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DRAWN BRASS BEARING ALLOYS

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The present invention relates to drawn brass bearing alloys and, more particularly, to drawn pre-pressed brass bearing alloys containing an excessively high copper content and to a method of producing the same.

Heretofore, conventional brass alloys have been used for the manufacture of bearings, but such alloys had to be cast and machined. Prior endeavors have been made to provide modified brass alloys containing hard constituents and capable of being pressed directly into a bearing with only a small amount of machining. Such alloys were incapable of being drawn and the art believed that the highest content of copper was about 58%.

I have discovered that special brass alloys containing a critical amount of silicon and of manganese and containing not less than 62% and not more than 80% of copper can be drawn and can be used satisfactorily as bearings.

It is an object of the invention to provide a drawn article constituted of brass alloy containing more than 62% and capable of being drawn in cold state.

A further object of the invention is to provide a special brass alloy capable of being pre-pressed hot and drawn cold into tubes or rods having accurate dimensions.

Another object of the invention is to provide hot pressed and cold drawn tubes made of brass alloys with a high copper content and capable of being used directly as a bearing.

The invention also contemplates the provision of novel bearing brass alloys which are softer while more resistant to wear than prior pressed alloys containing less copper. It is likewise within the contemplation of the invention to provide a drawable brass alloy containing silicon and manganese and hardened with about 0.05 to about 3.0% of nickel.

The invention also provides a drawn brass alloy bearing with a higher copper content and a thinner section than prior pressed brass alloys.

Other objects and advantages of the invention will become apparent from the following description.

According to the present invention, brass alloys are contemplated having not less than 62% and not more than 80% copper and containing a critical amount of silicon together with manganese. Special brass alloys having the following composition have been found to be capable of being drawn.

<table>
<thead>
<tr>
<th>Element</th>
<th>Per cent</th>
</tr>
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<tbody>
<tr>
<td>Copper</td>
<td>62 to 80</td>
</tr>
<tr>
<td>Silicon</td>
<td>0.5 to 5</td>
</tr>
<tr>
<td>Manganese</td>
<td>25 to 5</td>
</tr>
<tr>
<td>Zinc</td>
<td>Remainder</td>
</tr>
</tbody>
</table>

Alloys of the aforesaid type have been found to be especially susceptible to drawing operations when subjected to a preliminary working operation including pressing, extruding or rolling particularly while in a hot condition. Tubes constituted of the aforesaid special brass alloys with high copper content can be subjected to a preliminary pressing operation and then drawn to accurate dimensions. The precision can be such that the tubes can be cut into proper lengths and can be used directly as bearings, bushings, etc.

It has been discovered that the special brass alloys can be subjected to a heat treatment which involves heating the alloys in the soft condition to a temperature of about 300° C. to about 450° C. for several hours (for instance, about 2 hours to about 5 hours). This heat treatment increases the hardness of the brass alloys considerably. Prior to the aforesaid heat treatment, the alloys may be heated and quenched from about 750° C. which will harden the alloy (i.e. render the alloy harder than as cast), or may be allowed to cool slowly.

A special brass alloy composed of about 62.5% copper, about 1.1% silicon and about 2.75% manganese had its hardness increased from about 56 to about 169 Brinell by the aforesaid heat treatment.

For the purpose of hardening and strengthening the matrix of the special brass alloys herein, I have found that the addition of 0.05 to about 3% of nickel is very effective. From my observations it appears that nickel has the same influence on the structure of the alloy as increasing the copper.

It was a surprising discovery to find that the present alloys which are devoid or substantially free from aluminum can resist wear better than prior alloys containing aluminum. This discovery is accentuated by the fact that it is contrary to the belief of the art that aluminum was necessary or very beneficial to make the alloys harder and more resistant to wear.

The drawn articles produced in accordance with the present invention have a unique structure. Needles of manganese silicide are broken into fragments and are distributed in the matrix of the alloy. This may be clearly seen from the accompanying drawing which is a reproduction of a photomicrograph of the drawn alloys described herein. An explanation of the drawability is that during preliminary pressing operations the needles are oriented in a certain direction, usually parallel to each other, and that during the drawing the needles are broken into fragments which are distributed in the elongated copper-zinc crystals. This circumstance is also due in part to the great affinity of manganese for silicon and to the fact that silicon in the presence of manganese or iron will not enter into
the alpha copper-zinc solid solution, which would greatly decrease the drawability of the alloy, but 5 will combine with manganese to form the aforesaid needles which are crystallized from the alloy liquidus.

