July 27, 1943. J. A. ZUBLIN 2,325,459

THRUST BEARING ASSEMBLY

Filed Dec. 10, 1940

Fig. 1.

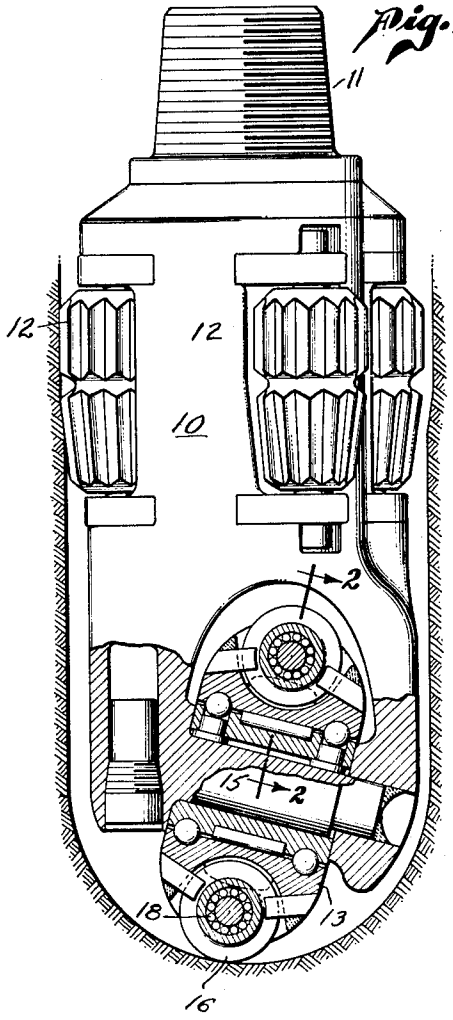
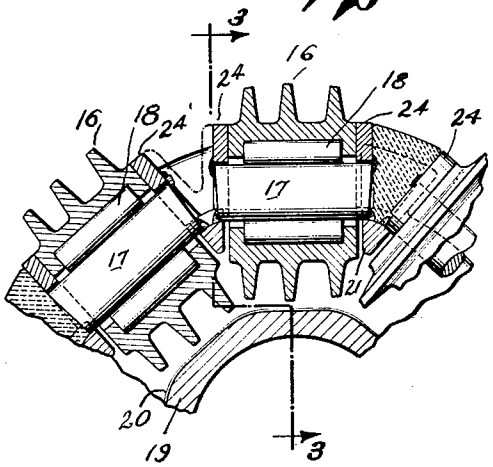


Fig. 2.



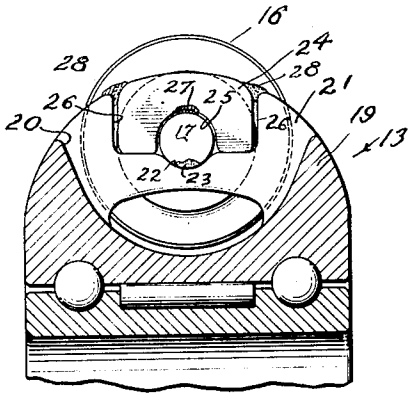


Fig. 3.

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Patented July 27, 1943 2,325,459

UNITED STATES PATENT OFFICE

2,325,459

THRUST BEARING ASSEMBLY

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Application December 10, 1940, Serial No. 369,438

1 Claim. (Cl. 255—71)

This invention relates to drilling bits for use in oil wells and the like, and more particularly to roller drilling bits.

In rotary drilling bits of the type described in my United States Patents Nos. 2,126,079 and 2,151,544, the cutters are quite small in diameter, and are subject to a heavy radial and thrust load during operation of the bit. Because of the small diameter of the cutters, there is insufficient room for the installation of a roller thrust bearing of the conventional type, and accordingly, it has been the practice in the past to allow the thrust load on the cutters to be taken by the shoulders of the recesses or slots in which the cutters run. As the slots or recesses are formed by casting, with its inherent limitations as to accuracy, the slots always require grinding or other finishing before they form a satisfactory support. As the casting has a hard case, such grinding removes part of the case, thus lessening the resistance of the casting to wear at that point. If the slots or recesses are formed by machine work before the casting is hardened, the subsequent treatment to produce a hard surface changes the size of the slots in an unpredictable manner, with the result that the cutters must be either made with ample clearance, to fit the slots, or else be selectively inserted, an extremely expensive and time consuming operation.

In addition to the above difficulties, no means is provided in the prior devices for renewing the cutters, with the result that the entire carrier must be discarded when the cutters are worn, although the rest of the bit may be satisfactory. Because of the difficulty of obtaining material, especially in times of national emergency, it becomes imperative that some means be devised to salvage the casting, by replacing the cutters when worn.

With the above difficulties and deficiencies in mind, it becomes a primary object of this invention to provide a thrust bearing which does not depend upon accuracy of the casting for its successful operation.

It is a further object of this invention to provide a cutter assembly with a thrust bearing without the necessity of machining or grinding of the carrier.

It is a further object of the present invention to provide a thrust bearing which is an integral part of the carrier and contributes to the strength of the entire assembly.

It is a further object of the present invention to provide a thrust bearing which can be installed to fit inaccurate cutters without the necessity of selective assembly.

