Patented May 23, 1933 1,910,446

UNITED STATES PATENT OFFICE

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MELTING COPPER-LEAD

No Drawing. Application filed August 18, 1931, Serial No. 557,947. Renewed January 18, 1933.

The present invention relates to a process for obtaining mixtures of copper and lead in either the molten state or in the solid state, wherein the metals are thoroughly intermixed so that articles may be cast or otherwise made therefrom of uniform composition throughout.

Attempts have hitherto been made to produce thorough mixtures of these metals, but this has always involved the addition of other elements or materials, such for example, as other metals or sulphur, and especially when the proportion of lead in the copper-lead metal ran from about thirty to fifty percent of the whole, the added materials generally being retained in the composition. I have found that the relatively pure copper-lead alloys have better anti-friction properties than similar alloys containing sulphur or other metals and that the alloy containing sixty percent of copper and forty percent of lead particularly has superior anti-friction properties for bearing purposes.

An object of my invention is the preparation of mixtures of copper and lead which have desirable bearing characteristics to a high degree.

Another object of my invention is the preparation of a molten mixture of copper and lead having the same composition throughout the mass thereof.

Another object of my invention is the preparation of a molten mixture of copper and lead having a uniform composition throughout the mass thereof so that that part of the mass poured first will have the same composition as that part of the mass poured last.

Another object of my invention is the preparation of mixtures of copper and lead which do not contain foreign substances.

Another object of my invention is the preparation of a bearing metal consisting essentially of copper and lead wherein the lead content may be as high as fifty percent of the whole.

Another object of my invention is the preparation of a bearing metal consisting of sixty percent of copper and forty percent of lead.

Another object of the invention is the preparation of various articles including bearing surfaces consisting of copper and lead in varying proportions wherein the lead may be the minor ingredient or equal to half of the whole mixture and wherein the composition of the article made is uniform throughout or may be controlled.

Another object of the invention is to cause copper and lead rapidly to become thoroughly mixed in the liquid state so that castings containing any desired proportion of lead up to forty percent of the whole or even fifty percent of the whole, the balance being copper, can be made of substantially unvarying composition.

Other objects of the invention will become apparent on reading the appended description.

Lead and copper are practically immiscible in the solid state but they are completely miscible at equilibrium in all proportions when in the liquid state above 1900° F. In practice, however, it has been very difficult to arrive at such equilibrium since the greater part of the lead tends to remain in the lower part of the melt, so that castings made by pouring such metal into a mold or by cast-welding such metal against and onto a solid metal, which may be a backing of iron or steel or other suitable material, vary in composition at different points thereof.

In the following I shall describe a specific process of melting together copper and lead for obtaining my novel result of a rapid and thorough intermixture of the ingredients, it being understood, however, that considerable variations in detail and changes may be made without departing from the essence of my invention, my preferred practice being as follows:

I prefer to melt in crucibles, but electric furnaces of the arc type are also practicable, and it is to be understood that any suitable type of melting device is within the spirit of my invention. When using a crucible I first heat it to about 1800° F. and then place in the bottom thereof one and one-half grams of cupric oxide (CuO) for

each pound of metal in the mixture when finally completed, this corresponding to about one-third of one percent of cupric oxide with respect to the entire melt.

On top of this copper oxide I place the total amount of lead required in pigs, this, of course, melting very rapidly. I next cover the molten lead with a protective flux which is made up of a mixture of borax and some earthy substance, such as shale or clay. The preparations of the borax and earthy substance should be so chosen that the flux will be fluid and afford a complete covering for the complete allow when the same is molten, but no determinate composition can be given, since this will vary with the type of earthy substance. It is desirable to have the earthy substance present in the flux, since borax attacks the crucible rather rapidly, the presence of the earthy substance in the flux reducing this to a degree dependent on the amount thereof present and on the composition thereof. For heating a two hundred pound melt, I preferably employ from eight and one-half to ten and one-half pounds of such flux.

In commercial operation there is always a certain amount of scrap metal resulting from previous pours and the like, and such copper-lead scrap may be added, and preferably is so added, along with the new or un-leaded copper. I prefer as a matter of shop practice to use the copper-lead scrap in the form of small pigs or briquettes, and these are put into the crucible containing the copper oxide and the molten lead and flux, whereupon there is added as much of the new or unleaded copper, which is preferably of electrolytic grade, as is required for the melt or as much as may be safely placed in the crucible.

I prefer to maintain a neutral to reducing atmosphere and I also prefer not to force the melting too strongly, since this may have a bad effect on the metal, as by gassing the metal if there is too much flame, or otherwise. When the copper and copper-lead scrap have been melted down, the crucible charge is completed, if not already complete, by the addition of the proper amount of copper or copper-lead scrap, or both.

Heating of the crucible may, of course, be continuous except for possible interruptions for charging it, as may be convenient.

The metal is brought to a good casting temperature before casting and with this in view the contents of the crucible are brought to a temperature of about 2100° to 2200° F.; the flame is shut off, the crucible removed from the furnace, and the flux is thickened by the addition of sand, and removed with a graphite stirring rod, leaving a thin protective covering of thickened flux from beneath which the metal is poured while an operator holds back the flux with a suitable skimmer.

In this manner I am able to pour castings and to make cast weldings so that the resulting solid articles will be of uniform composition, even though the lead content is forty percent or even fifty percent or more of the whole.

