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BEARING METAL AND METHOD OF MAKING SAME.

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My invention relates to the production of lead base metal alloys and its object is to provide a lead alloy of such character that it may be used for bearings, bushings or other like elements where anti-friction surfaces are required or other purposes where a hardened lead is desirable. The invention has particularly in view the production of an anti-friction metal which will be tough and relatively hard, so as to be capable of supporting heavy loads but which at the same time possesses lubricating properties.

A further object of the invention is to provide an alloy of this character, the alloying metals of which will not dross or burn out, at least to any undesirable extent, with reasonable care, either when the ingredient metals are melted up together in compounding or when the alloy is melted in casting operations.

A further object is to provide an alloy, the alloying metals of which will not oxidize when the metal is exposed to the atmosphere.

The alloy of my invention can be made according to two somewhat different methods, dependent upon whether the product requires primarily and particularly strength, toughness and load bearing capacity, where, for example, it is to be used for forming the bearing element as a whole; or requires to be soldered as, for example, where it is to be used merely as a lining, in which latter case strength is of relatively less importance but the metal must be of such character that it can be made to adhere by soldering to the base to which it is attached.

The method of making the alloy in the form suitable for complete bearings or bushings will be first described.

The primary hardening agent used is sodium and very small quantities of sodium will suffice to give the lead hardness and toughness provided the sodium is retained in the lead. Sodium alone tends to dross out of the lead, for example, when the alloy is melted for casting, and to oxidize on exposure of the alloy to the atmosphere. I have discovered that this drossing out can be prevented by the use of small amounts of calcium and aluminum; tin, also, preferably used contributing to the same result, which metals may, therefore, be termed "anti-drossing metals."

The method of compounding is preferably carried out as follows: The lead is heated to a temperature of approximately 1600° Fahrenheit, that is, so as to raise its temperature to or somewhat above the melting temperature of calcium which is 1400° Fahrenheit. The melted lead is covered with a supernatant flux or covering which will not burn at this temperature, which will exclude oxygen and which will be neutral to the metals, calcium and aluminum, to be introduced. The preferred covering consists of calcium chloride.

The calcium and aluminum are introduced into the lead while under this covering and the tin also if employed. The melt is then cooled to a temperature somewhat above the melting point of lead, that is, to a temperature, preferably, of between 650° and 700° Fahrenheit. After the calcium and aluminum have been added the metal may be poured into ingots and afterward re-heated for the addition of the sodium. In such case the melting of the lead and the addition of the sodium takes place under a supernatant covering consisting of sodium hydrate and rosin, soap, fuel oil or other organic substance which will create a reducing atmosphere or at least exclude oxygen. The sodium hydrate and rosin, or its equivalent, may be used in substantially equal proportions. The quantity of each may be approximately 1% of the melt. The quantity of sodium hydrate should be small so as to prevent reaction between it and the calcium in the alloy. The metallic sodium is put into the flux or supernatant covering and then stirred into the molten metal. The temperature rises very considerably, the reaction between the sodium and the other metals being exothermic. The sodium hydrate aids in excluding air from the metals and clarifies the metals by combining with the impurities therein.

The final alloy is then poured into ingots. It can be melted for casting without drossing to any substantial extent.

The alloy may be improved by using small quantities of tin which may be mixed with the lead in the first melting operation as stated.

The ingredient metals are used preferably in the following proportions by weight.

Sodium 0.3% to 1.0%, the preferred amount being 0.7% to 0.8%. The amount of sodium will vary according to the degree of hardness required. If substantially more than 1% of sodium is used the alloy is excessively brittle and tends to oxidize in the air.

Calcium 0.3% to 1.0%. There will be a certain loss of calcium due to oxidation in melting and re-melting and the amount used will depend upon this loss. The calcium apparently forms a protecting film of calcium hydroxide, during re-melting for casting, which prevents the drossing out of the sodium. If care is taken in the melting and re-melting operations the amount of calcium used may be small. The amount of calcium in the cast bearing should be not less than 0.1% and, as the cacium acts to a certain extent as a hardening agent, if it is present in a greater amount than approximately 1.0%, the metal will be too hard and brittle. 0.3% to 0.4% of calcium is preferred. If a rigid metal for bearing a heavy load is required there should be at least 0.3% of calcium in the finished article; for metals of lower strength and higher lubricating properties 0.2% of calcium might suffice.

Aluminum from 0.02% to 0.1%. A small amount of aluminum will suffice, and if it is used in quanttities substantially in excess of 0.1% it drosses out and also tends to make the metal viscous.

Tin 2.0% to 5.0%. The tin is an optional but preferred ingredient. It tends to make the metal more fluid and tougher and to a certain extent aids in preventing the drossing out of the other ingredients. If used in amounts substantially greater than 5% it tends to make the alloy too brittle. If the article itself is heated say to dull red the tin tends to prevent the burning out of the calcium and sodium.

Lead in an amount to make up 100%.

The alloy thus formed is of value for other purposes than for bearings because of its unexpectedly high tensile strength and ductility. For example, an alloy consisting of sodium 0.8%, calcium 0.3%, tin 2.0%, aluminum 0.02%, balance lead, has a tensile strength of 15,000 pounds per square inch and an elongation of 7% for a two inch length. This is about the tensile strength of leaded bronzes containing 75% of copper, 5% tin and 20% lead; or of the yellow brass, so-called.

An alloy to take the place of tin-lead babbitt, may be made by incorporating with lead, 2% to 5% of tin and 0.5% to 1.0% of sodium. The tin and lead are melted together and the sodium added with the melt at a temperature approximately the melting temperature of lead and covered with a flux, as described, neutral to sodium and of a character to exclude oxygen.

I claim:

1. Method of making a lead-sodium alloy which comprises introducing an anti-drossing metal into the molten lead heated to a point to melt said anti-drossing metal, allowing the melt to cool, and introducing sodium into the same while at a temperature between the melting point of sodium and its vaporizing point.

2. A lead alloy containing from 0.3% to 1.0% sodium, 0.3% to 1.0% calcium, and 0.02% to 0.1% aluminum.

3. A lead alloy containing a small quantity of tin and from 0.3% to 1.0% sodium, 0.3% to 1.0% calcium and 0.02% to 0.1% aluminum.

4. Method of compounding a lead sodium alloy which comprises introducing small quantities of calcium and aluminum into molten lead covered with a molten stratum of a halogen salt of an alkaline earth metal.

5. Method of compounding a lead sodium alloy which comprises introducing small quantities of calcium and aluminum into molten lead covered with a molten stratum of a halogen salt of an alkaline earth metal, allowing the melt to cool and introducing the sodium into the same when at a temperature below the vaporizing point of sodium.

6. Method of compounding a lead sodium alloy which comprises introducing small quantities of calcium and aluminum into molten lead covered with a molten stratum of calcium chloride.

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