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METHOD FOR THE PRODUCTION OF COMPOUND CAST BEARING BRASSES BY MEANS OF THE PLUNGING CASTING PROCESS

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Compound cast bearing brasses with supporting brass of steel and lining of lead bronze (Cu+Sn+Pb), the special advantages of which consists therein, that compared with white metal or Babbitt-metal bearings they possess quite considerably higher durability, are produced according to different methods with employment of sand-molds or chills. It is also known, to use herefore centrifugal- or dipping casting methods. According to all these methods a cooling of the compound cast piece is required at the termination of the casting proceeding, which eventually can be accurately regulated, for instance by ring shaped sprinklers.

It has also been proposed, to melt and even to cast the lead-bronze under exclusion of air and thereby that the whole crucible with the melting material is heated in an airtight chamber filled with a neutral gas atmosphere and to also carry through the casting within this chamber. This method is, however, comparatively complicated and does also not entirely prevent the absorption of gas, as also non-oxydising gases, such as hydrogen, are taken up by the molten mass of lead-bronze.

It is also usual to stir molten masses with rods of graphite or other material, in order to thus remove the gases.

It has further been proposed, to remove the impurities which might settle on the inner side of the supporting brass of steel by submitting the brass filled with lead-bronze and covering salt to a centrifuging movement, whereby owing to the centrifugal force the heavy lead-bronze displaces the impurities on the steel brass. The desired effect does, however, not take place completely as covering salt and lead-bronze partly get mixed the one with the other, so that a real separation of these materials does not occur. Owing to this fact the lead-bronze bearings produced in this manner are not suited for especially high stressed purposes, such as construction of motors for air craft.

Compared herewith, the present invention consists in that, with employment of the dipping casting process known as such, the method is conducted so that in a simple manner any impurity and gas-absorption is practically avoided.

This is attained thereby, that the molten lead-bronze is covered with such a thick layer of liquid salt, that the supporting brass serving as dipping vessel and filled with lead-bronze is, prior to the emerging, freed from the excess of lead-bronze by tilting within the salt cover and filled with liquid salt, whereas, in spite of the emerging, a completely continuous salt cover is ensured as well in the lead-bronze of the crucible as also in the lead-bronze of the scooping vessel. By suitable construction of the dipping vessel there is further ensured, that with a correspondingly shaped rod any point of the dipping vessel can be easily and thoroughly rubbed during the heating in salt and in lead-bronze.

The proceeding is, for instance, as follows:

An iron chill, which at the lower portion is tightly closed to form a dipping vessel, this being possible, for instance, by welding-on a sheet metal plate, by pressing-in a sheet metal plate or by working from the full or by other methods known as such, and which is equipped with a handle for gripping by the hands, is first dipped into the molten salt.

After the chill has been heated in the salt bath in known manner to the temperature of the salt of about 900 to 1000° C and by rubbing or the like with a rod of heat-proof material any impurities have been removed from the inner side of the dipping vessel, the dipping vessel filled with salt is brought into a molten mass of lead-bronze, which is covered with salt. With the aid of a heat-proof rod any impurities are again removed from the inner wall of the dipping vessel. The dipping vessel, which is now filled with the heavy lead-bronze, is taken out of the crucible in such a manner that the continuity of the salt layer on the lead-bronze of the dipping vessel and of the crucible is not destroyed. This is attained thereby that some of the lead-bronze by tilting the vessel is poured out of the vessel from above the molten lead-bronze, but from below the salt layer which covers the lead-bronze in the crucible, so that the salt replaces instantaneously this poured out lead-bronze. Only then the dipping vessel is taken out of the crucible and cooled.

In the method above described the dipping vessel of iron must be left in the molten mass of lead-bronze until heating of the vessel and a certain diffusion of molten mass and iron of the dipping vessel has occurred. With this object in view, the individual dipping vessel must remain at least a few minutes in the molten mass of lead-bronze. The molten mass of lead-bronze in the crucible takes up iron from the outer walls of the dipping vessels, whereby the molten mass is continually enriched in iron in the course of time. Also the molten mass inside the dipping vessel is continually enriched in iron during the time it remains in this dipping vessel. As already stated above, it is possible to effect part of the heating of the dipping vessel by dipping the same into molten salt prior to the dipping into the molten lead-bronze. As, however, iron contents of more than 0.5% are already prejudicial and such above 1% extremely strongly attack the crank shafts, the dipping vessel, according to a development of the invention, may be heated in the molten salt to above the temperature which corresponds to that of the molten lead-bronze. The dipping vessel is then dipped into the molten lead-bronze by the shortest way and left in the same only until the molten salt has been displaced and the dipping vessel has just filled with lead-bronze. The space between the molten salt and the crucible can be made so short, by placing the two crucibles directly the one at the side of the other, that only a very insignificant drop of temperature occurs.

