Feb. 25, 1936. G. S. SALZMAN 2,031,982

METHOD OF MAKING BEARINGS

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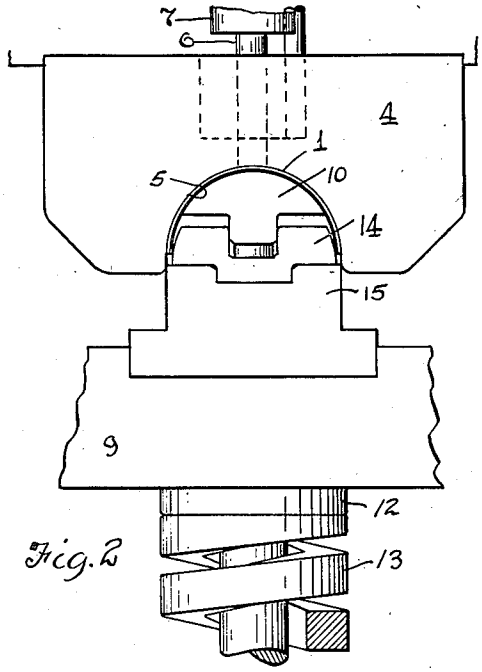


Fig. 2

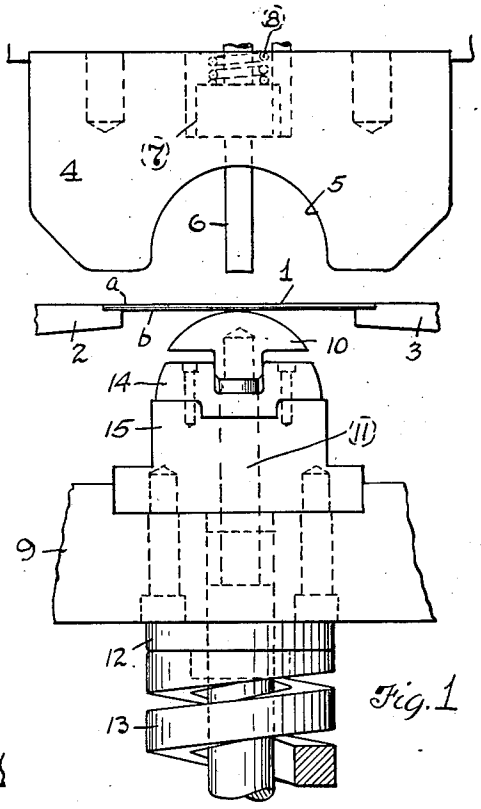


Fig. 1

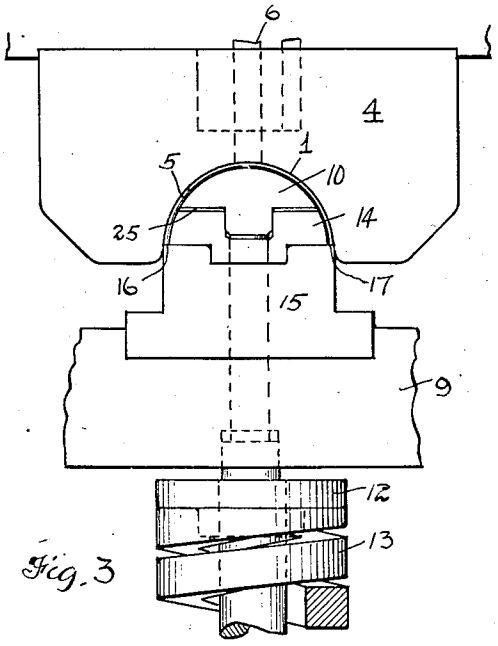


Fig. 3

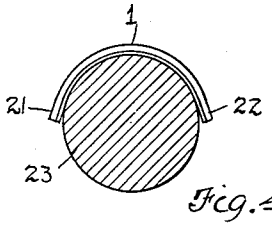


Fig. 4

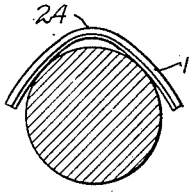


Fig. 5

INVENTOR.

