June 24, 1930. H. M. WILLIAMS ET AL 1,766,865

ALLOY STRUCTURE

Filed April 6, 1923

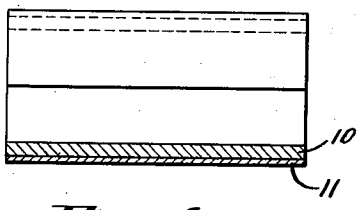


Fig. 1

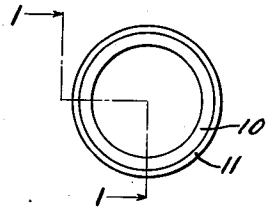


Fig. 2

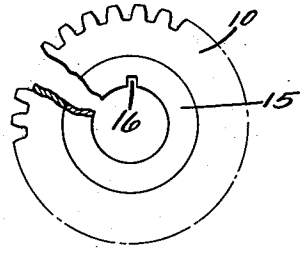


Fig. 3

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UNITED STATES PATENT OFFICE

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ALLOY STRUCTURE

Application filed April 6, 1923. Serial No. 630,414.

The present invention relates to porous alloy structures and particularly to such structures adapted to be used in conjunction with other arrangements where there is rubbing or sliding contact.

Among the objects of the invention is to furnish a substantial support for the porous alloy, which latter is relatively low in resistance to bending and shearing stresses.

Another object is to enable such porous alloy structures to be fixed securely to shafts, etc., so as to avoid radial displacement.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is an elevation partly in section on line 1—1 of Fig. 2, of a laminated bearing sleeve or bushing made according to the present invention.

Fig. 2 is an end view of the same.

Fig. 3 is a plan of a partially cut gear blank made in accordance with the invention, with part of the blank broken away.

Bearings of porous metallic materials capable of absorbing a relatively large proportion of liquid lubricant have been used for plain bearings with a large measure of success. These materials consist of a porous alloy, preferably bronze, having uniformly distributed therethrough a finely divided supporting filling material. Various materials have been used for the latter purpose and among these may be mentioned graphite, mica, magnesia, alumina, talc, etc.

Porous alloy structures, however, of the kind described, do not have sufficient strength to withstand the extreme heavy loads and shocks to which the articles would be subjected if used without reinforcement in some of the places where their properties would make them highly desirable. Accordingly the articles which are subject of the appended claims, have been devised to take care of this particular difficulty, which is overcome by reenforcing the bearing material with a ring or portion of non-porous relatively strong metal, for example, steel. Other materials such as malleable or cast iron and even brass and copper may be used with advantage but steel has been found preferable in most instances.

In the drawings, there have been illustrated a bushing constructed according to the present invention and also a gear.

In Figs. 1 and 2 the porous alloy portion is indicated at 10 and the reenforcing material at 11.

In Fig. 3 the gear is shown as being made of the porous alloy 10 carried upon a steel collar 15 which latter has been slotted as at 16 for the purpose of permitting the use of a key to fix the gear upon a shaft.

The process preferably followed in making plain porous metallic bearings which are not reinforced, is fully described in the patent to Harry M. Williams, No. 1,642,347, issued September 13, 1927, and consists in mixing together finely divided particles of alloy constituents, for example, copper 90 parts and tin 10 parts, together with the supporting filler material (from 2 to 8 parts) also in a finely divided condition. When these materials have been thoroughly mixed, a suitable amount of the mixture is placed in a die and put under a compression of about 75,000 to 80,000 lbs. per sq. inch. After having been compressed, the formed article is placed in a furnace and heated to a temperature of about 1350° F. for about five hours, under non-oxidizing conditions. The formed article is then allowed to cool without access of air and when cooled is sized by forcing through a suitable shaping die.

The process which is the subject of this application differs from that just described in that the amount of pressure applied in the second step is chosen with a different end in view.

In the process of making unreinforced bearings the pressure is so chosen that in the subsequent sintering or alloying process the article will neither swell nor shrink an objectionable amount, so that the die is substantially the size of the finished body.

In the process of this application, however,

when producing an article such as is shown in Fig. 1 of the drawings, in which the reinforcement is on the outside, such a pressure is used that, in the sintering operation, a certain amount of swelling tends to take place. In such cases a pressure of 85,000 to 90,000 lbs. per sq. inch is used. On the other hand, when an article of the type indicated in Fig. 3 is in prospect, the pressure is regulated so as to permit a small amount of shrinkage in the sintering operation, and in such cases a pressure of 65,000 to 70,000 lbs. is used. The reason for this will readily be seen as it is designed to give a better junction between the reenforcing ring and the alloy portion.

Another method of producing articles such as shown in Fig. 3 consists in compressing the alloyable materials between a steel core or liner prepared as indicated below, and an outside steel sleeve, using a compression of about 80,000 lbs. per square inch so as to cause an expansion or swelling in the heating operation. Upon heating this assembly, the compressed material will tend to expand more than the encasing steel sleeve and as the latter is sufficiently strong to resist the pressure, the alloying composition will be forced against the liner or core and exert great pressure against it. This procedure causes an effective bonding of the composition material with the liner or core, while the encasing sleeve may be comparatively easily removed.

