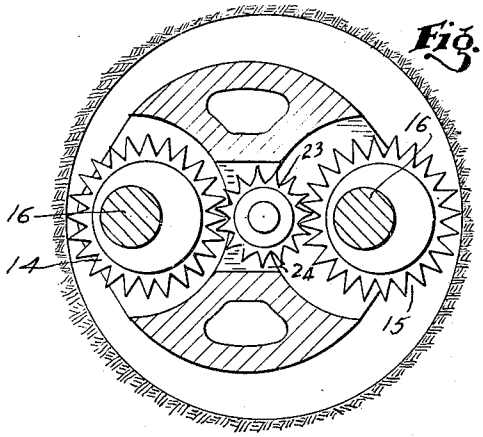
July 22, 1941. J. A. ZUBLIN 2,249,926

NONTRACKING ROLLER BIT

Filed May 13, 1940

Fig. 2



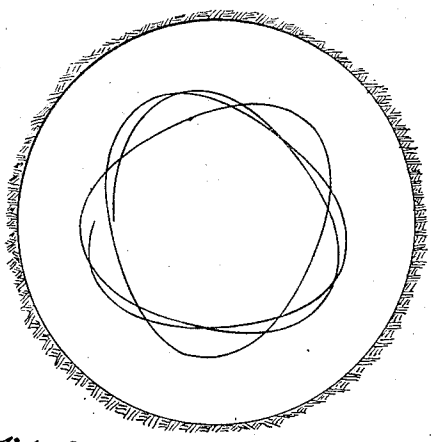


Fig. 4

Fig. 1

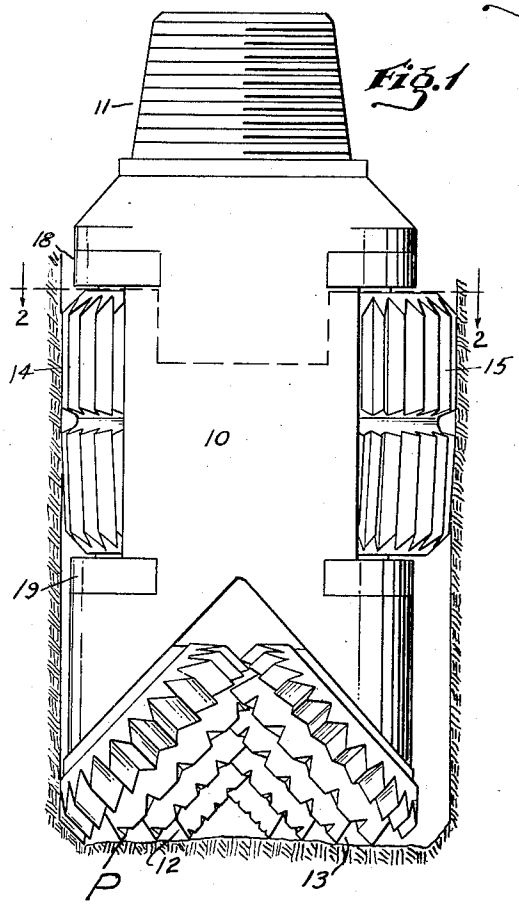
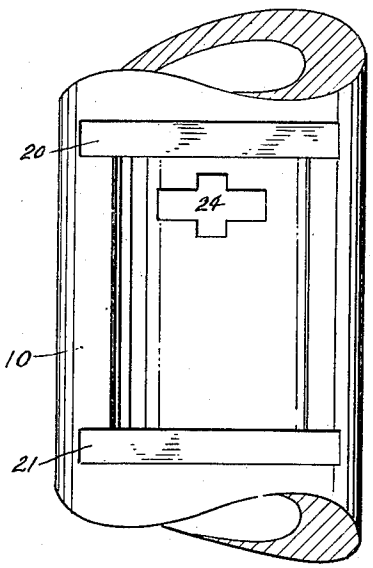


Fig. 3



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NONTRACKING ROLLER BIT

John A. Zublin, Los Angeles, Calif.

Application May 13, 1940, Serial No. 334,810

1 Claim. (Cl. 255—73)

This invention relates to rotary bits used in earth boring for oil wells and the like, and more particularly relates to that type of bit known as a roller bit.

In using drilling bits of the type having roller cutters mounted on a shank and rolling over the formation, a great deal of development work has gone toward attempts to preventing the cutters from "tracking" in the formation, i. e., the tendency of the cutters to follow the pattern in the formation. Such tracking hinders the cutting action of the bit, and may even cause it to cease entirely. This has been accomplished in a variety of ways, as by utilizing teeth on the cutters which are so arranged, and in such combinations, that tracking is supposed to be obviated. However, in all these schemes, the cutters continue to roll in concentric circles about the axis of the hole, and accordingly the modification which can be practiced on their action is limited.

It is proposed to modify the action of a roller bit on the formation by causing the cutters to abandon their concentric rolling motion to a slight degree, thus introducing a new variation in the action of the cutter to break up the pattern in the bottom of the bore. Since any bit will, in general, cut the smallest possible bore in the formation, and deviation from concentric motion requires a larger hole than the bit, the forces influencing the bit to abandon its concentric rotation must be quite large and positive, and independent of the speed of rotation of the bit.

It accordingly becomes an object of this invention to provide means for drilling a bore of sufficient diameter to allow the roller cutters to take nonconcentric paths over the formation.

It is a further object of this invention to provide means for causing the deviation of the cutters from concentric motion over the formation.

