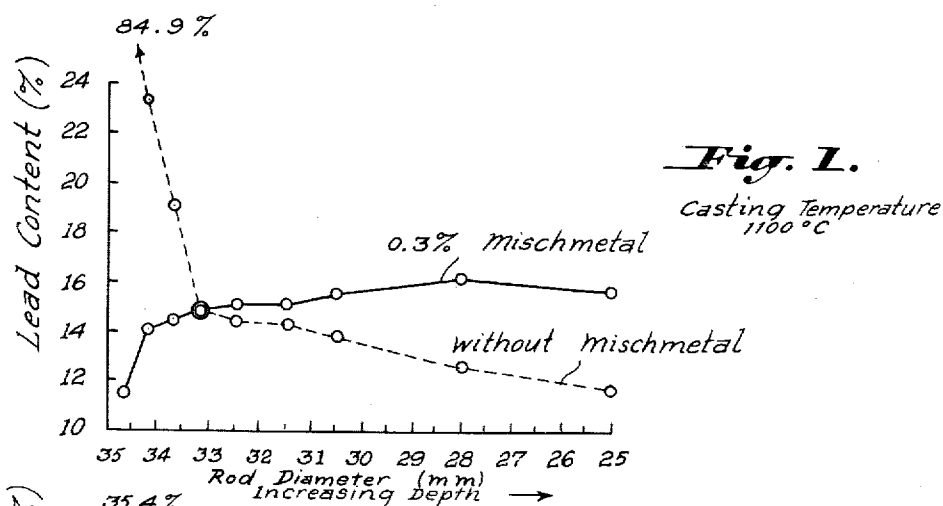
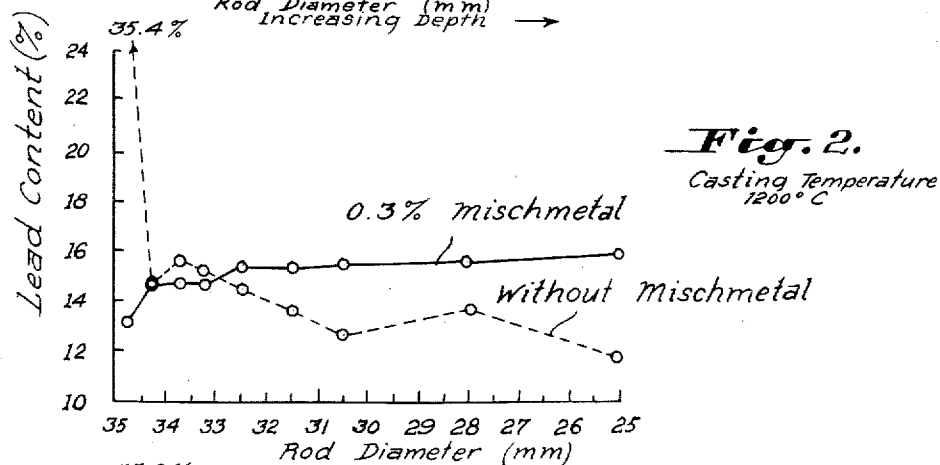
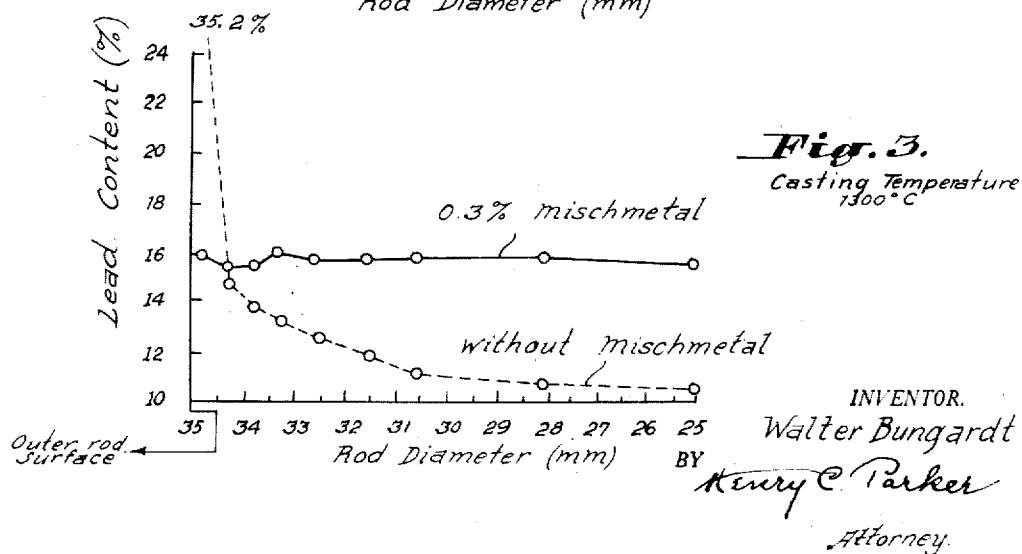


