Jan. 7, 1969 R. L. HUEBNER 3,419,949

METHOD OF RECONDITIONING CRANKSHAFTS, CAMSHAFTS, AND THE LIKE

Filed Dec. 14, 1966

Fig. 1.

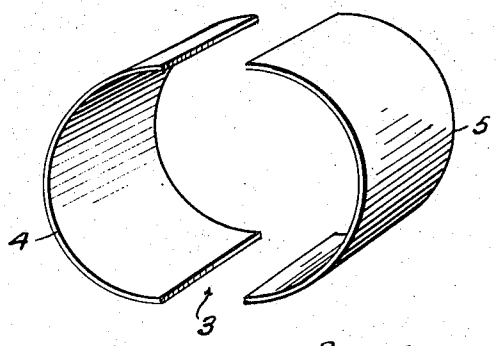


Fig. 2.

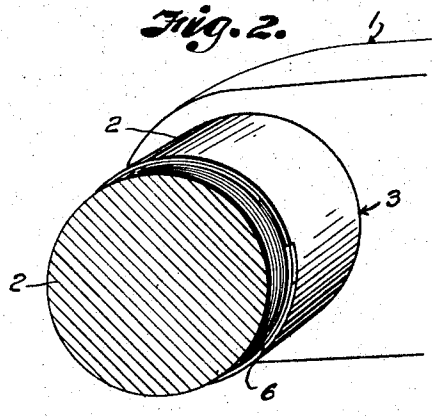


Fig. 3.

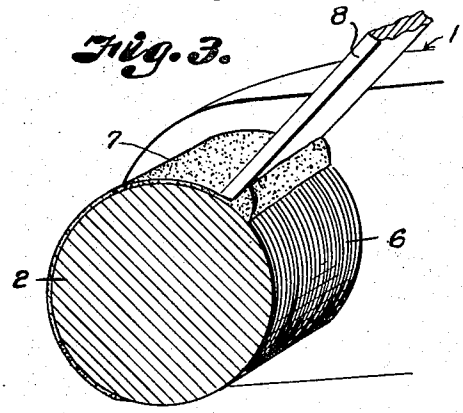


Fig. 4.

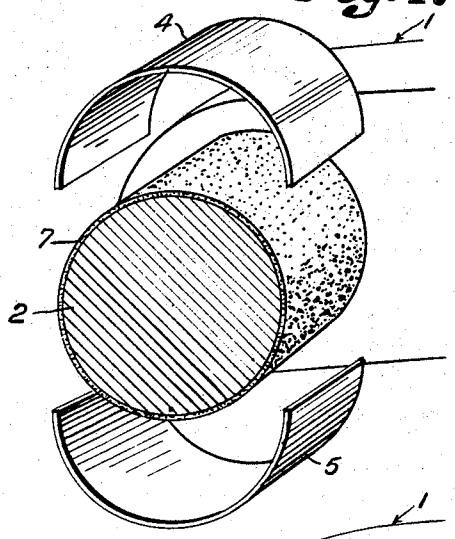


Fig. 5.

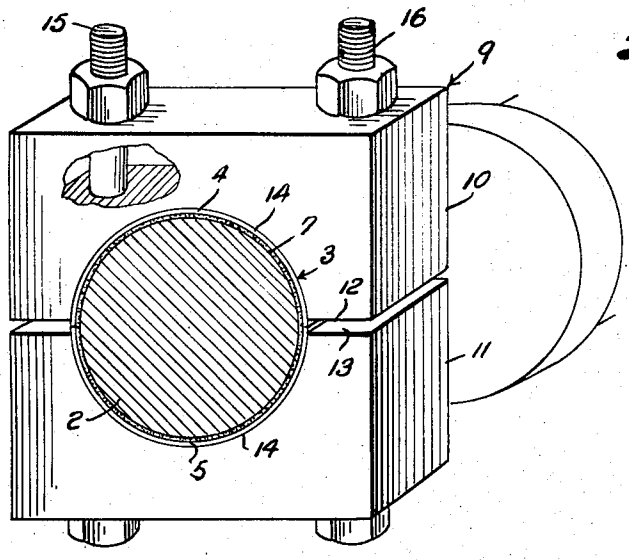
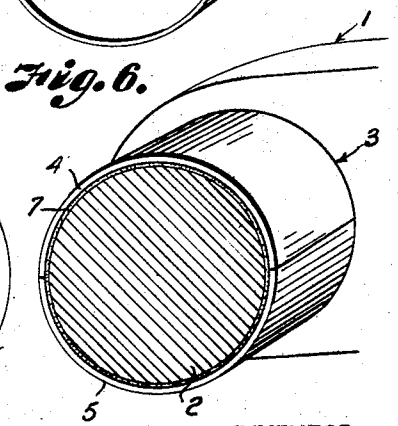


Fig. 6.



