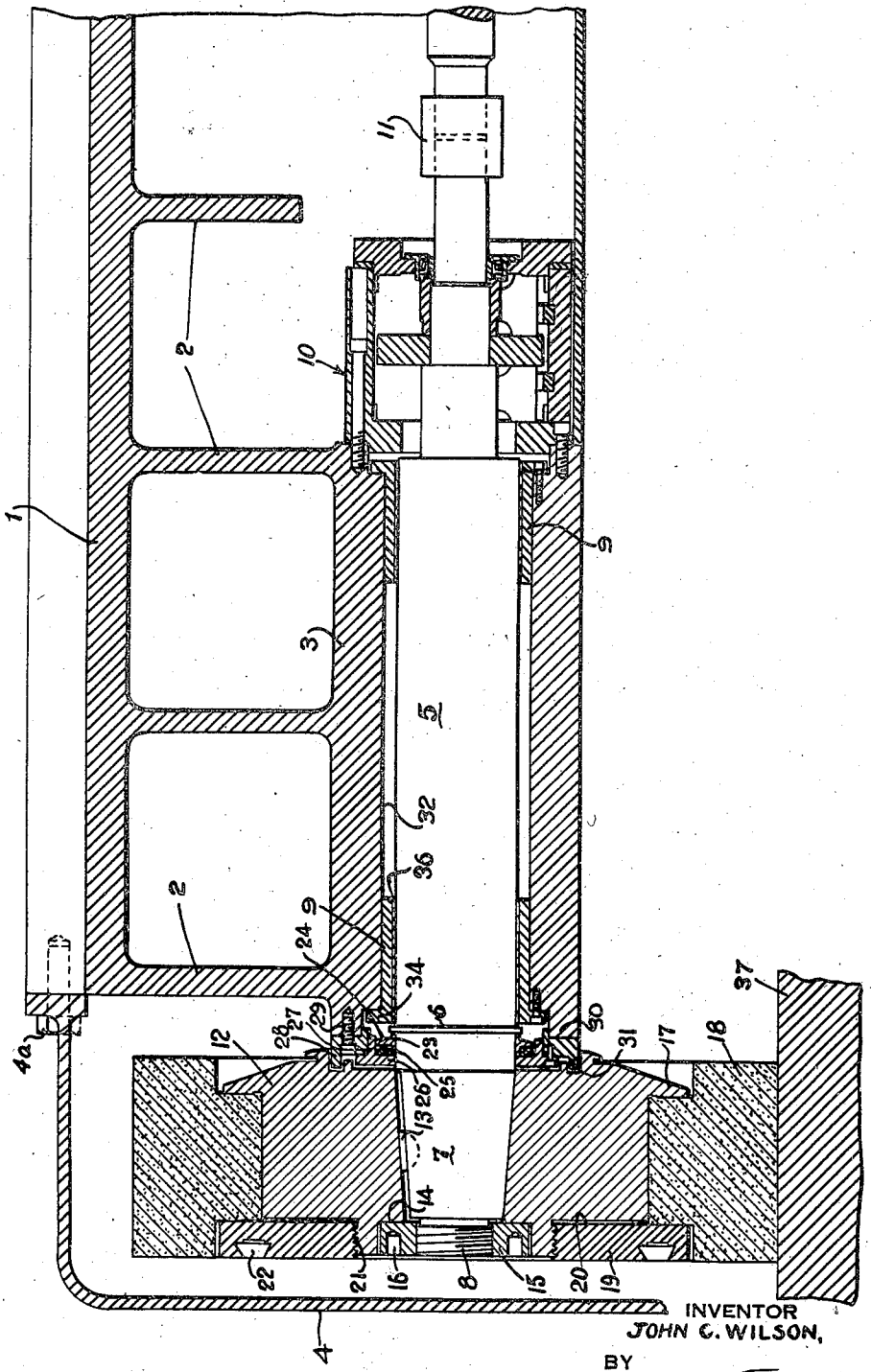
Feb. 4, 1947. J. C. WILSON 2,415,324

METHOD OF RE-JOURNALLING SPINDLE SHAFTS

Original Filed Nov. 11, 1943 2 Sheets-Sheet 1

Fig. 1.



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FIG. 2.