George S. Salzman

BY

Fay, Oberlin & Fay

ATTORNEYS.

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METHOD OF MAKING BEARINGS

George S. Salzman, Cleveland Heights, Ohio, assignor to The Cleveland Graphite Bronze Company, Cleveland, Ohio, a corporation of Ohio

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6 Claims. (Cl. 29—149.5)

The present invention, relating as indicated to the manufacture of bearings, has more particular reference to the quantity production of a semi-cylindrical or half-bearing having a bearing metal or babbit lining and conforming to certain necessary precision limits. The herein described method and apparatus is particularly applicable to bearings having a steel outer face, since one of the objects of my invention is to provide means for forming semi-cylindrical shapes which is especially adapted to act upon the peculiar bending properties of steel.

A further object is to produce a bearing in which the bearing metal has been subjected to a compressive force or mechanical cold working which is productive of a refinement of the grain structure of the metal with corresponding resultant increased strength and durability of the bearing. Objects and advantages additional to those above enumerated shall become apparent during the following description.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the method hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is an elevational view of a pair of die blocks constructed in conformity to the principles of my invention, showing the bearing blank in initial position; Figs. 2 and 3 illustrate further steps in the completion of the herein described process; Fig. 4 is a transverse sectional view of a half-bearing in position on a shaft showing the flat spots which occur adjacent the parting line to an exaggerated degree; Fig. 5 is another transverse sectional view also showing to an exaggerated degree the manner in which the steel die stock tends to bend during ordinary die practice.

Directing attention particularly to Figs. 1, 2 and 3, a flat piece of stock 1 is first placed in position upon the blank holders 2 and 3. This piece of bearing stock 1 is preferably of a bi-metallic composition, having the steel outer face *a* and the inner bearing metal or babbit portion *b*. The upper or female die 4 has a semi-cylindrical face 5 from which extends a plunger 6. The plunger 6 carries the stop block 7 upon which bears the compression spring 8. It will thus be seen that the plunger 6 is spring-loaded and free to project and retract in and out of the die surface 5. The purpose of the retractable plunger 6 is to serve as a means for holding the blank in position and preventing the bearing from bending on a smaller radius than that of the die surface 5 during the forming action of the dies.

The construction of the lower or male die, indicated generally by the numeral 9, is as follows:—The forming core 10, which has a die surface corresponding to a segment of the inner surface of the half-bearing, is carried upon the reciprocal shaft 11. The shaft is in turn spring-loaded by means of the stop washer 12 and compression spring 13. The compression spring 13 is of a strength sufficient to overcome the arcuate bending resistance of the bearing blank, 1. As shown in Fig. 2, the bearing blank 1 has been completely conformed to the inner surface 5 of the female die, and the compression spring 13 has not yet begun to act. In Fig. 3, however, upon the exertion of increased pressure upon the die block 9 the resistance of the spring 13 is overcome and the ironing pad 14 and upsetting punch 15 are forced with a sudden impact against the bearing blank. The ironing pad 14 also serves the function in that it prevents a thickening of the bearing along those portions with which it contacts, and forces the metal toward the central part of the bearing, with the result that there is accomplished a uniform upsetting action which is productive of uniform wall thickness. The force with which the punch 15 is driven against the parting line edges 16 and 17 of the bearing blank 1 is sufficient to impart an upsetting action to the metallic structure of the blank. The die or forming core 10, it should be noted, does not at any time seat upon the ironing pad or upsetting punch 14 and 15 respectively, but is always under spring pressure permitting the metal of the bearing blank to move comparatively freely when the upsetting punch 15 strikes home. As shown in Fig. 3, there is always some clearance between the forming core 10 and ironing pad 14 along the line 25.

The purpose of this last-described action of the forming core 10 in conjunction with the ironing pad 14 is to permit the force of the upsetting blow to be transmitted throughout the arcuate section of the bearing blank.

