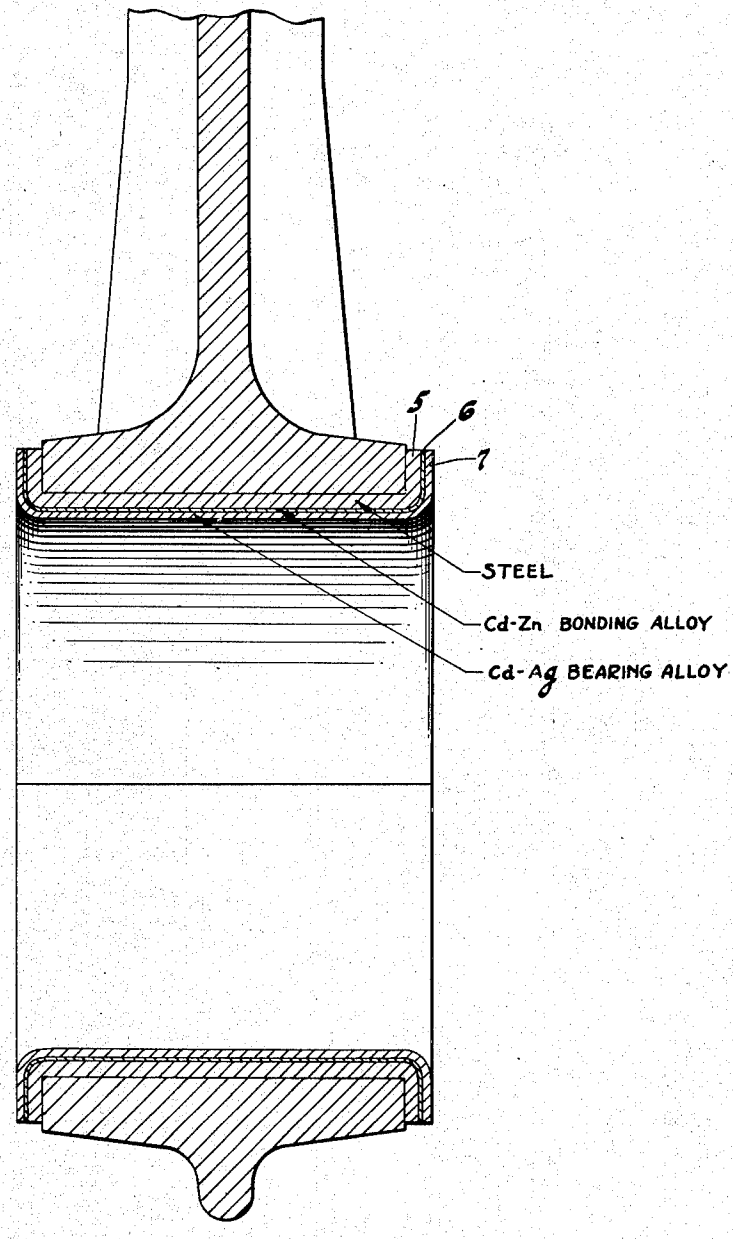
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BEARING

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BEARING

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The invention relates to bearings and processes of making same and is particularly concerned with the use of new and improved compositions or alloys peculiarly adapted to meet the exacting conditions to which bearings are subjected in high speed machinery.

Bearings designed for use under relatively high speeds and pressures, as in the principal bearings of internal combustion engines, are generally faced with a relatively soft alloy of the class known as Babbitt metal, comprising tin and small percentages of antimony and copper. In operating engines at high speeds involving high temperatures of the lubricant and bearing parts, babbitt surfaced bearings readily reach a temperature at which they become so weakened that disintegration occurs and sometimes they even reach the melting point.

In attempting to overcome the difficulties incident to the use of Babbitt metals, I have found that an alloy of cadmium with a relatively small content of silver and, preferably, a very small addition of copper and/or nickel possesses remarkable properties when embodied in bearing surfaces. The silver content does not become appreciably effective until about 0.5% has been added and the upper limit is in the neighborhood of 5%, although with a content of over 3.5% it becomes increasingly difficult to maintain the homogeneity of the alloy. The silver content that I have found most satisfactory is approximately from 1.75% to 2.50%.

Either copper or nickel, or both, may be added as hardening agents but the amount should be relatively small, not exceeding about 1% and preferably being restricted to between 0.25% and 0.5%. The bearing alloy in its preferred composition would therefore contain:

	Percent
Silver	1.75– 2.50
Copper or nickel	0.25– 0.5
Cadmium substantially the remainder or approximately	97 –98

An alloy such as described melts as about 610° F. as compared to about 450° F. for ordinary Babbitt metals. Its hardness may range from 38 to 50 on the Brinell scale, whereas Babbitt metals range about 21 to 30. The new alloy is also very tough and maintains its strength and toughness at temperatures far above those at which ordinary Babbitt metals disintegrate or melt under conditions occurring in bearing service. It also possess very high anti-friction qualities in contact with steel journals. Its durability has been demonstrated by the fact that a set of bearings faced with this alloy has outlasted three consecutive sets of babbitt-faced bearings under identical conditions.