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METHOD OF RECONDITIONING CRANKSHAFTS, CAMSHAFTS, AND THE LIKE

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U.S. Cl. 29—401 8 Claims
Int. Cl. B23p 7/00

ABSTRACT OF THE DISCLOSURE

A method of reconditioning worn shafts by reestablishing roundness of the worn portions, cementing sleeves thereon, and grinding the exterior surface of the sleeves down to the original diameters of the shafts.

BACKGROUND OF THE INVENTION

Field of the invention

This invention pertains to reestablishing bearing portions of crankshafts, camshafts, and similar shafts to their original diameter, so that standard sized main and connecting rod bearings may be used.

Description of the prior art

The present methods of conditioning worn shafts usually consist of grinding the bearing portions to establish roundness thereof and fitting thereto of undersized bearings. Such a method obviously results in removing temper of the metal through grinding off the bearing portions, and requires a large stock of various sizes of undersized bearings.

Other common methods are to build up the worn portions of a shaft by application of powdered metals, or by welding on metal which then must be ground to size. These latter methods are not satisfactory because the bearing surfaces thus established do no have the lasting properties and strength of the original bearing surfaces and involve the use of heat.

SUMMARY OF THE INVENTION

The present invention avoids difficulties of the prior art methods by providing relatively thin sleeves, or arcuate segments sufficient to make up sleeves. Such sleeves or segments may be provided from high quality steel, steel alloys, or other metal alloys having better wearing properties than the bearing surfaces of the original shafts. The bearing portions of the shafts are turned to round and reduced to the inner diameter of the sleeves. The sleeves are then cemented onto the shaft under pressure, using an epoxy adhesive. After setting of the adhesive through chemical action, the exterior surface of the sleeves are ground to accommodate standard sized bearings, so that the shaft after repair is equally as good or better than the original shaft, depending upon the quality of the metal used in the sleeves.

BRIEF DESCRIPTION OF THE DRAWING

The method of the present invention is illustrated in the accompanying drawing, wherein:

FIG. 1 is a perspective view of the segments in making up a sleeve.

FIG. 2 is a section through the bearing portion of a crankshaft illustrating the step of turning the bearing portion to round and for fitting the inner diameter of the segments of FIG. 1.

FIG. 3 is a similar view, and illustrating the application of the epoxy adhesive mixture which contains a hardener for chemically setting the adhesive.

FIG. 4 is a similar view, illustrating the application of the segments onto the bearing portion of the shaft.

FIG. 5 is a perspective view of a portion of the crankshaft, illustrating the clamp for applying pressure on the segments while the adhesive is setting.

FIG. 6 is a view of the shaft ready for grinding the exterior surface of the sleeve to the size of the original bearing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more in detail to the drawing:

In carrying out the preferred embodiment of the invention, **1** designates a portion of a crankshaft having a worn main bearing portion **2**, which may have been worn to out-of-round, scored because of lack of lubrication, or for other reason must be repaired to establish a truly cylindrical and smooth bearing surface. Such a surface is provided by a metal sleeve or shell **3** which may consist of two half-segments **4** and **5**, as illustrated in FIG. 1. The segments **4** and **5** are preshaped of a wear resistant metal or alloy which may be different from the metal of the shaft **1**.

Crankshafts are usually made from alloy steel designated by the class numbers 1045, 1145, 3135, 3140, 3141 and 4340. The low numbers are for small gas engines and the larger number for diesel and large engines. The segments **4** and **5** will preferably be formed from the alloy corresponding to the class number of the shaft. If desired, the segments may be made of one of the more expensive wear resistant, non-corrosive alloys.

The segments are of a size to cover the bearing surface and of a thickness to leave metal of at least five thousandths after machining or grinding back to the standard size of the shaft bearing as later to be described.

The shaping of the sleeve is dependent upon the metal used therein. For example, in some applications, the sleeve may be of strip form and brought into sleeve shape by wrapping about the bearing or journal to be repaired. However, in most instances the segments composing the sleeve are preshaped to form a cylinder at the time they are assembled on the shaft.