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PROCESS FOR MANUFACTURING BRASS AND BRONZE ALLOYS
CONTAINING LEAD
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PROCESS FOR MANUFACTURING BRASS AND BRONZE ALLOYS CONTAINING LEAD

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5 Claims. (Cl. 75—156.5)

This invention relates to process for manufacturing brass and bronze alloys containing lead; and it comprises an improvement in the manufacture of castings from bronze and brass alloys containing over 50% of copper wherein a small amount of misch metal, amounting to from about .2 to 5% by weight, is added to the alloy before casting, whereby the castability of the alloy is improved and a casting is produced having improved microcrystalline structure and uniformity of composition. The invention also includes the improved castings produced by the described process. An important feature of the invention is the improvement in leaded brasses and bronzes produced by the described addition of misch metal, these alloys containing from about 1 to 35% lead and producing castings whose surfaces are free from inclusions of lead; all as more fully hereinafter set forth and as claimed.

While the casting of brass and bronze alloys has been perfected to an extent not achieved with most other alloys, it is also true that the properties of most of these alloys leaves considerable room for improvement. This is especially true in the casting of intricate parts where the molten alloys lack sufficient fluidity to flow into small recesses and cavities. In many cases the castings formed are not entirely uniform in composition and the microcrystalline structures are sometimes not uniform throughout and are difficult to reproduce. Moreover special difficulties are encountered with certain types of brass and bronze alloys.

For example in the case of alloys classified as leaded brasses and bronzes of the type widely used as bearing metals difficulties frequently arise due to inclusions of lead in the surfaces of the castings. These inclusions appear to be caused by lead oozing to the surface during the solidification of the castings. A pitted surface results which must be machined before use. The turnings can, of course, be recovered and included in the next alloy batch in order to reduce the loss of metal but the machined castings contain less lead than desired. Moreover this lead content is unequally distributed since the surface layers contain more lead than the interiors of the castings.

I have discovered that the above described difficulties can be substantially eliminated by including from about .2 to 5% of misch metal in these brass and bronze alloys. Misch metal is a well known rare earth metal or cerium alloy and is sold under that name. It contains from about 45 to 55% of cerium, 25 to 35% of lanthanum, approximately 15 to 18% neodymium, with a balance of yttria and some further incidental impurities such as iron, silicon, carbon, phosphorous, aluminium, calcium, manganese and magnesium usually totalling less than 2.5%. In some impure misch metals the iron content may amount to 2% or slightly above. While these can be used in the present invention I prefer to use pure misch metals in which the iron content does not exceed 1% by weight.

My tests show that all the alloys classified as leaded brasses and bronzes can be substantially improved by incorporating small amounts of misch metal in their cast-

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ings. These alloys are included within the A. S. T. M. designation: B 119-45, namely: leaded red brass containing 2 to 8% zinc, tin less than 6%, usually less than the zinc, and lead over 0.5%; leaded semi-red brass containing 8 to 17% zinc, tin less than 6% and lead over 0.5%; leaded yellow brass containing over 17% zinc, tin less than 6%, under 2% total aluminum, manganese, nickel, or iron and lead over 0.5%; leaded high-strength yellow brass (leaded manganese bronze) containing over 17% zinc, tin less than 6%, over 2% total of aluminum, manganese, tin, nickel, and iron and over 0.5% lead; leaded nickel brass (leaded nickel silver) containing over 10% zinc, nickel in amounts sufficient to give white color and lead over 0.5%; leaded tin bronze containing up to 20% tin, zinc less than tin, lead over 0.5% and less than 6%; high-leaded tin bronze containing up to 20% tin, zinc less than tin, lead over 6%; lead bronze containing over 30% lead, zinc less than tin, tin under 10%; and leaded nickel bronze containing over 10% nickel, zinc less than nickel, under 10% tin and over 0.5% lead. The castability, machinability and uniformity of composition of all these alloys are improved by the addition of misch metal in accordance with this invention.