If up to the present only dipping vessels have been mentioned which are shaped like rotary bodies, the invention is not at all restricted thereto. In order to save metal for casting this can be applied onto bendable sheet metal plates of steel. In the sense of the present invention high quality compound cast bearings can be produced thereby, that box-shaped dipping vessels open at the upper end and consisting of two or more sheet metal plates mounted the one at the side of the other at a certain distance in a frame or vessel are first heated in a liquid salt bath and cleaned and then filled with liquid lead-bronze, thus displacing the salt, so that a small portion of the salt remains as covering layer on the dipping vessel. As already stated above, it can further be attained by rubbing with a rod on the inner surface of the dipping vessel, that slight impurities or gas bulbs, which might have settled on the inner wall, can be mechanically removed.

Up to the present it has only been stated that bearings are to be used which are cast on one side. If in a similar manner bearings cast on both sides are to be produced thereby that, for reasons of solidity, a thick iron wall is placed around the dipping vessel at a certain distance from the same, the lead-bronze does not adhere solidly on the outer surface of the dipping vessel, the binding is incomplete and the lead-bronze in the interval shows cracks. The lead-bronze adheres only incompletely on the wall laid around the dipping vessel. This defect cannot be overcome if, for instance, the inner side of the jacket is coated with layers which counter-act to the combination with liquid lead-bronze, for instance strong tindering.

Surprisingly a good binding of the outer wall of the dipping vessel can be produced if this outer wall is made of thin-walled sheet iron plate, according to a further development of the invention, and so that this sheet metal plate just withstands the pressure of the liquid lead-bronze, but can be curved inwards in accordance with the shrinking of the metal. In consideration of these conditions a perfect binding is obtained on the outer wall of the dipping vessel; the lead-bronze in the intermediate zone is dense and free from cracks. In a bearing brass with a welded-on bottom at 100 mm diameter and 70 mm height one has worked for instance with a wall thickness of the dipping vessel of 10 mm. The enclosing sheet metal wall was placed around the dipping vessel at a distance of 20 mm. If then the thickness of this wall was 3 mm, a binding on the outer wall of the dipping vessel had not taken place completely. The lead-bronze in the interval was cracked. If instead of the iron jacket 3 mm thick an iron plate only 0.5 mm thick was used, the bronze had well bound on the outer side of the dipping vessel. The surrounding thin sheet metal plate had been curved inwardly; the intermediate layer of lead-bronze was sound.

The real thickness of the sheet metal jacket is absolutely limited. The sheet metal must, on the one hand, be so thick that it withstands the pressure, of the molten lead-bronze, and, on the other hand, so thin that at the solidifying an alteration of shape in inward direction occurs. The thickness of the outer wall limited by these conditions depends evidently on the size of the dipping vessel, especially on the quantity of the molten mass of lead-bronze, which is between the outer wall and the steel lump to be cast. The relation of lead-bronze in kg to the thickness of the sheet metal plate in mm amounts approximately to 1:0.2.

Up to the present the manufacturing methods of bearings were represented only in relation to the heating or casting process. Such dipping vessels according to the invention filled with liquid lead-bronze and covering salt are then for cooling placed, for instance, into a ring-shaped sprinkler, but not brought to complete cooling to room temperature. The cooling by water is stopped already when on the inner surface of the vessel's red-heat temperature (700 to 800° C) exists on an extent of about one quarter of the diameter of the bearing.

If the dipping vessels are cooled in water from the casting temperature down to the room temperature, the steel cup directly exposed to the action of the water is much more rapidly cooled than the lead-bronze in the steel vessel. The heat expansion coefficients of the two metals or alloys are further very different, so that great tensions exist in the completely cooled vessels. Whilst therefore by the sudden cooling down to room temperature strong bulgings occur, these disagreeable properties can be avoided thereby, that the cooling from red heat temperature of the bearing core to room temperature is carried out without water cooling.

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