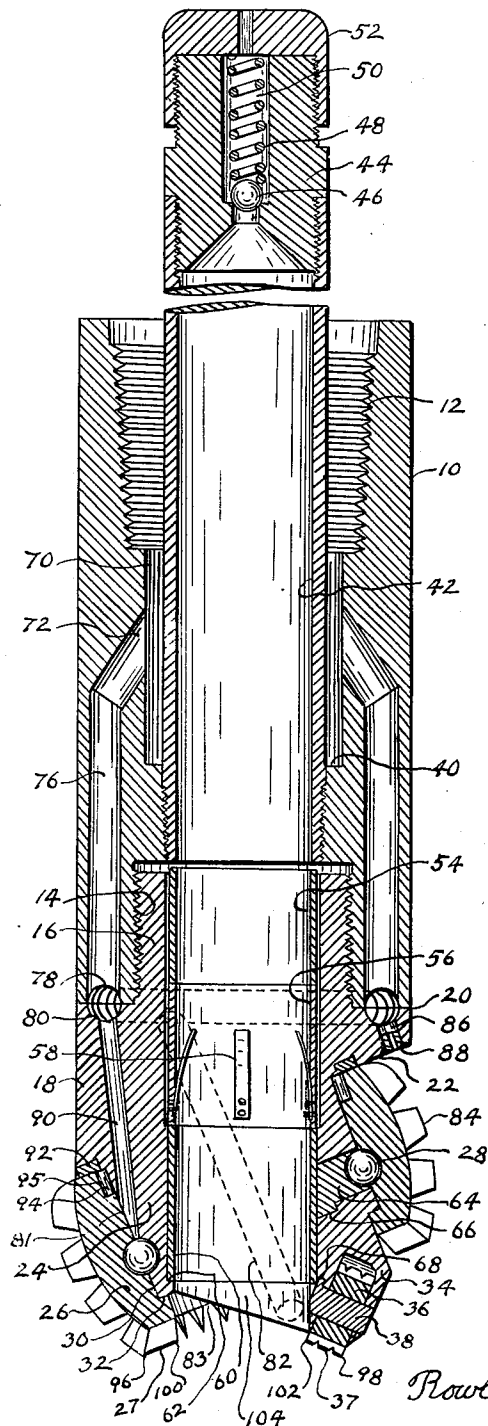


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ROLLER CORE DRILLING BIT
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ROLLER CORE DRILLING BIT

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9 Claims. (Cl. 255—72)

My invention relates to improvements in roller core drilling bits, and has particular application to earth boring drills adapted to be used for cutting a core as the drilling of the well proceeds, and is especially suited to formations that vary considerably in hardness, and further to extract a core from such formations as the borehole progresses.

One object of the invention is to provide a drill with novel features embodied for the purpose of giving greater strength and efficiency in drilling an annular borehole.

Another object of the invention is to provide a drill bit with parts that are easily assembled and easily disassembled for replacement of the parts.

Another object of the invention is to provide a drill bit that is more evenly balanced than heretofore in a bit provided with a single annular core cutter.

Another object of the invention is to provide a more efficient system for lubricating the bearings and flushing out the cuttings.

I attain these objects by mechanism illustrated in the accompanying drawing, in which the figure represents a vertical section of the roller core drilling bit.

Similar numerals refer to similar parts.

Referring to the drawing, the numeral 10 indicates the threaded connecting joint having a threaded box joint 12 at its upper end for connecting with an operating member, such as a drill pipe (not shown), when the tool is in operation. The lower end has a threaded box joint 14, which is screwed onto the threaded pin joint 16 of the bearing head 18. The connecting joint 10, and the bearing head 18, are shouldered at the joint 20.

The lower end of the bearing head 18 is provided with a bearing face 22, inclined to the axis of the bearing head and of the connecting joint, and for the purpose of illustration, this inclination is shown to be approximately $22\frac{1}{2}$ degrees, and the bearing pin 24 projects downwards from this face with its axis at a right angle to the face 22. The annular cutter 26 is rotatably mounted upon the bearing pin 24, and is removably secured thereon by the balls 28, these balls forming a bearing and a lock to lock the cutter upon the bearing head.

The bearing pin 24 has additional bearing faces, as 30 and 32, upon which the cutter 26 rotates.

The lower end of the bearing pin 24 is offset and has a downwardly extending portion 34, which extends below the annular cutter 26, and which houses the rotatable cutter 36 mounted upon the

pin 38 secured at both ends in the extension 34.

The lowermost tooth 27 of cutter 26 and the lowermost tooth 37 on cutter 36 have cutting edges forming equal angles with the axis of the tool.

The tool is what may be described as annular in shape, and is so constructed for the purpose of accommodating a core which is cut around by the cutters and stands upright inside the tool parallel to the axis of the boring head and the connecting joint.

Inside the lower middle portion of the connecting joint 10, a reduced portion 40 projects inwardly and has a female thread turned upon its inner face. A threaded inner tube or core barrel 42 is screwed to the threaded reduced portion and extends upwardly beyond the connecting joint 10 and has a valve body 44 secured to its upper end, the valve mechanism consists of a ball 46 compressed downwardly upon its seat by a compression spring 48 accommodated in a cylindrical chamber 50, and is secured therein by the perforated cap 52 threadedly connected to the body 44. This mechanism is for the purpose of shutting out the circulating fluid and to allow the gas, air or fluid in the core barrel to escape as the core rises in the tube.