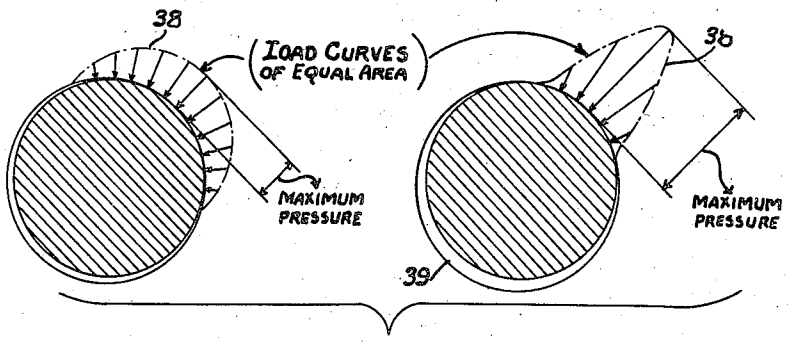


FIG. 3.

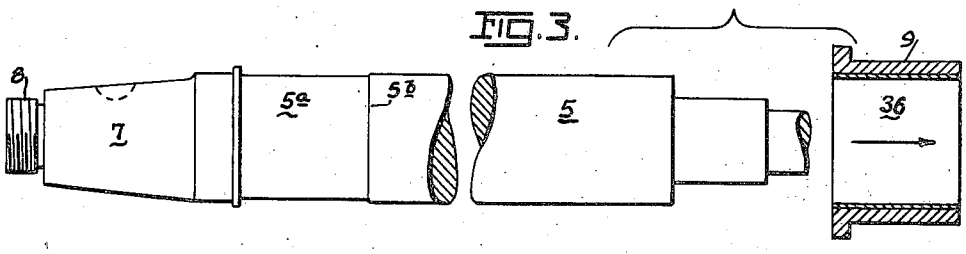


FIG. 4.

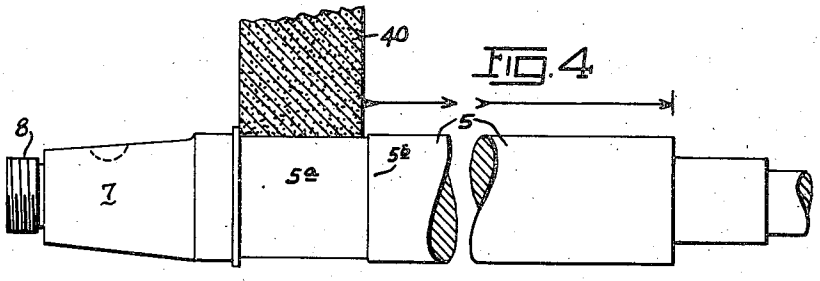
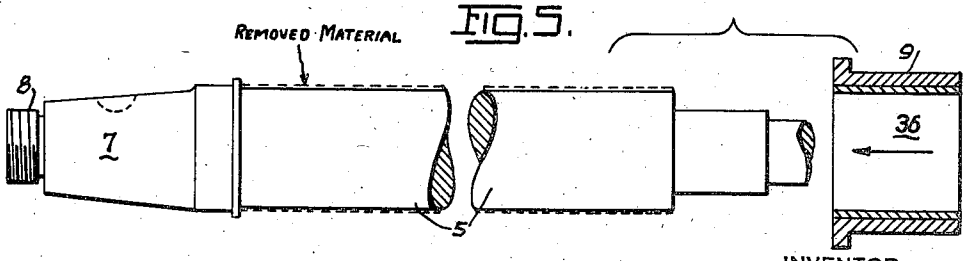


FIG. 5.



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UNITED STATES PATENT OFFICE

2,415,324

METHOD OF REJOURNALLING SPINDLE SHAFTS

John C. Wilson, Springfield, Ohio, assignor to The Thompson Grinder Company, Springfield, Ohio, a corporation of Ohio

Original application November 11, 1945, Serial No. 509,835. Divided and this application September 2, 1944, Serial No. 552,421

6 Claims. (Cl. 29—149.5)

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The present invention relates to precision tool working machines and more particularly to methods of rejournaling shafts of such machines.

