Published July 13, 1943

Serial No. 321,788

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF BERYLLIUM CEMENTED METALLIC ARTICLES

Hans Bernstorff, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 1, 1940

Object of my invention is a process for the manufacture of metallic articles which are predominantly subjected to surface abrasion, such as for instance, bearing boxes, cylinder walls, piston rings or collecting brushes.

Hitherto, bearings for special purposes have entirely been made of beryllium alloys, for instance, from a copper beryllium alloy. Moreover, it was suggested to coat metallic layers with beryllium or to use beryllium as cementation means, for instance, for cast iron, in order to increase its hardness and resistance against corrosion. The high cost price of beryllium, however, inhibited its utilization in a wide scale.

My invention is based on the fact that it is far more advantageous to produce only a thin surface coating of beryllium alloy on the metal base on the points where the latter is attacked by abrasion or wearing. In accordance with my invention, metallic articles which are subjected to a surface abrasion are produced in such a manner that the articles are superficially coated with a thin layer of metals, such as nickel, cobalt, chromium, manganese, especially copper, whereupon they are subjected to a heat treatment with beryllium whereby care is to be taken that oxygen is excluded. Instead of pure beryllium, beryllium alloys or mixtures of beryllium with other suitable metals, such as copper, nickel, cobalt, chromium or manganese may be used.

In carrying out my invention, for instance, a steel tube or a bearing box of iron is copper-plated or coated with any other suitable bearing metal, for instance, nickel, cobalt, chromium or manganese which after cementation with beryllium will resist to a stronger surface abrasion. Thereafter the interspace is filled with beryllium powder of a subdivided beryllium alloy, for instance of beryllium-copper alloy. I prefer to use cementation means of a great fineness, finer than 10.000 meshes or even more. Now the beryllium or beryllium alloy is brought into contact with the surface layer of the coating metal, at elevated temperture. As the beryllium has a special affinity to oxygen, mainly at elevated temperatures, the cementation is carried out either in vacuo or indifferent gases, as for instance, in an hydrogen or rare gas atmosphere. The cementation may be carried out advantageously in a resistance furnace or high frequency furnace, heated by hot gases to the necessary temperatures, i. e. to about 850° C. The diffusion of the beryllium may be enhanced by utilizatoin of hydraulic pressure

The advantages of my invention are obvious. As the metallic coating is made very thin, the time of cementation may be shortened considerably in comparison with the hitherto known processes. Moreover, by the sizing of the depth of the layer and by the content of beryllium in the cementation means as well as by the control of temperature during the cementation process, the quantity of beryllium to be diffused may be regulated in such a manner that the beryllium content in the cemented layer lies in the area which is especially suitable for bearing metals. Thus not only a very economic working will be secured, but at the same time a controlling of the beryllium concentration may avoid the forming of undesired phase, for instance, of brittle and coarsegrained intermetallic compounds in the cemented coating.

In accordance with my invention articles with a coating of bearing metals will be obtained with excellent properties as regards hardness, resistance against abrasion, self lubricating qualities and so on. After the cementation of the bearing metal coating, the articles may be subjected to an additional hardening by a suitable heat treatment. Articles which are coated with a copper beryllium layer may, for instance, be quenched at 700° C. and tempered again at temperatures of about 200 to 300° C.

My invention makes it possible to reduce the layer which is attacked by wearing, to a minimum depth, thereby using the beryllium only for its proper purpose, i. e. as hardening means. This opens the field for a wider utilization of beryllium in case hardening processes.

HANS BERNSTORFF