It is a further object of this invention to provide means for breaking up the pattern produced by rolling cutters on the formation.

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

Referring to the drawing, which shows one mode of practicing this invention:

Figure 1 is an elevation of a bit embodying this invention.

Figure 2 is a section taken on line 2—2 of Figure 1.

Figure 3 is a fragmentary elevation of the shank with the reamers removed.

Figure 4 is a diagram of the motion of the bit about the bore being produced.

A shank 10 is provided with a threaded pin 11 at the upper end thereof, for connection to the drill collar, as is usual. At its lower end the shank 10 is provided with a cutter assembly, here illustrated as a pair of conical cutters 12 and 13, mounted diametrically opposite each other to rotate on the shank and roll over the formation upon turning of the shank. Although illustrated as a pair of conical cutters, the cutter assembly may take any form desired, as, for example, three cones, or the various combinations of rollers well known in the art.

In the form shown, it will be observed that the cutters travel about the hole in such a manner that the teeth of cutter 12 travel on the crests of the pattern left by cutter 13, and vice versa. However, this still leaves a pattern on the formation, which interferes with the proper action of the cutters. To obviate this difficulty, reamers 14 and 15 are provided. These reamers are mounted in the shank 10 to rotate in contact with the formation. The particular reamer assembly forms no part of this invention, but they have been illustrated as mounted for rotation on pins 16, which pins are secured to plates, such as 18 and 19, which plates are welded in slots 20 and 21 cut into the shank.

Reamers 14 and 15 are shown as eccentrically mounted on pins 16. It will be noted that in the position shown in Figure 2 reamer 15 projects considerably from the shank, while reamer 14 is almost even with the surface of the shank 10. If now the bit be rotated, turning of the reamers on the formation will cause reamer 14 to project, and reamer 15 to withdraw, from their indicated positions. By virtue of the engagement of the reamers with the formation, this will cause the whole shank to move sideways, and result in the cutters 12 and 13 being forced to travel about a constantly shifting axis. This precludes the possibility of the cutters 12 and 13 tracking in the formation in concentric paths. It will be noted that the diameter of the bore produced is not a multiple of the diameter of the reamers, and consequently the position of the bit at which the reamers take the position shown in Figure 1 constantly changes. Thus the bit can be considered as travelling in a sort of elliptical or oval path, the major axis of the ellipse constantly rotating about the bore at a different rate than the rotational speed of the bit.

In order that reamers be prevented from falling out of the correct relative position to each other, some means may be provided to insure that one revolution of each reamer is accompanied by

a revolution of the other. This is accomplished, in the present instance, by the pinion **23** shown in Figure 2. A simple mode of application of this pinion to the present assembly is to provide a cross-shaped hole **24**, extending through the shank. The pinion **23**, with a short shaft keyed thereto, is simply inserted in the hole **24**, and the reamers assembled in their proper relative positions. The pinion **23** will slide back and forth in the hole as the reamers rotate, and the engagement of the teeth of the reamers with the teeth of the pinion will keep the reamers properly positioned with respect to each other.

It is to be understood, of course, that in the event the eccentricity of the reamers is small compared to the depth of their teeth, the pinion **23** can be rotatably mounted on a shaft which is in turn fixed to the shank **10**, and the length of the teeth may be depended upon to keep the pinion **23** and the reamers in geared relation. Also, any of the special gear teeth known in the machine art for driving gears which have the distances between their centers varying may be utilized. But, inasmuch as there is no real driving of one reamer by the other, except as is engendered by the irregularity of the action of the reamers on the formation, no difficulty is experienced because of the illustrated form of pinion and mounting.

Other forms of reamers besides those of eccentric circular cross-section may be used. As an example, elliptical reamers with their major axes ninety degrees out of phase may be used, but, as the amount of movement normally desired is so slight, the additional complications of such a form of reamer is a matter of choice.

In all these forms of reamers, it is preferable that there be some play between the reamers and the pinion, to prevent the differential surface speed of the reamers over the formation from generating large scraping components of motion on the formation.

This invention is not limited to a pair of reamer rollers. Three reamers can be used, properly designed and pinioned together, to give a sort of triangular shifting of the axis of the bit, as may be desirable in some cases.

In Figure 4 there is shown, by way of illustration, the path of the point of contact P of one of the rows of teeth of cutter **12**. Normally, the point P would generate a circle as the cutter **12** revolves about the axis of the bore and the axis of the shank. Due to the influence of the reamers, however, the path takes on the aspect of a plurality of incomplete ovals, the major axes of which ovals constantly change with respect to the formation. In the portion of the path shown in Figure 4, which illustrates the result of three revolutions of the shank **10**, this tendency is clearly apparent. Of course, the exact path depends upon the eccentricity of the reamers and their diameter, compared to the diameter of the bore being produced, but the above is a generalized description of the motion obtaining. It is readily apparent that such motion is very efficacious in removing any pattern which may develop on the formation.

It is to be understood that the above description is not intended to be limitative, but illustrative only, and that the scope of this invention is best determined from the appended claim.

What I claim as my invention is:

In a rotary drilling bit, a shank, a rolling cutter assembly mounted on said shank, a pair of wall engaging cutters mounted for rotation on said shank, the cutting surfaces of said wall engaging cutters being eccentric to the axes of rotation of said cutters, and gear means between said wall engaging cutters maintaining them in substantially constant angular rotational position with each other in such a manner that when the maximum radius of one cutter is in engagement with the wall of the bore being produced, the minimum radius of the other cutter is in formation engaging position.

JOHN A. ZUBLIN.