The matter of properly journalling a grinding wheel in its bearings presents an exceedingly difficult problem. The slightest misfit, wobble or play due to wear is sufficient to cause the periphery of the wheel to run untrue with consequent errors in the ground surface. This tendency to improperly grind is even further enhanced as the size of the grinding wheel is increased, particularly when the wheel is supported only on one side in an overhanging bearing.

In the prior grinding machines, it is customary to provide a bearing made of solid bronze or a liner constituted of lead. These bearings usually were of the split sleeve type and a wedge structure was employed to maintain a reasonably tight fit about the shaft. While bearings of this general type were fairly satisfactory they are open to the objection of uneven wear due to the fact that the metals employed are not of an unusually tough character and considerable stresses are introduced at the bearings due to the upward push exerted on the wheel by the workpiece. This upward force has a rotary movement so that the component forces are not exerted in a symmetrical manner. The greater the wear at the bearing surface, the more tendency there is for this force to concentrate on a relatively small area which in turn aggravates the misfit. This condition is still further aggravated by reason of the fact that the character of the metal forming the bearing is entirely different from that of the shaft so that the latter and the surrounding bearing have different coefficients of expansion, which fact of itself may initiate undue wear and an eventual misfit.

In my parent application, Serial No. 509,835, filed November 11, 1943, of which this present application is a division, I have described a bearing in sleeve form which is made of steel and lined by an especially tough metal such as silver. Thus the body of the bearing is constituted of substantially the same metal as the shaft so that no complications of unequal thermal expansions are present.

Object of the invention is a method according to which these sleeves may be readily replaced in case of wear.

Another object of the invention is a method by which the shaft as well as the bearing can be treated so as to make them fit for re-use.

The invention will be better understood when

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reference is made to the following description and the accompanying drawings in which:

Figure 1 represents a longitudinal, sectional view of the wheel end of a precision grinding machine provided with the improved bearing.

Figure 2 shows a pair of diagrams typifying by way of comparison the differences in the load curves of the improved form of bearing and the conventional form.

Figures 3 to 5 illustrate as a series the method of removing the bearing from the shaft, then grinding the shaft to accommodate an undersized bearing and then applying the replacement bearing in place.

Referring more particularly to Figure 1, reference character 1 designates a portion of the main frame casting of the grinding machine. This casting is provided with a plurality of inwardly extending strengthening webs 2, on which is supported a tubular housing 3 which extends longitudinally of the frame. There is a wheel guard 4 of curvilinear shape secured by shoulders as indicated at 4A to the main frame.

The shaft of the grinding machine is indicated at 5 and may be fabricated of wrought or cold rolled steel, this shaft being provided with a small shoulder indicated at 6 and terminating at the left hand end in a tapered portion 7 having a screw portion 8. This shaft is journalled within the housing 3 by a pair of improved bearing elements indicated at 9 which will be described presently, these elements being spaced considerably apart as shown on the drawings. The right hand end of the shaft 5 is supported in any suitable form of ball bearing (not shown) and intermediate the two main bearings there may be provided any suitable and well known type of thrust bearing generally designated 10. If desired, a coupling 11 may also be employed between the two lengths of the extended shaft.

The grinding wheel structure is carried on the tapered end 7 of the shaft and may comprise a cylindrical holder or support 12 having a tapered bore and keyed to the shaft as indicated at 13. The holder 12 may be counterbored as indicated at 14 to receive a flat nut 15 having a threaded bore which engages the threads on the shaft. This nut is provided with a plurality of drilled holes 16 to accommodate a spanner wrench. The holder or support 12 is also provided with a radially extending lip 17 which forms a ledge against which the grinding wheel 18 may be pressed and held in position by a large flat nut 19 which is received by an undercut recess 20 formed in the

support 12. The nut 19 has a threaded bore 21 which engages threads formed on a cylindrical portion rising from the recess 20. An annular groove 22 having an inverted tapered shape may be provided in the nut 19 to receive the usual balancing counterweights.

Directly to the left of the shoulder 6 and surrounding the shaft there is a ring 23 having a centrally disposed, radially extending projection 24 to leave a recess for a packing ring 25. The packing compartment is completed by a ring 26 which is positioned directly to the right of the support 12 and is provided with a longitudinally extending projection 27. This projection fits snugly within a larger ring 28 which is secured as by screws 29 to a lip portion 30 formed on the frame. The ring 28 has a longitudinally extending projection 31 which is loosely received by a groove formed in the support member 12. It will be understood that the ring 23 rotates with the shaft but the rings 26 and 28 are stationary with respect to the shaft. The packing 25 consitutes an effective oil seal.