The bearing portion of the shaft is machined down to the inner diameter of the sleeve, to bring the bearing portion into cylindrical shape, and turned to size as indicated by the curved shading **6** in FIGS. 2 and 3.

After turning the bearing portion to size, the segments **4** and **5** are cemented thereon by an epoxy adhesive indicated by the stippling **7**. Suitable adhesives of this type are readily available on the market, such as the adhesive manufactured by the Devcon Corporation, Danvers, Mass., under the trade name "Devcon," the particular adhesive being known by the designation "Devcon C," which is a plastic compound containing fine steel powders and epoxy plastics to which a hardener is added just before use. The plastic with the hardener therein makes a paste that is easily spread upon the machined surface of the bearing portion of the shaft by a paddle or like applicator **8** in a substantially smooth, uniform coating, after which the segments **4** and **5** are applied over the bearing portion of the shaft as shown in FIG. 4 and brought into contact with the adhesive **7**.

A clamp **9** is then applied to the segments to hold pressure thereon until the adhesive becomes thoroughly set. The clamp may be of any type capable of providing the necessary pressure. In the illustrated instance, the clamp **9** consists of blocks **10** and **11** having facing portions **12** and **13** each provided with a substantially semi-cylindrical recess **14** having a radius of curvature substantially the outer radius of the segments, to closely fit the segments and draw them smoothly and evenly to the adhesive. The

blocks are drawn together by bolts **15** and **16** to apply the desired pressure. Any excess of adhesive may be wiped off before setting thereof. The adhesive sets in about two hours, however, the clamp **9** is preferably left on overnight to assure a strong, permanent, tough bond of the segments **4** and **5** to the crankshaft. The next step is to grind the exterior cylindrical surface of the sleeve segments to the size of the main bearing. The adhesive when set forms a strong, permanent, tough and rigid bond between the shaft and sleeve segments. It can also be machined and any protrusion may be ground off with grinding of the segments composing the sleeve. When the sleeve is finished, it provides a long lasting bearing surface having the size of the original bearing. The shaft, therefore, has the same strength and toughness of the original shaft, as no heat need be involved in the reconstruction thereof. There is no shrinkage or expansion in the adhesive under the working temperature of the shaft.

Another type of epoxy adhesive that is found to be satisfactory is sold under the trademark "Humble-Weld" and is distributed by Oil Field Chemical Department, Enjay Chemical Company, 8230 Stedman St., Houston, Tex.

Epoxy adhesives from both sources are usually sold in kits, and each kit contains one container of a metal and epoxy plastic and a second container of hardener, which materials are mixed together just prior to use thereof.

An additional type of adhesive that is satisfactory is sold under the trademark "ChemWeld U–1012" and is distributed by Chemweld Products Company, Big Lake, Tex.

What I claim and desire to secure by Letters Patent is:

1. A method of reconditioning bearing portions of shafts, including

turning the bearing portion to a circular cross section,

covering the circumference of the bearing portion with metallic adhesive capable of taking a set,

applying a split sleeve on the adhesive having a thickness to build up the bearing portion of the shaft,

and applying pressure exteriorly of the sleeve during setting of the adhesive to assure bonding of the sleeve with the shaft.

2. A method of reconditioning bearing portions of shafts as described in claim **1**, and including

grinding the exterior surface of the bonded-on sleeve to restore the original diameter of the bearing portion.

3. A method of reconditioning bearing portions of shafts as described in claim **1**,

wherein the adhesive is a mixture of an epoxy plastic and a hardening agent.

4. A method of reconditioning bearing portions of shafts as described in claim **2**,

wherein the adhesive is a mixture of an epoxy plastic and a hardening agent.

5. A method of reconditioning bearing portions of shafts as described in claim **1**,

wherein the adhesive is a mixture of epoxy plastic, powdered metal, and a hardener.

6. A method of reconditioning bearing portions of shafts as described in claim **2**,

wherein the adhesive is a mixture of epoxy plastic, powdered metal, and a hardener.

7. A method of reconditioning bearing portions of shafts as described in claim **1**,

in which the split sleeve comprises cylindrical segments sufficient to encompass the turned-down bearing portion of the shaft.

8. A method of reconditioning bearing portions of shafts as described in claim **7**, and including

grinding the exterior surface of the segments to the size of a bearing to be fitted thereon.

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U.S. Cl. X.R.

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