For the purposes of further illustration of the theory of my invention I have shown in Fig. 4 a bearing blank 1' which has merely been subjected to the coin-pressing action of two semi-cylindrical dies. It will be noted that there occur the

flat spots or areas 21 and 22 adjacent the parting line of the bearing. It is one of the purposes therefore, of the upsetting action of the above-described apparatus to eliminate the flat spots 21 and 22 from the blank and to produce a perfect half circle which will conform to precision requirements. In other words, such upsetting action may be more precisely defined as a compressive force, tangentially directed along the parting line of the bearing, and of sufficient magnitude to rearrange the grain structure of the material of the bearing.

In order to still further illustrate the functional features of my method and apparatus, there has been shown in Fig. 5 the manner in which the die stock, especially when of steel constituency, tends to bulge at its center portion. This bulge is indicated to an exaggerated degree at the point 24. The presence of the spring loaded retractable plunger 6 therefore is for the purpose of eliminating the tendency of the die stock to bend into a radius less than that of the semi-cylindrical die.

It should also be noted that the presence of the forming core or die 10 may be dispensed with when the upsetting pressure is exerted along the parting line of the bearing die stock. The forming core 10, after performing its function of conforming the flat blank to the semi-cylindrical die surface 5, effects no further mechanical deformation upon the die stock and during the upsetting stroke serves merely as a means for properly retaining the semi-cylindrical blank in place.

My method and apparatus perform the further function in that there is imparted a refining or densifying action upon the bearing metal *b*. When the bi-metallic blank is first arcuated as shown in Fig. 2, there occurs a slight extrusion of the babbit, due to the fact that the inner surface of the bearing blank 1 is subjected to the greater deformation. When the upsetting punch strikes home, as shown in Fig. 3, there is exerted upon the babbit metal portion *b* a secondary mechanical deformation which produces a grain refinement in the bearing metal portion. It should be further noted that this final mechanical working or refinement of the grain structure is produced by stress acting in a tangential direction, which has a tendency therefore to improve the properties of the bearing metal in that particular direction in which the maximum stresses will be exerted upon it when in use.

It will thus be seen that my invention provides a method and means for economically and rapidly producing semi-cylindrical bearings which will not only conform to the requirements of precision practice, but also possess improved qualities of durability.

Other forms may be employed embodying the features of my invention instead of the one here explained, change being made in the form or construction, provided the elements stated by any of the following claims or the equivalent of such stated elements be employed, whether produced by my preferred method or by others embodying steps equivalent to those stated in the following claims.

I therefore particularly point out and distinctly claim as my invention:—

1. In the manufacture of semi-cylindrical bearings and the like, the method of conforming the bearing to a radius equal to that of the completed article and then applying a tangentially directed force against the parting line of the bearing sufficient to mechanically deform and rearrange the grain structure of the bearing material.

2. In the manufacture of semi-cylindrical bearings and the like, the method of arcuating the central portion of a flat blank to a radius equal to that of the completed bearing and then applying a compressive force against the end faces of said blank, whereby the blank is subjected to mechanical deformation and the grain structure of its material rearranged.

3. In the manufacture of semi-cylindrical bearings and the like, the method of arcuating the central portion of a flat blank to a radius equal to that of the completed bearing, and then applying a compressive force against the parting line of the bearing, whereby the blank is subjected to mechanical deformation and the grain structure of its material rearranged.

4. In the manufacture of semi-cylindrical bearings and the like, the method of arcuating the central portion of a flat blank to a radius equal to that of the completed bearing, and then applying a compressive force against the parting line of the bearing, while said central portion is held under forming pressure, whereby the blank is subjected to mechanical deformation and the grain structure of its material rearranged.

5. In the manufacture of semi-cylindrical bearings and the like, the method of arcuating the central portion of a flat blank to a radius equal to that of the completed bearing, and then subjecting the end faces to a sudden impact tangentially directed against the parting line of the bearing, whereby the blank is subjected to mechanical deformation and the grain structure of its material rearranged.

6. In the manufacture of semi-cylindrical bearings and the like, the method of retaining the center portion of a flat blank against an arcuate male die surface during the operation of arcuate bending of said blank, conforming said blank to a radius equal to that of the completed bearing, and then applying a compressive force against the parting line of the bearing, whereby the blank is subjected to mechanical deformation and the grain structure of its material rearranged.

GEORGE S. SALZMAN.