Nov. 17, 1936. R. R. CRUM 2,061,141

ROLLER BIT BEARING STRUCTURE

Filed March 18, 1935

Fig. 1

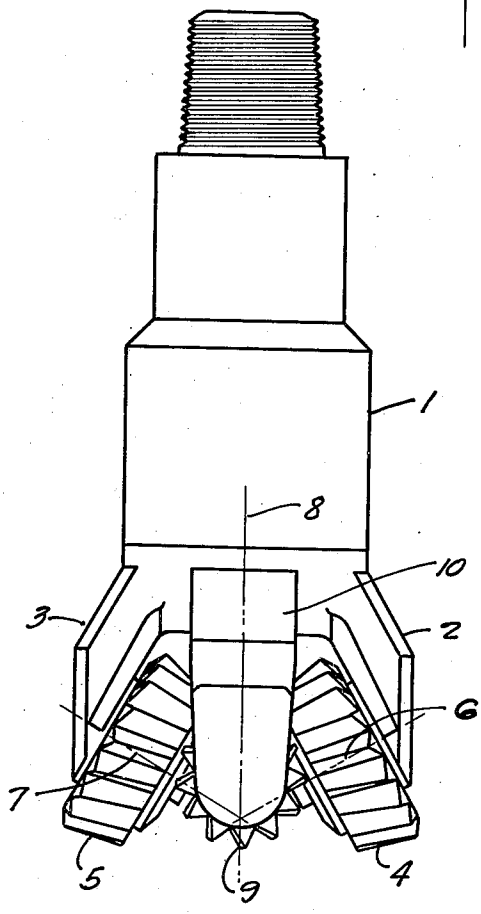


Fig. 2

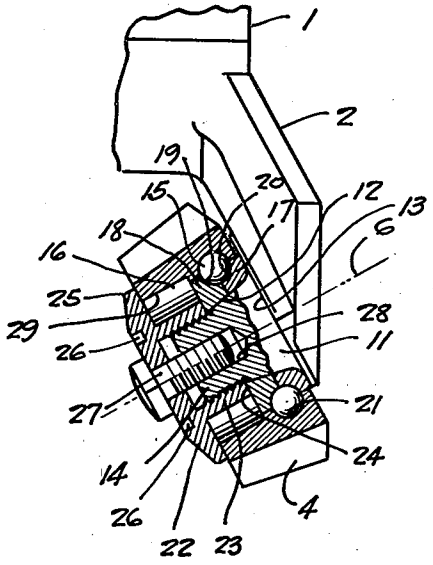
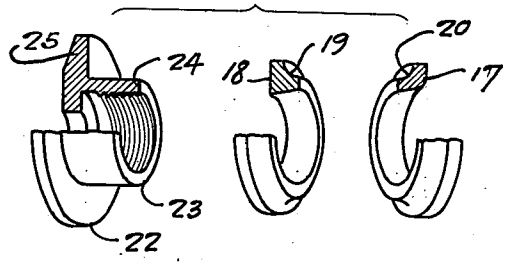


Fig. 3



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ROLLER BIT BEARING STRUCTURE

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Application March 18, 1935, Serial No. 11,651

9 Claims. (Cl. 255—71)

This invention relates to roller or disc bits, for rotary well drilling, and more particularly to the mode in which the discs or rollers are rotatably mounted.

In a prior application, Serial No. 715,504, filed March 14, 1934, for Roller bit, in the name of Roland R. Crum, a bit structure is disclosed, having rollers or discs supported by the aid of anti-friction bearings. This application is a continuation in part of the said prior application.

In such roller bits, it is now common to provide a bit frame or body with a roller support directed generally in a radial direction with respect to the axis of the body. It is one of the objects of this invention to make it possible to support the rollers on the bit frame by the aid of anti-friction bearings and in a sturdy manner.

In order to ensure against the accidental dropping off of the roller when a break or other unforeseen occurrence happens, the bearing structure should be sturdy and reliable. The breaking off of such structures during deep well drilling operations as in oil well drilling, results in a costly and time consuming "fishing" operation.

Accordingly it is another object of this invention to provide a bit structure that can be safely and effectively utilized in deep well drilling.