It is a further object of this invention to provide a bearing assembly which allows the cutters to be replaced when worn, thus permitting re-use of the carrier.

Other objects and advantages will become apparent as the description proceeds.

Referring now to the drawing, illustrating one embodiment of my invention:

Figure 1 is a drawing, partly in section, of a bit embodying my invention;

Figure 2 is a fragmentary enlarged section taken on line 2—2 of Figure 1, looking in the direction of the arrows; and

Figure 3 is a section taken along line 3—3 of Figure 2, looking in the direction of the arrows.

The present invention is illustrated as embodied in a drilling bit having a shank 10, which carries on its upper end a threaded pin 11 for connection with the drilling string, and which has a plurality of reamers 12 for centering the bit and reaming the bore to gauge. On its lower end, the shank 10 carries a carrier wheel 13, which is mounted on a pin 15 secured by the shank 10. This construction is fully described in my United States Patent No. 2,151,544.

For cutting the formation, the wheel or carrier has arranged around its periphery a plurality of rolling cutters 16, mounted for rotation on the carrier by means of pins 17. In the shown form, these cutters run on rollers 18, which, together with the pins 17 and the inner bores of the cutters 16, form roller bearings. The pins are secured to the carrier, and it can be readily seen that the cutters 16 are free to move axially on the pins 17, under thrust loads imposed on the cutters 16 by the action of the cutters on the formation.

To receive the cutters 16, the main casting 19 is provided with a peripheral concave surface 20, extending completely around the casting, which thus forms a recess from which the cutters project in position to engage the formation. In order to support the cutters and pins 17 preparatory to welding, a bridge 21 crosses the concavity between each pair of cutters, and has on its upper surface a depression 22, adapted to receive the ends of an adjacent pair of pins 17. This depression is merely for the purpose of accurately locating the pins 17 during the assembly operation, the pins being merely laid in the depression 22 and tacked in place at 23.

In order to form a bearing surface for the cutters, and to take the thrust load, it is proposed

to supply a pair of plates for each cutter, to be secured to the casting 19 by welding. In the shown form, each of these plates 24 takes the form of a horseshoe, having a recess 25 for reception of the pin 17. It is desirable to have the plates extend over as much as possible of the end of the cutter, so it may be as efficient as possible, which is the reason for the selection of the horseshoe shape. But, inasmuch as the reaction of the formation is only transmitted from the exterior of the cutters, it is often sufficient to have the plate member extend over the exterior half of the cutter only.

It can be seen that if these plates 24 are secured to the wheel casting they will form a suitable thrust bearing to prevent the axial movement of the cutters. To accomplish the securing of the plates in position, they are so formed that they fit the bridge 22 between each of the pairs of cutters, thus forming, with the bridge, a sort of trough which can be filled with welding material. The plate 24 is, in each instance, intended to fit between the shoulders 26 formed on the bridge. Preparatory to filling the trough which is formed by the plates 24, the bottom of the bridge and the shoulders 26, the plates may be tacked in place by attachment to the pins at 27 and to the casting at 28. The filling material is preferably applied to completely fill the cavity, but it may be desired to only partly fill the cavity, as illustrated to the left of the central roller of Figure 2. In that event, if it is necessary for securing a smooth outer surface to fill the resulting void, any cheap filler such as cement may be applied.

It will be noted, in Figure 2, that the bridges 21 are so spaced that there is ample clearance between them and the cutters, thus preventing inaccuracies of the casting from affecting the fit of the cutters. On the other hand, the plates 24 are accurately positioned during tacking to the carrier, by simply tilting the carrier until the plate being tacked on is in the position of the plate 24', in which position the plate will rest in proper position during the tacking process.

After the trough between the plates of each pair of cutters is filled with welding material, the welding material becomes the chief support of the pins 17. Thus the horizontal part of the bridge in Figure 3 is intended to form a support for the pins only during the welding operation, to position the pins properly, and to form a surface for the reception of the welding material. The welding material unites with the ends of the pins and with the surface of the plates, forming, in effect, a solid bridge which is adequate to carry the heavy loads imposed on the cutters during use.

With this form of assembly, it is possible to utilize the main wheel casting with a new set of cutters by simply cutting out the cutters and their pins with a torch and reforming the upper surface of the bridge as shown in Figure 3, which can be very readily done with any of the numerous profiling cutting torches. New cutter assemblies, together with the plates, can then be welded in place without difficulty.

Although I have described a specific embodiment of my invention, it is to be understood that the above description is intended to be illustrative only, and that the scope of the present invention is to be determined by the appended claim.

I claim:

In an earth boring tool having a carrier provided with a recess and a bridge extending across said recess, a pair of cutters rotatably mounted on pins, said cutter and pin assemblies being mounted with adjacent ends of the pins resting on said bridge; the combination of an indentation in the surface of the bridge, a pair of shoulders on said bridge, the indentation in said bridge receiving adjacent ends of said pins therein, a pair of plate members so positioned on said pins closely adjacent the ends of said cutters and between the shoulders on said bridge as to form thrust bearings for said cutters, said plate members, the adjacent ends of said pins and said bridge defining the walls of a cavity, and welding material in said cavity securing said pins and said plate members to said carrier with said plate members in thrust supporting position closely adjacent the ends of said cutters.

JOHN A. ZUBLIN.