Oct. 9, 1923. 1,469,793

C. W. JOHNSON ET AL

METHOD OF INSTALLING BUSHINGS

Filed April 15, 1922

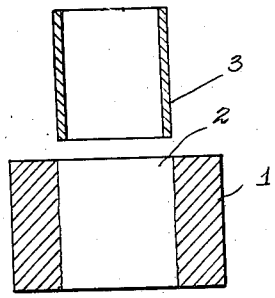


Fig 1

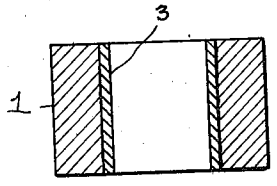


Fig 2

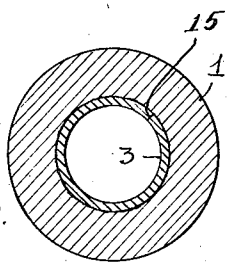
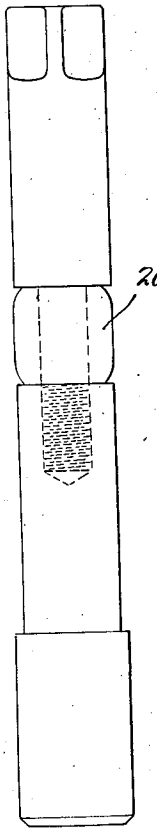


Fig. 3.



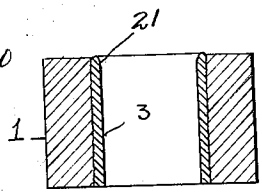


Fig 4

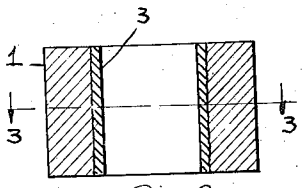


Fig. 8.

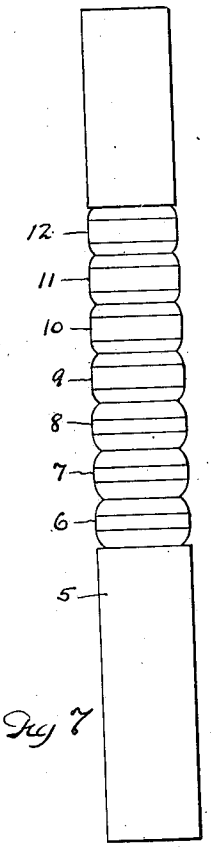


Fig 7

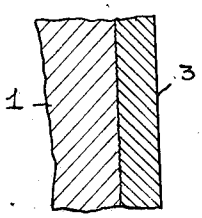


Fig. 5.

Fig. 6.

INVENTORS
Carl W. Johnson and
James L. Myers
BY
Day, Oberlin & Day
ATTORNEYS

Patented Oct. 9, 1923. 1,469,793

UNITED STATES PATENT OFFICE.

CARL W. JOHNSON, OF EAST CLEVELAND, AND JAMES L. MYERS, OF CLEVELAND HEIGHTS, OHIO, ASSIGNORS TO THE CLEVELAND GRAPHITE BRONZE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

METHOD OF INSTALLING BUSHINGS.

Application filed April 15, 1922. Serial No. 553,247.

To all whom it may concern:

Be it known that we, CARL W. JOHNSON and JAMES L. MYERS, citizens of the United States, and residents of East Cleveland, county of Cuyahoga, and State of Ohio, and of Cleveland Heights, county of Cuyahoga, and State of Ohio, respectively, have jointly invented a new and useful Improvement in Methods of Installing Bushings, of which the following is a specification, the principle of the invention being herein explained and the best mode in which we have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention relates to an improved method of pressing into place bushings having a certain amount of ductility and at the same time smoothing or burnishing the inside surface of the bearing. The principal object of the invention is the provision of a method for simultaneously setting the metal of the bearing into the irregularities in the bore of the article in which the bearing is to be placed and finishing to a desired size and also burnishing the bearing surface. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

