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SILVER ALLOY

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5 Claims. (Cl. 75—1)

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.

This application is a division of my co-pending application Ser. No. 536,087, filed May 8, 1931.

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 practising the invention.

The invention comprises a tarnish-resisting silver alloy made from about 85–93% silver and an appreciable amount sufficient to alter the properties of the alloy up to 4% of cadmium, antimony, copper, zinc, manganese and nickel-chromium alloy and the balance tin. In preparing the above alloys it is important that they be substantially homogeneous throughout. The proportions just given 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 the silver alloys, the properties were determined by testing a series of the alloys. Tin forms 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 specified above impart tarnish-resisting properties to the silver-tin 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 the silver-zinc and the silver-antimony alloys. The inclusion of small amounts of cadmium, zinc, antimony, manganese, copper and nickel-chromium alloy in silver increases the tarnish-resisting properties.

Cadmium, zinc, antimony, copper, manganese and nickel-chromium alloy added to silver-tin alloys control the workability of the resulting 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 highly polished and covered by a 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 specimen was kept in contact with this solution for five minutes, then washed and dried. The tarnish was then observed on the specimen.

As noted above the alloys vary in their hardness according to the components thereof and I have tested this hardness in accordance with the well-known Brinnell test, the test being applied to the alloys as cast. The Brinnell 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 in tabular form a series of alloys prepared in accordance with my invention, by mixing the metals as indicated. The alloys are tarnish-resisting when tested by the method described above and give the following Brinnell hardness test in the alloys as cast.

Silver	Tin	Cadmium	Antimony	Copper	Zinc	Manganese	Nickel chromium	Brinnell hardness
90	8.5	1.5						52
90	7.0	3.0						57
90	8.5		1.5					59
90	7.5		2.5					52
90	7.0			3.0				52
90	6.0			4.0				54
90	6.7				3.3			47
90	7.5					2.5		40
90	8.5					1.5		36
90	9.0						1.0	54
90	7.5						2.5	41

The alloys prepared as indicated in the above examples all 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 immersion 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. As is well understood in melting volatile metals such as cadmium and zinc there may be some oxidation and loss thereof. In making alloys therefrom such loss should be compensated in the melt mixture if recovery of the proportions of those metals therein stated is to be made.

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 of for example borax, or glass, and charcoal. The molten mixtures are thoroughly mixed, then cast in the usual manner.

It will be observed that the various alloys herein described contain silver and tin, with silver ranging upwards from approximately 85%. To this combination of silver and tin is added one or more metals which alter the tarnish resistance of the silver-tin combination and change as well the workability of the resulting alloy. The other metals just referred to and which have been previously set forth herein are:—cadmium, copper, zinc, antimony, nickel-chromium and manganese.

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 homogeneous tarnish-resisting silver-tin alloy having the silver and the tin in amounts ranging respectively from 85 to 92 per cent and from 4 to 11 per cent, and aggregating from 96 to 99 per cent of the alloy, and holding in solid solution as the balance of the alloy one or more of the workability-control metals, cadmium, zinc, antimony, copper, manganese and nickel-chromium alloy, selected in such amounts as will insure to the resulting alloy a Brinnell hardness of not less than 36.

2. A stain-resisting alloy composed of 1.5 to 4% of cadmium, 85 to 92% of silver and the balance tin.

3. A tarnish-resisting silver alloy consisting of about 90 per cent silver, about 8.5 to 7.0 per cent tin, and about 1.5 to 3.0 per cent cadmium.

4. A tarnish-resisting silver alloy consisting of about 90 per cent silver, about 8.5 to 7.5 per cent tin, and about 1.5 to 2.5 per cent antimony.

5. A tarnish-resisting silver alloy consisting of about 90 per cent silver, 7 to 6 per cent tin, and about 3 to 3.6 per cent copper.

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