It is still another object of this invention to provide an anti-friction bearing structure that is simple in structure and easily assembled.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawing accompanying and forming part of the present specification. This form shall now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawing:

Figure 1 is a side elevation of a roller disc bit in which the invention is incorporated;

Fig. 2 is a sectional view on an enlarged scale showing the construction of the bearing support utilized for one of the roller disc bits and incorporating the invention; and

Fig. 3 is an isometric view of certain parts of the anti-friction bearing structure, the parts being in quarter section and shown in separated positions.

The bit body includes a frame 1 having diametrically opposite arms 2 and 3, joined in any appropriate manner to the frame 1. Upon these arms are supported respectively the roller cutters 4 and 5, having axes 6 and 7 directed downwardly and toward the main axis 8 of the body.

Intermediate the roller disc cutters 4 and 5 are a pair of diametrically opposite disc cutters, one of which is shown at 9. These intermediate cutters can be supported on arms such as 10.

Since in the prior application referred to hereinbefore, the particular construction and advantages of this type of bit structure are amply described and claimed, further reference thereto is considered unnecessary. It is advisable merely to note that the bit is adapted to be supported on the end of a drill string, and rotated about the axis 8, the power for rotation being obtained by appropriate connection to a rotary table or the like at the top of the well.

The roller discs 4 and 5 are appropriately supported for rotation about axes 6 and 7 in a manner clearly disclosed in Figs. 2 and 3. The arm 2 is shown in this instance as made of a casting or forging having an integral pin 11. This pin 11 has a tapered portion 12 ending in an abrupt shoulder 13. The free end 14 of the pin 11 is shown as externally threaded. In the present instance a ball bearing structure 15 is provided adjacent that end of pin 11 which is closest to the arm 2. This structure serves as a thrust bearing and sustains axial forces acting on the cutter 4. The roller bearing structure 16 is provided adjacent the free end of pin 14, and sustains radial forces, acting on the cutter 4. The manner in which these anti-friction structures are formed constitutes the important features of the invention.

In order to form the inner race for ball bearing structure 15, use is made of a pair of annular members 17 and 18. These have internal surfaces, corresponding with the tapered portion 12 of pin 11. The plane of contact between members 17 and 18 is perpendicular to the axis 6, and occurs at the minimum diameter of the quadrant grooves 19 and 20. Quadrant groove 19 is formed in the annular member 18 and a corresponding groove 20 is formed in the annular member 17. The two of them in cooperation form the inner race for a series of balls forming the ball bearing structure 15.

The outer race of ball bearing structure 15

is provided by an internal semi-circular groove 21 formed in the inner cylindrical surface of the roller disc 4. By virtue of the split inner race, the assembly of the ball bearing parts is facilitated. Thus for example, the balls 15 can first be placed inside of the outer race 21; then the ring 17 can be placed in position from the right hand side of the disc 4, and then member 18 can be placed inside of the disc 4 from the left hand side thereof.

In order to hold the assembled structure in place on the pin 14, use is made of a flanged retaining member 22. This retaining member has a body portion 23 provided with an external cylindrical surface and an internally threaded portion engaging the threads on the portion 14 of pin 11. Its inner end has a flat surface 24 adapted to abut against the corresponding adjacent flat surface of the ring 18. As member 22 is threaded onto the pin 11, its flange 25 is arranged to contact with the inner surface of the cutter 4. The abutting surface 24 serves therefore to confine the ball bearing structure against axial movement with respect to the pin 11, and holds the ball bearing structure firmly against the abrupt surface 13.

The member 22 can be turned for tightening purposes by the aid of a pair of diametric depressions or sockets 26 placed in the flange 25, and capable of being engaged by a spanner wrench. However, in order further to ensure against accidental separation of the parts, a cap screw 27 can be provided, passing through an aperture in flange 25 and threaded into an axial tapped hole 28 in the pin 11.

In order to provide a sturdy and effective antifriction radial bearing structure, use is made of cylindrical roller members 16 forming the roller bearing. The inner race for these roller members is provided by the external cylindrical surface of member 22. The outer race is formed by the internal cylindrical surface 29 formed on the inside of the roller disc 4. The rollers 16 are confined against axial movement by the spacing of the flange 25 from the annular member 18.

The assembly of the roller bearing 16 is readily apparent. After the ball bearing structure is assembled as heretofore described, the rollers 16 can be inserted inside of the cutter 4; and then the flanged member 22 can be placed inside of the rollers 16. The entire structure can now be telescoped over the pin 11, and member 22 turned by a spanner wrench until the surface 24 abuts against the contiguous surface of the ring 18. Of course there is sufficient running clearance between flange 25 and the cutter 4 to permit its free rotation.