The application of the new alloy to bearing members such as sleeves, bushings, connecting rods, etc., usually of steel, involves some difficulties in regard to the bonding of the alloy to the base or backing member. I have found it feasible to produce an extremely adherent and, in fact, integral connection between the alloy facing and steel or iron base or backing members by first coating the base with an alloy which produces a result similar to that obtained by the so-called "tinning" process employed to secure Babbitt metals to a base. The coating alloy I employ for this purpose comprises cadmium with an addition of zinc or antimony. When antimony is used the content may be about 7% or 8%; zinc may be used in amounts of 5% to 20%, the preferred range being about 10%–15%.

The amount of bonding metal, as zinc, added to the cadmium to constitute the coating or bonding alloy depends somewhat upon the amount of such metal permissible in the bearing surface, since the bonding constituents diffuse through the bearing alloy when the latter is cast upon the coated surface. I find, for example, that the bearing metal gives most satisfactory service if the amount of zinc present at its surface is not over about 0.25%. Therefore, although the zinc or antimony is required to provide coherence or alloying with the surface of the base, as bronze or ferrous metal, and also serves to protect the cadmium ingredient from oxidation, its amount should be restricted as indicated.

A process of making a bearing member embodying the invention may be described briefly as follows. A foundation or base of strong metal as bronze or steel, is first cleaned by the usual methods, as by removing rust, grease, etc., then fluxed as usual for metal coating, as with zinc chloride and hydrochloric acid. The coating or bonding alloy is then applied. This may be done by dipping the base in a molten bath of the bonding alloy which is maintained at a temperature of 650°–700° F. An immersion of about 30 seconds will usually be sufficient to effect coating and bring the temperature of the base up to near that of the bath. The bearing surface is then cast upon the base while the latter is still hot, the fused alloy being at a temperature of about 700°–750° F. After cooling, the bearing surface is finished to the desired dimensions. The final

thickness of the bearing alloy coating need not be over about .010 inch for use, for example, in connecting rod bearings for internal combustion engines for automobiles.

The bond between the bearing alloy and the base is so strong and the bearing alloy itself is so tough that a steel base thus surfaced may be bent substantially upon itself without cracking the alloy or fracturing the bond. These properties, in addition to the relative melting points of the bonding alloy and the bearing alloy, render it possible to make bearing members, such as sleeves or bushings, by first making a blank in the form of sheet material, and then shaping the material to the desired form. For this purpose I prefer to cast the bearing alloy in bar form and cold roll it with any necessary intermediate annealing, to effect the desired reduction in thickness. The cold working of the metal improves its physical properties especially in regard to its compactness and tensile strength. The thin sheet may then be placed upon a sheet of backing material, as sheet steel, with bonding alloy interposed, as by previously coating the base sheet, and the bonding brought about by pressure at a temperature approximating 550° F. The composite sheet so produced may then be severed into blanks of suitable size and formed into bearing members by customary processes.

The accompanying drawing illustrates a bearing member made in accordance with the invention. The base or backing element 5 is indicated as "steel", the intermediate layer 6 of bonding alloy, which, of course, substantially disappears in the completed article by diffusion into the base metal and the bearing alloy, is indicated as "Cd—Zn bonding alloy", and the anti-friction bearing metal 7 is indicated as "Cd—Ag bearing alloy", the specific indications in all cases being for purposes of illustration only. The bearing may, of course, be of any form suitable for the use to which it may be applied.

While I have referred specifically herein to the application of the invention to the manufacture of bearings, it will be understood that various features thereof may be of more general application and I do not desire to be restricted by such description except as required by the appended claims.

I claim:

1. A bearing comprising a base of relatively hard and strong metal and a facing integrally bonded thereto, said facing comprising an alloy of cadmium with relatively small additions of silver and a hardening metal.

2. A bearing as in claim 1, said alloy containing 1.75% to 2.50% silver and 0.25% to 1% of a hardening metal.

3. A bearing comprising a steel backing and an anti-friction facing integrally bonded thereto, said facing comprising an alloy of cadmium with relatively small additions of silver and hardening metal.

4. Structure as in claim 3, said bond comprising cadmium-zinc alloy.

5. Structure as in claim 3, said facing comprising 1.75%–2.50% silver, 0.25%–1% copper and/or nickel, zinc to the amount of not over approximately 0.25%, and the remainder substantially cadmium.

6. A bearing comprising a base of relatively hard and strong metal, a facing of an alloy of cadmium and silver and an intermediate bonding layer comprising an alloy containing cadmium and a metal tending to adhere to the said base.

7. A bearing as set forth in claim 6, the base metal being of ferrous metal and the intermediate bonding layer comprising an alloy of cadmium and zinc.

8. A bearing alloy consisting of silver 0.5 to 5%, a metal of the class consisting of copper and nickel in amount sufficient to impart appreciable hardness but not in excess of about 1% and the balance substantially cadmium.

9. A bearing alloy consisting of silver 1.75 to 2.50%, a metal of the class consisting of copper and nickel 0.25 to 0.5% and the balance substantially cadmium.

10. A bearing comprising a surface layer of a metal alloy consisting chiefly of cadmium and including .5 to 5% of silver, the alloy including a small proportion of a hardening metal.

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