing magnesium, such as coin silver or standard silver materials containing only silver and copper in percentages ranging from 7.5 to 10%. At the same time it was found that after completion of the tests, the contact resistance was very much lower than that of binary silver-copper alloys, without magnesium.

The contact material of the present invention has been found useful for a large number of electrical contact applications, such as for instance, sensitive direct current relays, overload cut outs, voltage regulators, thermostats, indicating and recording gauges and the like. The other uses of the new alloy are in the form of silverware, such as is used for jewelry purposes, tableware, industrial and similar applications.

The alloy of the present invention has a commercial advantage since the addition of magnesium in the percentages contemplated, provides a material of low specific gravity, therefore, it is possible, with such low density alloys, as contemplated in the present invention, to produce a larger number of finished products per unit weight of material.

While the present invention as to its objects and advantages has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby, but 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 composed of .05 to 15% magnesium, .1 to 30% copper, balance substantially all silver.

2. An electric contact composed of 1 to 4% magnesium, .5 to 10% copper, balance substantially all silver.

3. An electric contact composed of .05 to 8% magnesium, 1 to 10% copper, balance substantially all silver.

4. An electric contact composed of 5 to 15% magnesium, 5 to 30% copper, balance substantially all silver.

5. An electric contact composed of .05 to 4% magnesium, 5 to 30% copper, balance substantially all silver.

6. An electric contact composed of 3% magnesium, 5% copper, balance silver.

7. An electric contact composed of 6% magnesium, 15% copper, balance silver.

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