My improved leaded bronzes contain from about 1 to 35% of lead, from about 3 to 10% of tin, from about 0 to 4.5% of zinc, from about 0 to 3% of nickel and from about .2 to 5.0% (preferably from about 0.2 to 0.5%) of cerium misch metal, with a balance, over 50%, of copper.

The accompanying drawing shows the striking improvement in the uniformity of composition produced in castings of a typical leaded bronze rod, containing 15% lead, 3% tin, 2.5% nickel and 79.5% copper, by the addition to this alloy of only 0.3% misch metal. The data shown plotted in the three figures of the drawing were obtained by casting rods in sand at different casting temperatures from the alloy stated, both with and without the addition of 0.3% misch metal, all of the rods having original diameters of 35 mm., then machining off surface layers from these rods to depths of 0.25 mm., 0.75 mm., 1.25 mm., 1.75 mm. etc. and analyzing the cuttings for their lead content. The lead contents thus obtained are plotted in the figures as ordinates against the rod diameters (after machining) as abscissas.

The rod diameters are plotted in such fashion that the centers of the coordinates coincide with the surfaces of the rods, i. e. at diameters of 35 mm. The curves thus show the lead contents of the rods as a function of the distances from the surface layer. The dotted lines in each of the figures represent the data obtained with alloys free from misch metal while the full lines are plotted from the data obtained with the same alloys but containing 0.3% added misch metal.

The two alloy compositions used in the three figures were the same and the procedures used in obtaining the data were identical except for the temperatures used in producing the castings. The data plotted in Fig. 1 were obtained from castings produced at a casting temperature of 1100° C., those plotted in Fig. 2 were obtained from castings cast at a temperature of 1200° C., while those plotted in Fig. 3 were from castings produced at 1300° C. Thus the figures show the effect of the casting temperature on the uniformity of the alloy compositions as a function of the distance from the surface layer.

The figures of the drawing show that in castings free from misch metal there is a surprisingly high concentration of lead in the surface layers, ranging from 35.2% to 84.9%. They also show that when misch metal is added to the alloys the lead distribution becomes substantially uniform throughout the castings although Figs. 1 and 2 show that at the lower casting temperatures the concentration of lead in the surface layer is slightly below the

average rather than above. There is an optimum percentage of misch metal for each casting temperature at which the surface concentration of lead becomes substantially identical to that of the average. In Fig. 3 the percentage is close to this optimum whereas in Figs. 1 and 2 the percentage of misch metal is slightly above the optimum for the casting temperatures employed. In most cases the addition of only from about 0.2 to 0.5% of cerium misch metal or from about 0.1 to 0.3%, based on its cerium content, is required to produce best results.

All of the sand castings produced in the above described tests from the alloy which was free from misch metal were found to have uneven and pitted surfaces rich in lead. Before commercial use these surfaces would have had to be removed resulting in considerable costs both for machining and for metal recovery. In contrast the castings produced from the alloy containing misch metal were copper-colored, smooth and homogeneous and would have required a minimum of finishing before use.

The various extraneous metals and impurities present in technical grades of misch metal generally produce no detrimental effects. The novel technical effect, namely the elimination of surface inclusions of lead, is obtained regardless of these impurities. The other physical and mechanical properties, such as hardness, malleability and elasticity are either maintained or improved by the misch metal additions regardless of impurities present in the misch metal. However in the case of several special uses for the alloys in question it is desirable to employ the purer grades of misch metal in order to keep the impurities, especially iron, to a minimum.

The misch metal can be added as such to the molten copper base alloy or in the form of a cerium-rich pre-alloy, if desired. My alloys are particularly suitable for use as bearing metals, for armatures and apparatus for the chemical and electrical industries.