The housing 3 is provided with a bore 32 somewhat larger than the size of the shaft 5 to leave an annular space for receiving the bearings 9. The latter are formed as a continuous cylinder having at their outer ends radially extending flanges 34, these flanges fitting snugly against the side surfaces of a pair of recesses formed near the end of the housing. The interior diameter of the bearings 9 is such as to fit the shaft 5 fairly snugly but without undue friction and also without the slightest misfit or wear.

An enlarged view of the bearings 9 is shown in Figures 3 and 5 and it will be noted that these bearings comprise a sleeve of steel with a relatively thin liner 36 of the order of a few thousandths of an inch and formed of a tough, wearing metal such as silver. This liner may be formed in any suitable manner for example by electrolytic deposition, chemical precipitation or by electronic action. In the electrolytic method the electrolyte contains silver and the silver ions are attracted toward and deposited on the steel body. The chemical precipitation method is so well known as to require no particular description. In case it is desired to deposit silver on the steel sleeve by electronic bombardment, the sleeve is placed in a highly evacuated envelope and a filament of silver is positioned within the sleeve. A high positive potential may be applied between the filament of silver and the steel sleeve while the filament is simultaneously rendered incandescent so that fine particles of silver are caused to leave the filament and to be attracted toward and deposited on the silver sleeve. Other ways will readily suggest themselves to those skilled in the art for procuring the thin silver lining within the steel sleeve, the main desiratum being to cause the silver to adhere tenaciously to the interior surface of the sleeve and at the same time provide a continuous layer of silver in spite of its minute thickness.

When the shaft 5 is first fitted within the sleeve 9, a relatively snug but sliding fit is obtained so that contact is made with the shaft throughout its entire periphery and this fit is maintained over a relatively long period of time due to the toughness and wearing qualities of the silver. Referring to Figure 1, it will be noted that the wheel 13 presses downwardly on the workpiece 37 and the reaction is such that the shaft 5 presses upwardly against the silver liner substantially over one-half of the periphery

thereof. This load curve has an area of load distribution similar to that indicated at 38 in Figure 2. It will be noted that the arrows, the lengths of which suggest the various intensities of pressure, are substantially equal over the entire load curve showing that no part of the silver liner is subjected to an abnormal load. This load curve may be compared with a curve of an entirely different shape shown to the right in Figure 2, which follows the use of the ordinary form of bearing and in which considerable wear is present indicated at 39. In this case, contact between the shaft and the bearing is established over a very restricted area, so that assuming the total load to be the same as in the previous case and represented by the pushing-up effect of the workpiece 37, the load curve indicates that certain parts of the bearing are subjected to extremely large and abnormal pressures. This gives rise to further excessive wear, which in turn additionally reduces the area to which the pressure is applied until practically all of the upward pressure of the workpiece 37 is carried by only a few points on the bearing. This in turn results in a misfit or wobbly bearing to the extent that the grinding wheel 18 cannot grind the workpiece to the desired degree of accuracy.

Consequently, by providing a silver liner backed by a steel sleeve, and providing initially the proper closeness of fit, a bearing of this character has an extremely long life which precludes even the slightest misfit or wobbly condition. Of course, over a long period of time a certain amount of wear will be caused even within the improved bearing, and in accordance with another feature of my invention, provision is made by which the slightly worn bearing may be replaced by a new fitted bearing. This particular aspect of the invention is illustrated in Figures 3 to 5.

In Figure 3, it is assumed that the shaft 5 at the position 5a where it rotated within the left hand sleeve bearing 9 shows the sign of wear as indicated by the presence of the shoulder 5b, necessitating a replacement of the bearing sleeve. The shaft and the bearing are first removed from the machine by dismantling the wheel end and disconnecting the thrust bearing 10 and the coupling 11 after which both of the bearings 9 can be slid to the right off the shaft. The removal of the left hand worn bearing from the shaft 5 is indicated in Figure 3. The next step is to grind the shaft by a grinding wheel 40 at the position of the bearing as shown in Figure 4 and then moving the grinding wheel throughout the entire length of the main portion of the shaft to the right of the collar 6. Thus, the shoulder 5b no longer exists and the shaft is ground to a perfectly round shape but of smaller diameter than the original size. A new undersized sleeve 9 coated on its interior with silver may be applied to the shaft as indicated in Figure 5 and the parts of the machine assembled together, at which time any wobble or misfit of the shaft within its bearings is entirely eliminated. Consequently, the invention contemplates two aspects (1) in which an improved bearing is provided having an extraordinary long life due to the toughness and hard wearing qualities of the silver liner, and (2) when wear eventually develops an improved technique or method of replacing the bearing is provided.