I do not wish to limit my invention by or to any theory, but my process appears to depend upon some phenomenon of oxidation of the lead by the copper oxide prior to the addition of the copper, such oxidation apparently facilitating the mixing of the copper and lead in the molten state so that the molten mass will be practically of uniform composition throughout. Apparently, lead oxide is dissolved in or in some way carried by the molten lead, and my theory of a partially oxidized molten lead is based on my discovery that good results may be obtained when the copper oxide may be replaced by an equivalent amount of lead oxide, and also since good results may also be had without the addition of any metal oxide, if the molten lead be first slightly oxidized by suitable exposure. The process, however, is facilitated by the addition of copper or lead oxide, and of these I prefer the copper oxide. I assume that such copper oxide reacts promptly with the superhot lead to produce metallic copper and lead oxide.

The cupriferous material, that is, the electrolytic copper or the copper lead scrap, which is placed in the crucible on top of the molten lead melts slowly, and as it trickles down it immediately becomes thoroughly mixed with the lead which I believe to be partially oxidized. When the melting has been completed, the crucible contains a thoroughly mixed melt of copper and lead without the necessity of stirring. It is to be noted, however, that if the copper is melted first and the lead dropped into the melt, no amount of stirring will result in a melt which is of uniform composition throughout and the first castings out of the crucible may contain as little as ten percent of lead.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The process of making uniform mixtures of copper and lead, which comprises adding molten metal of the class consisting of copper and copper-and-lead to molten lead at a temperature above the melting point of copper and containing lead oxide.

2. The process of making uniform mixtures of copper and lead, which comprises adding molten copper to molten lead containing lead oxide.

3. The process of making uniform mixtures of copper and lead, which comprises

adding molten copper-lead metal to molten lead containing lead oxide.

4. The process of making uniform mixtures of copper and lead, which comprises adding molten copper and copper-lead metal to molten lead containing lead oxide.

5. The process of making uniform mixtures of copper and lead, which comprises melting lead in the presence of an oxidizing agent to obtain a small amount of oxide therein, and melting thereinto metal of the class consisting of copper and copper-and-lead.

6. The process of making uniform mixtures of copper and lead, which comprises melting lead in contact with a small amount of copper oxide, and melting thereinto metals of the class consisting of copper and copper-and-lead.

7. The process of making uniform mixtures of copper and lead, which comprises melting into super-heated molten lead containing lead oxide metal of the class consisting of copper and copper-and-lead.

8. The process of making uniform mixtures of copper and lead, which comprises mixing molten copper with molten lead which contains lead oxide and which is at about the melting point of the copper.

9. The process of making uniform mixtures of copper and lead, which comprises placing lead in a crucible of inorganic material which is at a temperature of about 1800° F. and which contains an amount of a material of the group consisiting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the mixture when finally completed, covering the molten mass with a protective flux, adding solid copper thereto and melting the copper.

10. The process of making uniform mixtures of copper and lead, which comprises placing lead in a crucible of inorganic material which is at a temperature of about 1800° F. and which contains an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the mixture when finally completed, covering the molten mass with a protective flux of borax and siliceous earthy substance, adding solid copper thereto and melting the copper.

11. The process of making uniform mixtures of copper and lead, which comprises placing the total amount of lead required as pigs in a crucible of inorganic material which is at a temperature of 1800° F. and which contains an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grains of cupric oxide for each pound of metal in the mixture when finally completed, covering the molten mass with a protective flux of borax and siliceous earthy material, adding copper pigs and any previously made copper-lead scrap thereto, and melting the copper and scrap.

12. The process of making uniform mixtures of copper and lead, which comprises placing the total amount of lead required as pigs in a crucible of inorganic material which is at a temperature of 1800° F. and which contains an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the mixture when finally completed, covering the molten mass with a protective flux of borax and siliceous earthy material, adding copper pigs and any previously made copper-lead scrap thereto, melting the copper and scrap, heating the metal to about 2100° to 2200° F., thickening the flux with sand, removing most of it with a rod, and pouring the metal from beneath the remaining thin layer of thickened flux.

13. The process of making uniform mixtures of copper and lead, which comprises melting into super-heated molten lead containing lead oxide metal of the class consisting of copper and copper-and-lead, the amount of said lead oxide being equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product.

14. The process of making uniform mixtures of copper and lead, which comprises mixing molten copper metal with molten lead which contains lead oxide and which is at a temperature at least as high as the melting point of the copper metal, the amount of said lead oxide being equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product.

15. The process of making uniform mixtures of copper and lead, which comprises heating lead together with an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product, covering the molten mass with a protective flux, adding solid copper thereto and melting the copper.

16. The process of making uniform mixtures of copper and lead, which comprises heating lead together with an amount of a material of the group consisting of copper oxide and lead oxide, equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product, covering the molten mass with a protective flux of borax and siliceous earthy substance, adding solid copper thereto and melting the copper.

17. The process of making uniform mixtures of copper and lead, which comprises

heating lead together with an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product, covering the molten mass with a protective flux of borax and siliceous earthy material, adding copper pigs and any previously made copper-lead scrap thereto, and melting the copper and scrap.

18. The process of making uniform mixtures of copper and lead, which comprises heating lead together with an amount of a material of the group consisting of copper oxide and lead oxide equivalent to about one and one-half grams of cupric oxide for each pound of metal in the final product, covering the molten mass with a protective flux of borax and siliceous earthy material, adding copper pigs and any previously made copper-lead scrap thereto, melting the copper and scrap, heating the metal to about 2100° to 2200° F., thickening the flux with sand, removing most of it with a rod, and pouring the metal from beneath the remaining thin layer of thickened flux.

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