

Oct. 5, 1954

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2,690,935

DRILL BIT

Filed July 13, 1949

Fig. 1.

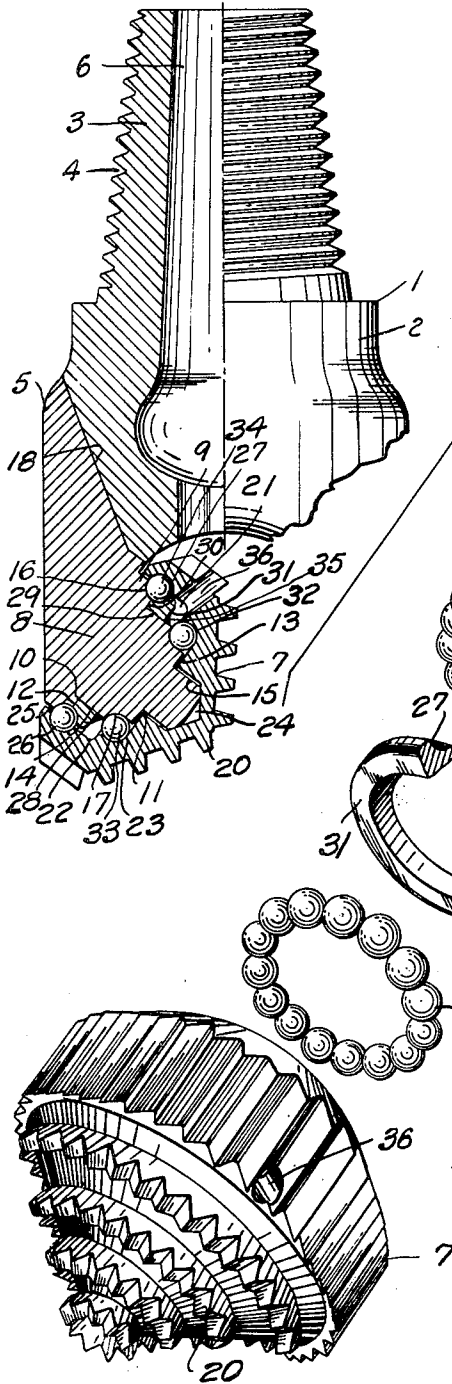


Fig. 2.

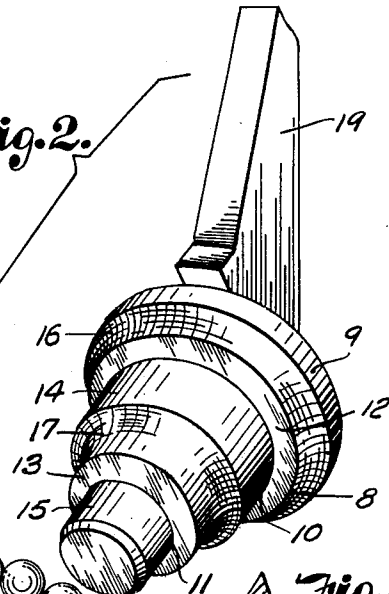


Fig. 3.

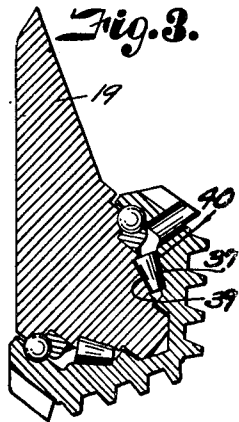
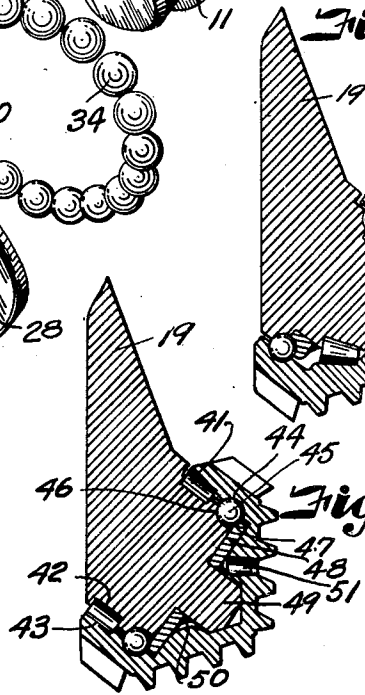


Fig. 4.