While I have indicated the manner in which the left hand sleeve bearing may be removed from the shaft 5 and replaced by a new and under-

sized bearing, it will be understood that should excessive wear be present only at the right hand bearing, the latter is moved in the manner described and only that portion of the shaft is ground as would accommodate a new undersized right hand bearing. However, in general, it will be found that the bearing immediately adjacent the wheel 18 takes on the greater part of the load stresses due to the pressure exerted upwardly by th workpiece 37 on the grinding wheel. Consequently, the left hand bearing in Figure 1 may require replacement more often than the right hand bearing in which case the entire length of the shaft 5 is ground to restore the circularity of shape and both bearings are replaced simultaneously by two undersized bearings. It will be apparent that the undersized aspect of the bearings 9 may be obtained simply by increasing the thickness of the liner and in the case of the electronic bombardment method of applying the silver, it is merely necessary to subject the bearing to the bombardment until the proper thickness of silver has been obtained and then grind the interior diameter of the silver liner to the proper undersized dimension. Thus, the improved technique not only permits the same bearings 9 to be used over and over again but with increased liner thicknesses, but also provides a bearing replacement technique which assures a snug but slidable fit between the shaft and the bearing.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a grinding machine having a shaft carrying a grinder wheel at its end, said shaft being journalled within a sleeve bearing, the method of re-journalling the shaft which includes the steps of removing the sleeve bearing, grinding the shaft to a smaller size at the position of the bearing, and then mounting a sleeve bearing in position which has an undersized bore such as to fit the smaller sized shaft dimension.

2. A method of re-journalling the shaft of grinding machines and similar machines being subjected to wear by rotational friction between the shaft and the bearing comprising the steps of removing said shaft and said bearing, grinding said shaft to a less diameter thereby providing a new smooth surface, increasing the thickness of said bearing by lining it with a metal so that a snug fit of said shaft in said bearing is obtained when mounted.

3. A method of re-journalling the shaft of grinding machines and similar machines being subjected to wear by rotational friction between the shaft and the bearing comprising the steps of removing said shaft and said bearing, grinding said shaft to a lesser thickness thereby providing a new smooth surface, increasing the thickness of said bearing by lining it with silver so that a snug fit of said shaft in said bearing is obtained when mounted.

4. A method of re-journalling the shaft of grinding machines and similar machines being subjected to wear by rotational friction between the shaft and the bearing comprising the steps of removing said shaft and said bearing, grinding said shaft to a lesser thickness thereby providing a new smooth surface, increasing the thickness of said bearing by electrolytically depositing a metal lining so that a snug fit of said shaft in said bearing is obtained when mounted.

5. A method of re-journalling the shaft of grinding machines and similar machines being subjected to wear by rotational friction between the shaft and the bearing comprising the steps of removing said shaft and said bearing, grinding said shaft to a lesser thickness thereby providing a new smooth surface, increasing the thickness of said bearing by chemically precipitating a metal lining on the inner surface of said bearing so that a snug fit of said shaft in said bearing is obtained when mounted.

6. A method of re-journalling the shaft of grinding machines and similar machines being subjected to wear by rotational friction between the shaft and the bearing comprising the steps of removing said shaft and said bearing, grinding said shaft to a lesser thickness thereby providing a new smooth surface, increasing the thickness of said bearing by depositing a metal coating on the inner surface of said bearing by electronic action so that a snug fit of said shaft in said bearing is obtained when mounted.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,374,624	Zumwalt	Apr. 12, 1921
2,187,755	Ryder	Jan. 23, 1940
2,198,074	Berry	Apr. 23, 1940
2,185,483	Ward	Jan. 2, 1940
2,180,883	Scott	Nov. 21, 1939