It should be added that in producing the articles mentioned herein the reenforcing ring is first tinned upon the surface to be in contact with the alloy and then placed in the die and the operations carried out as described.

The tinning step is carried out to facilitate a cohesive bonding of the alloy and steel or other metal. The junction, therefore, is not merely a pressure contact, but is also a welded or soldered joint. It is obvious that, when using other metals than those mentioned, the "tinning" may be done with something other than tin so as to facilitate the bonding of the layers or laminations.

While the forms of embodiments of the invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What we claim is as follows:

1. A new article of manufacture consisting of a body comprising porous metal bonded cohesively to a reinforcing body of relatively strong non-porous metal by a metallic alloy bond.

2. As a new article of manufacture a hollow cylinder of peripherally laminated structure, one of the laminations of which is of a non-porous relatively strong metal and another of which comprises a porous alloy, said metal and alloy being secured together by a metallic alloy bond.

3. As a new article of manufacture a hollow cylinder of peripherally laminated structure, one of the laminations of which is of non-porous relatively strong metal and another of which comprises porous bronze, said metal and alloy being secured together by a metallic alloy bond.

4. As a new article of manufacture a hollow cylinder of peripherally laminated structure, one of the laminations of which is of a non-porous relatively strong metal and another of which is a porous alloy containing uniformly distributed therethrough a supporting filling material, said metal and alloy being secured together by a metallic alloy bond.

5. As a new article of manufacture a hollow cylinder of peripherally laminated structure, one of the laminations of which is a non-porous relatively strong metal and another of which is porous bronze, containing uniformly distributed therethrough a supporting filling material, said metal and alloy being secured together by a metallic alloy bond.

6. As a new article of manufacture a hollow cylinder of steel having secured therein a lining of a porous alloy, bonded to the steel by a metallic alloy bond.

7. As a new article of manufacture a hollow cylinder of steel having secured therein a lining of a porous alloy, containing uniformly distributed therethrough a supporting filling material and bonded to the steel by a metallic alloy bond.

8. A process of producing laminated structures of porous alloy and non-porous stronger metal laminæ which comprises intimately mixing finely divided alloy constituents; compressing said constituents in a die of which the said metal lamina suitably prepared constitutes a portion; removing the so formed laminated article from the die and heating under non-oxidizing conditions to cause alloying of the said constituents and bonding of the laminæ.

9. A process of producing laminated structures of porous alloy and non-porous stronger metal laminæ which comprises intimately mixing finely divided alloy constituents; compressing said constituents in a die of which the said metal lamina suitably prepared constitutes a portion; adjusting the pressure to such an amount that, in the subsequent heating, the alloy in formation will exert pressure against the said metal lamina.

10. The process which comprises intimately mixing finely divided alloy constituents and finely divided supporting filling material; compressing the mixture into a tinned metal sleeve under such a pressure that the alloy material will expand in a

subsequent heating step; and heating the thus formed article to cause alloying and bonding of the alloy to the sleeve.

11. The process of producing reenforced bearing bushings which comprises simultaneously forming a porous alloy bearing element and bonding said bearing element to a reenforcing sleeve by a metallic bond which alloys with the porous bearing element.

12. A process of making reinforced members adapted to be used with one surface in rubbing contact with another member, which consists in mixing finely divided particles of metal, compressing and thereby molding a quantity of the metallic particles in contact with a reinforceing body of solid metal, and highly heating the so combined molded metallic particles and solid metal until coherence is effected between the molded particles and between said molded particles and the said solid metal.

13. The method of making a bearing member which consists in providing a bearing back, tinning the back, applying powdered metal to the back, subjecting the metal to very heavy pressure to cause it to adhere to the back, and highly heating the resulting article to cause the metal to unite with the tinned back in good heat conducting relation.

14. In the method as defined in claim 13, said pressure being of such degree as to cause the metals to exert pressure against the back during the heating operation for facilitating the union.

15. The method of making a bearing member which consists in providing a bearing back, placing a quantity of finely powdered metal in the back and applying heavy pressure to the powdered metal to cause it to adhere to the back.

16. The method of making a bearing member which consists in providing a bearing back, tinning the back, placing a quantity of finely powdered metal in the back and applying heavy pressure to the powdered metal to cause it to adhere to the back.

17. The method of making a bearing member which consists in providing a bearing back, placing a quantity of finely powdered metallic alloy constituents in the back and applying heavy pressure to the said constituents to cause them to adhere to the back.

18. The method of making a bearing member which consists in providing a bearing back, tinning the back, placing a quantity of finely powdered metallic alloy constituents in the back and applying heavy pressure to the alloy constituents to cause them to adhere to the back.

19. A bearing element comprising a bearing lining of porous metallic structure attached to a relatively strong metal back therefor by an alloy bond.

20. A bearing element comprising a bearing lining of porous metallic structure capable of absorbing lubricant, a relatively strong metal back therefor, and an interposed metal stratum alloyed with both said lining and backing.

21. A bearing element comprising a bearing lining of porous metallic structure capable of absorbing a considerable amount of lubricant, a ferrous metal back for said lining having a metal coating on its surface adjacent said lining, said coating being alloyed with the metal of said lining to give an alloy bond.

In testimony whereof we hereto affix our signatures.

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