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2,690,935

DRILL BIT

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Application July 13, 1949, Serial No. 104,428

7 Claims. (Cl. 308—8.2)

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This invention relates to drill bits employing rotary cutters for use in drilling earth formations. In drills of this character it is desirable to mount the cutters on roller bearings, but when such bits are made in the smaller sizes the size of the cutters and spindles make it difficult to provide a bearing structure capable of withstanding the heavy loads that are applied to such bits.

It is therefore a principal object of the present invention to provide a bit of this character with a spindle and cutter structure utilizing bearings capable of withstanding heavy loads.

Other objects of the invention are to provide for simple and secure retention of the cutters and bearings on the spindles of the bit by means of the bearings and bearing races, and to provide one of the bearing races for each cutter with a key section that is adapted to be welded to the spindle through an opening in the cutter.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved structure, the preferred forms of which are illustrated in the accompanying drawing wherein:

Fig. 1 is a side elevational view of a portion of a drill bit having spindles and cutters constructed in accordance with the present invention, one side of the bit being shown in vertical section to better illustrate the cutter and spindle construction as well as the arrangement of the bearings on which the cutters rotate.

Fig. 2 is a perspective view of a spindle, bearings and cutter shown in disassembled spaced relation.

Fig. 3 is a vertical section through a spindle and cutter showing a modified form of the invention.

Fig. 4 is a similar view showing a further modified form of the invention.

Referring more in detail to the drawing:

1 designates a drill bit constructed in accordance with the present invention and which includes a body portion 2 having an upwardly tapered shank 3 provided with a threaded exterior 4 for engagement with a drill collar or tool joint (not shown). At the lower end of the body are two or more downwardly extending legs 5, only one of which is shown in the drawing. Formed in the axis of the bit is a channel 6 through which a drilling or flushing fluid is conducted downwardly to the cutters 7 that are rotatably mounted on spindles 8 carried by the legs 5.

Each spindle extends downwardly and inwardly at an incline from each leg and has a circular base portion 9 and downwardly stepped shoulder-like grooves 10 and 11, to provide axially spaced radial face portions 12 and 13 located in planes extending at right angles to the axis of the spindles, and cylindrical faces 14 and 15.

Formed at the juncture of the base 9 with the

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face 12 is a partial race 16, and at the juncture of the faces 13 and 15 is a full inner raceway 17.

In order to facilitate the assembly later described, the body of the bit and legs are provided with longitudinal slots 18 to receive shanks 19 formed as integral parts of the spindle and extending diametrically across the base portions 9 which are welded into the slots 18 as in conventional bit construction. Cutters 7 are of cone shape and are provided on the exterior faces with teeth 20, which may be of any desired shape and arrangement. Formed in the inner side of each cutter is a spindle receiving recess 21 having stepped annular shoulder-like grooves 22 and 23 encircling a smaller axial recess 24, the grooves 21 being of a diameter to receive the base portions 9 of the spindle and the recess 24 being of a diameter to receive the terminals of the spindles. The groove 22 has an outer cylindrical face 25 in which is formed an outer raceway 26 adapted to cooperate with the partial bearing race 16 and with a partial raceway 27 that is formed circumferentially of a ring 28, the partial raceways 26 and 16 cooperating to form an inner raceway. The ring 28 has a cylindrical inner face 29 of a diameter to be snugly received on the cylindrical face 14 of the spindle and parallel side faces 30 and 31. The rings are applied to the spindles so that the side face 30, having the partial raceway 27, seats against the faces 12 of the spindles. Formed at the base of the shoulder-like groove 23 of each cutter is an outer raceway 32 that cooperates with the inner raceway 17 to receive ball bearings 33 which support the axial thrust of the cutter in the direction of the supporting leg and cooperates with similar walls 34 in the inner and outer raceways previously described to take the radial loads.

In assembling the structure the balls are inserted in the outer raceway 32 and retained therein by coating the balls with a small amount of grease or other slightly adhesive material. The ring 28 is then inserted in the cutter with the race side 30 outermost. The ball bearings 34 are then inserted in the outer raceway 26 and partial raceway 27 of the ring 28. The spindle 8 is then inserted in the cutter with the terminal thereof engaging in the recess 24 and the ring 28 passing onto the cylindrical supporting face 14 to abut against the face 12. The ring 28 is then welded to the spindle as indicated at 35. This is effected by welding through an opening 36 formed in the wall of the cutter. After making the weld the cutter is partially rotated and another weld is made through the opening 36 whereupon the cutter is again rotated another step and another weld effected until a sufficient number of welds have been made around the ring to adequately retain the cutter. The other cutters are then assembled on their spindles in like

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manner. The spindles are then ready for application to the body of the bit. This is effected by sliding the shanks 19 into the slots 18 and welding the edges thereof as is conventional practice.