While I have emphasized in the foregoing the elimination of lead inclusions, i. e. the segregation of lead, as being an important new technical effect obtained by the addition of misch metal to leaded brasses and bronzes, an effect which is of equal importance in many cases is the elimination of microporosity in and improvement of the structure of castings. Thus I have found that leaded copper base alloys can be improved which have the following specific compositions:

5% tin, 5% lead, 5% zinc, balance copper
4% tin, 6% lead, 7% zinc, balance copper
3% tin, 7% lead, 9% zinc, balance copper
3% tin, 5% lead, 16% zinc, 16% nickel, balance copper

By the addition of from about 0.2 to 0.5% misch metal these alloys show improved castability, an improvement in structure, greater uniformity in technical properties and elimination of microporosity.

Malleable copper alloys of the type classified as brass and special brass alloys can also be improved by the addition of from about .2 to 3% of misch metal. The improved alloys show greater formability both when heated and in the cold, when rolled into sheet, when forged, when extruded and when drawn, for example.

The so-called gun metals, containing 10% tin and 2% zinc or 8% tin and 4% zinc, with a balance of copper, can be improved by similar additions of misch metal. The castability of these gun metals is improved and the castings have a greater uniformity.

The properties of the so-called aluminum bronzes can also be improved by the addition of small amounts of misch metal. These alloys contain from about 88 to 96.1% of copper, 4 to 13% aluminum with lesser amounts of tin and iron. The use of these comparatively inexpensive alloys has been seriously handicapped due to their inferior casting properties due to their high viscosities when molten. I have found that the addition of misch metal to

such aluminum bronzes in amounts ranging from about 0.2 to 5% substantially increases the fluidities of the melts to such an extent that they can be cast readily into intricate castings of excellent properties.

While I have described what I consider to be the most advantageous modifications of my invention it is evident, of course, that various modifications can be made in the specific features which have been described without departing from the purview of this invention. My tests show that the addition of small amounts of one or more rare earth metals or of misch metal will produce improved metal containing from about 8 to 10% of tin and from more than 50% copper) which are usually classed as brasses and bronzes. These alloys usually contain at least about 5% of at least one metal capable of alloying with copper to form a brass or bronze. The more common alloying metals present in this type of alloys are zinc, tin, nickel, aluminum, manganese, lead, antimony, phosphorus, silicon and cobalt. All castings and alloys of this type are improved with respect to uniformity of composition, better and more uniform microcrystalline structure and improved castability due to greater fluidity, these improvements being in addition to special improvements, such as elimination of surface inclusions of lead in castings of leaded brasses and bronzes, the elimination of microporosity in certain alloys and improvement in formability in malleable copper alloys, as explained previously. The improvements noted are due to the presence of the rare earth metals in the misch metal additions. At the present time it would not be economically feasible to add these metals individually and in pure form to the copper alloys due to their prohibitive cost in this form. However, should these metals ever become commercially available in pure form at moderate cost, the advantages of the present invention can be realized by the addition of at least one of the rare earth metals to the copper base alloys in proportions ranging from .2 to 5% by weight. Other modifications of my invention which fall within the scope of the following claims will be immediately evident to those skilled in the art.

What I claim is:

1. An improved process for preventing lead from oozing to the surface of leaded brass and bronze alloys containing at least 50% copper and between about 1 and 35% lead during the casting thereof which comprises adding from about .2 to 5% of misch metal to such an alloy while in the molten state, and then casting the alloy.

2. An improved process for preventing lead from oozing to the surface of leaded brass and bronze alloys containing at least 50% copper and at least 15% lead during the casting thereof which comprises adding about .3% misch metal to such an alloy while it is in the molten state and then casting the alloy.

3. The process of claim 1 wherein the alloy is an aluminum bronze containing from 4 to 13% aluminum.

4. The process of claim 1 wherein the alloy is a gun metal containing from about 8 to 10% of tin and from about 4 to 2% of zinc.

5. The process of claim 1 wherein the composition of the misch metal is from 45 to 55% of cerium, from about 25 to 35% of lanthanum, from about 15 to 18% of neodymium with a balance of yttria and further incidental impurities, the iron content being less than 1% by weight.

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