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

In said annexed drawing:—

Fig. 1 is a central vertical section through an article and a bushing before assembly; Fig. 2 is a similar view showing a bushing in place in such an article; Fig. 3 is a plan view of a split bushing installed by the present method; Fig. 4 is a view similar to Fig. 2, but showing the effect of setting and burnishing the bushing by means of a tool of the character shown in Fig. 5; Fig. 5 is a side elevation of one form of burnishing tool which may be used; Fig. 6 is a partial section, on an enlarged scale, showing the engagement between the bushing and the wall of the article in which it is placed; Fig. 7 is a side elevation of a preferred type of burnishing tool; and Fig. 8 is a section through a bearing and article, showing the engagement of the bearing when installed by the tool shown in Fig. 7.

The best type of bearing is one in which the bearing is perfectly fitted into the bore or hole in the article in which the bearing is to be placed, that is, one in which the outer wall of the bearing is suported at every point by the metal of the bore. In practice it has been practically impossible to even approximate such a condition. Holes, whether reamed, bored, or reamed and ground, are very irregular and bushings are ordinarily equally irregular on their outer surfaces and are also of such a rigid nature that they cannot give enough to fill up the irregularities in the bore. We have found, however, that with bushings made of certain materials, which are hard without being brittle and are somewhat ductile, it is possible to press the bushing into the bore in such a way as to force the ductile metal of the bushing into all of the irregularities in the bore and practically lock the bushing into place. At the same time the bearing surface of the bushing is burnished and polished and given a slight hardening action.

In Fig. 1 there is shown an article 1 provided with an opening 2 therethrough in which is to be placed a bushing 3. Whether the hole 2 in this article 1 is a drilled, bored or reamed hole, it is more or less irregular, that is, the surface of the hole is uneven and irregular, the irregularities being produced by the operation of the cutting tool which produced or surfaced the hole. Of these types of holes, the reamed hole is the smoothest, but there is sufficient irregularity even in the surface of a reamed hole so that only about 50 per cent of the outer surface of the bearing placed in the hole is actually supported by and is in contact with the metal walls of the hole. The result is that unless the bearing itself is extremely rigid and hard, it is worked back into these irregularities during use, and the consequence is an irregular enlargement of the inner or bearing wall of the bushing. Bearings which lend themselves readily to the present method of installation are relatively soft metals such as brasses and bronzes, particularly when formed of rolled or drawn material, although cast metal can also be locked into the irregularities of the bore by

this method. The method is particularly well adapted to the installation of split rolled bearings, although by no means limited to these as we have indicated above.

In Fig. 1 we have shown such a bearing 3 which may either be of drawn tubing, or of rolled material which has been circled to form a cylinder, or any material in which a certain amount of ductility is retained in the metal. This bearing is first pressed into place in the bore 2 of the article in which it is to be used and is then burnished by means of a tool which is shown in Fig. 7. The bearings should first be made up with an inside diameter of from three to five thousandths less than the desired finished size. This allows a certain amount of excess metal which may be used to fill up the irregularities in the bore, and the working of the metal causes it to flow into these irregularities and increases the hardness of the metal and adds to the properties of the article as a bearing.

The tool which we desire to use for the purpose of setting back the bearing into the bore and burnishing the surface of the bearing consists of a plunger having a lower cylindrical portion 5 which is of uniform diameter from one end to the other and which is followed by a series of burnishing buttons 6, 7, 8, 9, 10, 11 and 12. Of these buttons, the ones numbered 6, 7 and 8 will vary from five thousandths under size to exactly the size of the bushing as it is originally formed. The button 9 may also desirably be of .001 over the original inside diameter of the bushing, while the buttons 10, 11 and 12 all vary from .001 to .003 over the size of the button 9. In installing a cast metal bushing the tool should not be oversize at any point since cast metal has much less resiliency than rolled and drawn metal. With these latter, the tool is oversize but the bushing returns to a finished diameter slightly less than the maximum diameter of the tool.