The form of the invention shown in Fig. 3 is substantially the same as that just described with the exception that tapered rollers 37 are substituted for the ball thrust bearings 33. Consequently, the inner and outer raceways 39 and 40 on the spindle and cutter are shaped to accommodate the tapered rollers, otherwise, the construction is the same and the cutters are applied to the spindles as above described.

In the form of the invention shown in Fig. 4 roller bearings 41 are used for the radial bearings. Consequently, the inner and outer races 42 and 43 on the spindle and within the cutter are of cylindrical shape and of a depth to accommodate the roller bearings 41. In this instance the outer race 44 for the thrust bearings 45 are provided in the cutters and the inner raceways by a partial race 45 in the spindle and a partial race 47 in a washer 48 that is sleeved onto the terminal 49 of the spindle. In this instance the thrust bearings constitute the lock for securing the cutter on the spindle. This is effected by welding the washer 48 to the terminal 49 of the spindle as at 50, the welds being effected through an opening 51 in the wall of the cutter in the manner previously described in connection with the other forms of the invention.

With the structure thus described, it is obvious that relatively large antifriction bearings may be used in the respective raceways or they may be used in combination with roller bearings. It is also apparent that the cutter and spindle parts are of ample strength to withstand the loads to which such bits are subjected.

From the foregoing it is obvious that I have provided an improved structure and simple method of retaining the cutters on the spindles of the bit.

What I claim and desire to secure by Letters Patent is:

1. In a drill bit, a spindle, a cutter having a recess for receiving the spindle, an antifriction bearing means between the cutter and spindle, an annular key member encircling a part of the spindle and having a portion engaging the antifriction means, and a weld connecting the annular key member with the spindle for retaining the antifriction bearing means and rotatably securing the cutter on the spindle, said cutter having an opening through which said weld is applied.

2. In a drill bit, a spindle having an annular shoulder encircled by a partial raceway, a cutter having a recess for receiving the spindle and provided with an internal annular raceway, bearings in said raceways, a retaining member sleeved on the spindle and having a partial raceway cooperating with the partial raceway of the spindle to retain said bearings for rotatably securing the cutter on the spindle, and a weld connecting the retaining member with the spindle and in contact with said shoulder, said cutter having an opening through which said weld is applied.

3. In a drill bit, a spindle having axially spaced shoulders provided with bearing raceways, a cutter having a recess for receiving the spindle and provided with raceways cooperating with the raceways of the spindle, bearings in said raceways, an annular retaining member, encircling

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the spindle intermediate the spindle raceways and having a raceway cooperating with one of the spindle raceways, and a weld securing the annular retaining member to the spindle, said weld being applied through an opening in the cutter.

4. In a drill bit, a spindle radial and thrust bearings on said spindle, a cutter on said spindle having raceways for said bearings, an annular key member encircling the terminal of the spindle and having a portion engaging one of said bearings, said cutter having an opening in registry with a side of the key member opposite said bearing engaging portion, and a weld fixing the annular key member to the spindle, said weld being applied through said opening in the cutter.

5. In a drill bit, a spindle having stepped annular shoulders encircled by raceways and a terminal of smaller diameter, a cutter having a recess for said terminal and provided with annular raceways registering with the raceways of the spindle, bearings in said raceways, an annular retaining member encircling the spindle intermediate the raceways and forming a part of one of the raceways to retain the cutter rotatably on the spindle, and a weld connecting the retaining member with the spindle.

6. In a drill bit, a spindle having spaced raceways and having a terminal forming a shoulder with the outermost of said raceways, a cutter having raceways registering with the raceways of the spindle, bearings in said raceways, a washer sleeved on the terminal of the spindle and having a raceway portion engaging the outermost of said bearings for retaining the cutter on the spindle, and a weld between the washer and terminal of the spindle for retaining the washer against said shoulder, said cutter having an opening registering with the weld whereby said weld is applied through said opening in the cutter.

7. In a drill bit including a body member provided with a spindle forming a unitary part thereof, said spindle having stepped bearing engaging portions, a cutter having a recess for accommodating said spindle and having bearing engaging portions complementary with the stepped bearing engaging portions of the spindle, antifriction bearing means between the complementary bearing engaging portions of the spindle and the cutter, an annular key member encircling the spindle and engaging one of said antifriction bearing means to retain said bearing means when the antifriction bearing means and the annular key member are placed within the cutter and the assembly slipped onto the spindle, and a weld connecting the key member to the spindle to retain said bearing means and cutter and annular key member assembly on the spindle.

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