It is seen that the forces exerted by the disc 4 upon the supporting pin 11 are adequately sustained by the generous roller bearing surfaces, forming a radial support, and by the ball bearings 15, serving to sustain the axial thrust. The sturdy construction ensures that in actual use of the bit, there is no likelihood of any binding action, even when the forces imposed on the bit are severe.

I claim:

1. A roller cutter having an inner annular surface forming an outer race, a pair of annular members cooperating to form an inner race, rolling members in the race, a pin upon which the annular members are placed, and detachable means supported on the pin to hold the annular members in place.

2. A pin, a cutter, and means for rotatably supporting the cutter on the pin, comprising a series of balls, a series of rollers, means forming an inner race for the balls and telescoped over the pin, and a member forming the inner race for the rollers and detachably supported on the pin and acting to confine the means forming the inner ball race against movement.

3. A pin having a tapered surface as well as a threaded end, a pair of annular members disposed on the tapered surface and having grooves cooperating to form an inner ball race, a roller cutter having an internal groove forming an outer ball race, as well as an inner cylindrical surface axially spaced from said outer ball race, balls in the said race, an internally threaded member threaded on the pin and having an end surface for confining the annular members against axial movement, said internally threaded member having an external cylindrical surface, forming with the internal cylindrical surface of the roller cutter, a roller bearing race, and rollers in said race.

4. A pin support having a tapered surface as well as a threaded end, said tapered surface having its smaller end adjacent the threaded portion, and its larger end adjacent an abrupt shoulder, a pair of grooved annular members disposed on said tapered surface, the grooves forming an inner ball race, a roller disc having an internal groove cooperating with the annular members and forming an outer ball race, balls in said race, and a member threaded on the pin and having a surface confining said annular members against axial movement.

5. A pin support having a tapered surface as well as a threaded end, said tapered surface having its smaller end adjacent the threaded portion, and its larger end adjacent an abrupt shoulder, a pair of grooved annular members disposed on said tapered surface, the grooves forming an inner ball race, a roller disc having an internal groove cooperating with the annular members and forming an outer ball race, balls in said race, a member threaded on the pin and having a surface confining said annular members against axial movement, said roller cutter and said threaded member having respectively internal and external surfaces forming a race for a roller bearing, and rollers in said race, said threaded member having a flange confining said rollers against outward axial movement, one of the annular members having an end surface confining said rollers against inward axial movement.

6. A pin having a threaded end, a pair of annular members disposed on said pin, and having grooves cooperating to form an inner ball race, a roller cutter having an internal groove forming an outer ball race, balls in said race, and an internally threaded member threaded on the pin and having an end surface for confining the annular members against axial movement; as well as a flange for confining the roller cutter against axial movement.

7. A pin having a threaded end, a pair of annular members disposed on said pin, and having grooves cooperating to form an inner ball race, a roller cutter having an internal groove forming an outer ball race, balls in said race, an internally threaded member threaded on the pin and having an end surface for confining the annular members against axial movement, said internally threaded member having an external cylindrical surface, forming with an internal cylin-

drical surface of the roller cutter, a roller bearing race, and rollers in said race.

8. A pin having a threaded end, means forming the inner race of a thrust bearing disposed on the pin, a roller cutter having a surface forming the outer race of said thrust bearing, roller members between said races, an internally threaded member threaded on the pin and having an end surface for confining said inner race against axial movement, said internally threaded member having an external surface forming the inner race of a radial bearing, an internal surface on said cutter forming the outer race of said radial bearing, roller members between said races, there being a coaxial threaded bore in said pin, and a locking member threadedly secured in said bore having a head, said head engaging said internally threaded member whereby said member is locked in place.

9. A pin having a threaded end, a cutter, and means for rotatably supporting the cutter on the pin comprising a thrust bearing and a radial bearing, means forming an inner race for the thrust bearing and telescoped over the pin, an internally threaded member threaded on the pin having an external surface forming the inner race for said radial bearing and having an end surface for confining the inner race of said thrust bearing against axial movement, there being a coaxial threaded bore in said pin, and locking means threadedly secured in said bore and engaging said threaded member, whereby said member is locked in place.

ROLAND R. CRUM.