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SILVER ALLOYS

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2 Claims. (Cl. 75—173)

This invention relates to the production of tarnish-resisting silver alloys of a fineness equivalent to sterling 925 and standard quality 900 fine, as well as the composition of other silver alloys possessing tarnish-resisting properties.

It is well known that silver alloys and articles made of silver when exposed to the atmosphere or when in contact with substances containing sulfur assume a darkened color known as tarnish. The object of this invention is to provide silver alloys of fineness of sterling quality and otherwise which possess tarnish-resisting properties and also which may be readily made into articles which possess sufficient hardness to withstand the usual wear and tear.

The invention comprises the novel compositions and component mixtures comprised in such compositions, specific embodiments of which are described hereinafter by way of example only and in accordance with what I now consider the preferred manner of practicing the invention.

This application is a continuation of my copending application Ser. No. 36,962 filed August 20, 1935.

The invention comprises a homogeneous tarnish-resisting silver-tin alloy, with said component metals ranging respectively from 85 to 93% and from 3 to 14%, totaling not more than about 99.5% and not less than about 99% of the alloy, and silicon in an amount not exceeding 1%. The amount of silicon used is preferably such that up to about 0.7% is found in the resulting finished alloy. The proportion of silicon may exceed 0.7% to 1% if desired, but in amounts between 0.7% and 1% the brittleness of the alloy increases somewhat and its workability and other features are not as good as in the preferred range below 0.7% silicon. A certain amount of silicon is apt to be lost in melting depending on the technique employed in its addition and it is, therefore, well to add a somewhat larger amount thereof to the mixed melt than expected in the resulting alloy. As stated this additional amount will depend on the technique employed and can be readily determined for a given case by making one or more melts and observing the resulting amount of such metal obtained in the finished melt. The proportions above given produce homogeneous solid alloys. In preparing the above alloys it is important that they be substantially homogeneous throughout. The proportions given above produce homogeneous solid alloys. Heterogeneous combinations do not possess the desired properties and I, therefore, have selected the homogeneous compositions given.

As regards the specific effect of the metals present in silver alloys the properties were determined by testing a series of the alloys. Tin forms homogeneous solid solution alloys with silver, up to 15% tin and 85% silver. Tin increases the hardness and lowers the melting point of the resulting alloy. Other elements as silicon alone impart tarnish-resisting properties to the alloy and also increase the hardness of the resulting alloy.

The results of the tests demonstrated that the silver-tin alloys are more tarnish-resisting than silver-zinc and silver-antimony alloys.

The compositions made up embodying the metals indicated above were tested to determine their tarnish-resisting properties as follows:—A small cast block of the composition to be tested was rolled into sheets, which were highly polished and covered by a water solution of ammonium sulfide containing an excess of free sulfur. This solution of ammonium sulfide and sulfur was selected from a number of tarnish-producing materials, as the most active of the various agents tested. The most satisfactory solution of ammonium sulfide and free sulfur consisted of an N/10 ammonium sulfide plus N/100 excess free sulfur. The expressions N/10 and N/100 are intended to designate respectively 10th normal and 100th normal solutions. In accordance with the standard practice a normal solution is one containing an equivalent weight in grams of the substance dissolved in one liter of water or other solvent. The specimen was kept in contact with this solution for five minutes, then washed and dried. The tarnish was then observed on the specimen. When identical specimens were exposed to the atmosphere for several months, the tarnish-resisting effects observed corresponded to those obtained in the much shorter interval of the above test.

As noted above the alloys vary in their hardness according to their composition and I have tested this hardness in accordance with the well-known Brinell test, the test being applied to the alloys as cast. The Brinell test on sterling silver as such, containing 92.5% silver and 7.5% copper shows a hardness of 67, as cast. I find that alloys having tarnish-resisting properties can be produced with the hardnesses indicated for sterling silver or with hardnesses which are less or greater than sterling silver.

I give below several alloys prepared in accord-

ance with my invention, together with the results of the above tarnish test and the Brinell hardness test made on the alloy as cast.

Example No.	Composition of mixtures—melted—parts by weight	Brinell hardness
1	90 silver, 9 tin, 1 silicon	58
2	90 silver, 9.3 tin, 0.7 silicon	68
3	92.5 silver, 7 tin, 0.5 silicon	43

The alloys prepared as indicated in the above examples showed by appropriate tests that they were substantially homogeneous alloys, being substantially free from heterogeneous structure. Each of the alloys of the above examples, when subjected to the ammonium sulfide and sulfur tests indicated above, had a tarnish-resisting property capable of resisting such treatment substantially without appearance of tarnish. Sterling silver and standard silver and various other silver alloys when subjected to this test showed appreciable tarnish. The silver employed in the above melts was a fine commercial electrolytic silver as crystals of a high grade of purity and the other metals were also commercial products of high purity.

The following process is carried out in forming the alloys of the metal or metals with silver and tin:—

The alloys are prepared by melting the weighed amounts of electrolytic silver and the other constituents under a flux or for example borax, or glass, and charcoal. The molten mixtures are thoroughly mixed, then cast in the usual manner. Silicon may be added either as metallic silicon, or the silver alloy of silicon may first be prepared, and then the other constituent added. It is found that silicon can be easily incorporated with silver by placing a layer of the electrolytic silver crystals in the crucible, placing the silicon on the layer of silver and covering with the remaining electrolytic silver; the combination results when the silver is entirely melted.

This application contains claims to three element alloys, while my copending application Ser. No. 36,962 above referred to, contains claims to four or more element alloys.

While I have described my improvements in great detail and with respect to certain preferred embodiments thereof, I do not desire to be limited to such details or embodiments since many changes and modifications may be made and the invention embodied in widely different forms without departing from the spirit and scope thereof in its broader aspects. Hence I desire to cover all equivalents and all modifications and forms coming within the language or scope of any one or more of the appended claims.

What I claim as new and desire to secure by Letters Patent, is:

1. A tarnish-resisting silver alloy consisting of about 85 to 93% of silver by weight, silicon in the proportion by weight of an appreciable amount but not more than about 1.0%, and tin constituting the remainder of the alloy.

2. A tarnish-resisting silver alloy consisting of about 90 to 92.5% silver, 7 to 9% tin and 0.5 to 1% silicon.

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