In mounting the bushing and operating upon it by our improved method, a bushing is first pressed into the bore of an article where it is held. If, in certain cases and with certain kinds of bushings, there is not sufficient frictional resistance to hold the bushing in place during the burnishing, the article and bushing may be mounted over a fixture which allows passage of the tool but not the bushing. The function of the buttons is to enlarge the bushing, increase this frictional resistance between the inner wall of the bore and the outer wall of the bushing and set the metal of the bushing back into the bore. The buttons must be graduated enough to increase the resistance between the bushing and wall fast enough to hold the bushing in place against the downward component of the thrust which is exerted by the rounded walls of the various buttons. The use of a series of buttons decreases the wear on each and increases the life of the tool, and any desired number may be used as desired for varying conditions. The bushing is formed of relatively soft and somewhat ductile material and metal of the bushing is caused to flow into the tiny irregularities in the bore, while the metal of the inner surface of the bushing is also caused to flow and is brought to a highly polished condition and is also somewhat hardened by the passage of the burnishing tool.

The engagement between the bushing and the bore is illustrated in Fig. 6 and this engagement has been found to be so secure that when such bushings are used in axles in vertical positions, there is no necessity for any flange on the bushing to prevent them from falling out, while in order to remove the bushing, it is necessary to place the article and bushing under a press and to exert several times the pressure necessary to push out a bushing that has merely been installed by the usual method. Upon removal the outer surfaces of the bearings are found to have extremely irregular and rough patterns which are evidently produced by the flowing of the metal into the tiny crevices and irregularities in the bore.

The advantages of the present method consist in the surface which may be given to the bearing, the arrangement between the wall of the bearing and the wall of the hole in which it is used, and the increase in the Brinell hardness of the metal, and a considerable increase in the surface hardness of the bushing.

If desired, a burnishing tool, such as is shown in Fig. 5 may be used. This tool is provided with a single button 20 and the entire burnishing and setting operation is performed by the passage of this single button. The bearing is set back into the bore by the use of such tool, but it produces slightly flared edges 21 (see Fig. 4) and does not give as perfect results as the tool of Fig. 7. It does, however, increase the Brinell hardness of the material, provide a highly polished bearing surface and flow metal into the irregularities of the bore to a sufficient extent to hold the bearing in place against considerable end pressure.

The present method is particularly well adapted to the installation of split bearings made of rolled material, since these bearings are hard while still being quite ductile, and the longitudinal split 15, (see Fig. 3) makes them flexible and allows them to spread easily into the bore under the action of the burnishing tool. Excess metal in this case flows into the split, that is, it allows flow circumferentially as well as radially into the irregularities in the bore, so that the finished

installation shows no gap between the adjacent edges of the split. No bushing can be any stronger than its supporting wall and by the present method the bushing is brought into full contact and support by the backing metal of the article in which it is placed.

Other forms may be employed embodying the features of our invention instead of the one herein 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 our preferred method or by others embodying steps equivalent to those stated in the following claims.

We therefore particularly point out and distinctly claim as our invention:—

1. In a method of installing bushings, the steps which consist in mounting in a one-piece solid article having a cylindrical hole therethrough with laterally imperforate walls, a bushing of a ductile material having an undersized inside diameter, and then sizing such inside diameter of said bushing by causing excess metal to flow into the irregularities of the wall of such hole.

2. In a method of installing bushings, the steps which consist in mounting in a solid integral member having a hole therethrough, a bushing formed of relatively thin material compared to the thickness of said member and having an undersized inside diameter, and then sizing such inside diameter of said bushing by causing excess metal to flow into the irregularities of the wall of such hole through said member.

3. In a method of installing bushings, the steps which consist in mounting in a solid integral non-expansible member having a hole therethrough, a split bushing formed of relatively thin ductile sheet metal and having an undersized inside diameter, then sizing such inside diameter of said bushing by causing excess metal to flow into the irregularities of the solid non-expansible wall of such hole through said member.

4. In a method of installing longitudinally split tubular bearings, the steps which consist in mounting in a hole a longitudinally split bushing of a ductile material having an undersize inside diameter, and then sizing such inside diameter of said bushing by causing excess metal to flow into the gap between the adjacent edges of such split and into the irregularities of such holes.

Signed by us this 10th day of April, 1922.

CARL W. JOHNSON.
JAMES L. MYERS.