It is to be observed that the present invention provides drawable alloys and drawable articles with over 62% of copper and drawable alloys containing 58% to 62% of copper after such alloys have been subjected to preliminary pressing, etc.

Furthermore, the present invention provides pressable brass alloys containing silicon and manganese or iron and containing over 62% of copper.

I claim:

1. As a new article of manufacture, a pre-pressed tube, rod and the like cold drawn to accurate dimensions comprising a brass composed of a relatively soft matrix constituted substantially of an alpha copper-zinc solid solution containing visible, distributed, fragmentary, wear-resistant needles containing manganese silicide crystallized from the alloy liquidus, said brass consisting of not less than about 62% and not more than about 80% copper, an effective fractional percent from 0.05% up to 5% of silicon, an effective fractional percent from 0.05% up to about 5% of manganese, the great affinity of manganese for silicon being such as to form the aforesaid needles in the alpha-copper-zinc solid solution, and the balance consisting substantially of zinc, said article being softer while more wear-resistant than corresponding brasses without the aforesaid visible, distributed, fragmentary needles.

2. As a new article of manufacture, a drawn bearing made directly from a hot pressed tube cold drawn to accurate dimensions comprising a brass composed of a relatively soft matrix constituted substantially of an alpha copper-zinc solid solution containing visible, distributed, fragmentary, wear-resistant needles containing manganese silicide crystallized from the alloy liquidus, said brass consisting of not less than about 62% and not more than about 80% copper, an effective fractional percent from 0.05% up to about 5% of silicon, an effective fractional percent from 0.05% up to about 5% of manganese, the great affinity of manganese for silicon being such as to form the aforesaid needles in the alpha-copper-zinc solid solution, and the balance consisting substantially of zinc, said article being softer while more wear-resistant than corresponding brasses without the aforesaid visible, distributed, fragmentary needles.

3. As a new article of manufacture, a pre-pressed and drawn article composed of a relatively soft matrix constituted of an alpha copper-zinc solid solution containing visible, distributed, fragmentary, wear-resistant needles containing manganese silicide crystallized from the alloy liquidus, said brass consisting of not less than about 62% and not more than about 80% copper, an effective fractional percent from 0.05% up to about 5% of silicon, an effective fractional percent from 0.05% up to about 5% of manganese, the great affinity of manganese for silicon being such as to form the aforesaid needles in the alpha-copper-zinc solid solution, and the balance consisting substantially of zinc, said article being softer while more wear-resistant than corresponding brasses without the aforesaid visible, distributed, fragmentary needles.

4. As a new article of manufacture, a pre-pressed and drawn article composed of a relatively soft matrix constituted of an alpha copper-zinc solid solution containing visible, distributed, fragmentary, wear-resistant needles containing manganese silicide crystallized from the alloy liquidus, said brass consisting of about 62.5% copper, about 1.1% silicon, about 2.75% manganese and the balance consisting substantially of zinc, the great affinity of manganese for silicon being such as to form the aforesaid needles in the alpha-copper-zinc solid solution, and the article being softer while more wear-resistant than corresponding brasses without the aforesaid visible, distributed, fragmentary needles.

5. A drawn article of manufacture comprising a brass composed of a relatively soft matrix constituted of an alpha copper-zinc solid solution containing visible, distributed, fragmentary, wear-resistant needles containing manganese silicide crystallized from the alloy liquidus, said brass consisting of not less than about 62% and not more than about 80% copper, an effective fractional percentage from 0.05% up to about 5% of silicon, an effective fractional percentage from 0.05% up to about 5% of manganese, and the balance consisting substantially of zinc, the great affinity of said manganese for silicon being such as to form the aforesaid needles in the alpha-copper-zinc solid solution, and said article having been heated to and quenched from a temperature of about 750° C., and having been reheated to a temperature of about 300° C. to about 450° C. for a period of several hours without substantial change in size and shape of the aforesaid needles, and whereby the article is softer while more wear-resistant than corresponding brasses without the aforesaid visible, distributed, fragmentary needles.

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