Below the core barrel 42 and inside the bearing head is the loosely fitting hollow cylindrical sleeve 54, which rests upon and holds in place the hollow cylindrical loosely fitting core lifter 56 having spring arms 58 secured at their lower end to the inner portion of the core lifter, the top end of the spring arms projects inwardly, for the purpose of gripping and lifting the core (not shown).

Below the core lift 56 is another hollow cylindrical but fairly snugly fitting cylindrical sleeve 60. This sleeve rests upon the shoulder 62 inside and at the lower end of the bearing head 18, and is for the purpose of securing in place the plug 64. This plug 64 is cylindrical in shape, one end being provided with a ball groove, the other end is approximately flat and angular, and has a shoulder 66 to prevent the plug from either turning or squeezing the ball, the plug fits the cylindrical opening in the bearing head through which the balls are inserted and removed.

The sleeve 60 when in place, retains the plug 64 in operating position.

An embodiment of this form of lock is shown in Patent No. 1,760,317 issued to this applicant.

The sleeve 60, also retains the pin 38 in operating position. The pin 38 is provided with a

shoulder 68 for the purpose of preventing the pin from turning or moving outwardly, the sleeve when in position prevents the pin moving inwardly. Upon removal of the sleeve, the pin may be removed inwardly, the cutter 36 is then released.

A system of lubrication and flushing out is provided by forcing fluid down the drill pipe, (not shown), and into the central cylindrical chamber 70 provided inside the connecting joint 10. The fluid then passes into the connecting passages 72, and then passes into the vertical passages 76 and on into the horizontal annular groove 78 formed around the bottom of the connecting joint and also around the horizontal annular groove 80 formed on the top of the shoulder of the bearing head. These two grooves are in alignment and form a single cylindrical passage circling the inside of the tool.

From the annular passage 80, a duct 82 on each side of the bearing head conducts the fluid through the bearing pin 24 to the outside of the tool below the annular cutter 26 and carries the cuttings through the grooves 83 of the cutter teeth 84, and up out of the borehole.

Another passage 86 is provided and connects with the annular passage 80. This passage 86 is provided with a reduced bushing 88, which is welded in place at the mouth of the passage. The reduced bushing is made of such extremely hard material that its replacement will not be necessary.

A similar passage is shown in Fig. 3 Patent No. 1,334,632 issued to this applicant, and is for the purpose of washing the cuttings from around the cutter.

The fluid passage 90 connects the annular passage 80 with the annular cutter bearing 81 for the purpose of lubricating the bearing and for preventing the cuttings entering the bearing.

The replaceable bearing member 92 is provided to take the wear caused by the thrust of the bearing head upon the cutter 26, this member may be extended when the size of the tool permits.

Roller antifriction bearings 94 are positioned around the upper interior portion of the cutter 26, the interior of the cutter is shown to be approximately cylindrical in shape, and is provided with an annular groove 95 for the accommodation of the rollers.

In the larger sized bits several rows of antifriction bearings may be inserted for the purpose of preserving the bearing and lessening friction. When balls are used it is necessary to groove both the bearing pin and the cutter, as this is the usual practice with ball bearings, but when rollers are used it is only necessary to groove either the bearing pin or the cutter.

The outer general contour of the cutter 26 may be described as a spheroid, the center of which is at the intersection of the cutter and tool axes, the end teeth 27 are at a right angle to the cutter axis. The teeth 84 have the appearance of nicked ribs in a plane perpendicular to the cutter axis. This form of cutter is shown in Patent No. 1,254,268 and the wide and varying teeth spacings 83 is shown in Fig. 2 of Patent No. 1,334,632, both patents being granted to this applicant.

In operation, the tool is connected to the operating member and rotated to the right as the cutters come in contact with the formation. The point 96 of the annular cutter 26, and the point 98 of the cutter 36 first begin to cut and continue to cut inwards towards and around and

form a central core with a diameter equal to the distance between the inner points 100 of the annular cutter 26 and the inner points 102 of the cutter 36. The core projects upwards between the walls 104 of the vertical central aperture formed through the tool, and into the core barrel as the hole is cut away by the reaming side teeth of the annular cutter 26. The cuttings are carried out of the borehole by the circulating fluid, as described.

When a sufficient length of core has been cut to fill the core barrel, the tool is raised, the core lifter grips and lifts the core, the core being removed from the core barrel upon the tool reaching the surface.

I am aware that core drilling bits have been made with roller cutters, I therefore do not claim such a combination broadly; but

I claim:

1. A roller drilling tool, embodying a connecting joint, a tubular bearing head for attachment to said joint provided with a tubular bearing pin extending outwardly therefrom and upon which an annular cutter is rotatably mounted, said cutter being of such dimensions that it cuts on diametrically opposite sides of the borehole simultaneously, and is rotatably locked thereon by locking means inserted into a groove formed partly in said cutter and partly in said bearing pin through an aperture in said pin, said locking means being secured in said groove by a plug inserted into said aperture, said plug being secured therein by a sleeve located in the interior of said bearing pin.

2. A roller drilling tool, embodying a connecting joint, a bearing head having a lower bearing face inclined to the axis of said head and a tubular bearing pin connected thereto at a right angle to said face, an annular cutter, of such dimensions that it cuts upon diametrically opposite sides of the borehole simultaneously rotatably mounted upon said pin, and rotatably secured upon said pin by rolling members inserted into grooves formed partly in said bearing pin and partly in said cutter through a hole in said pin, said members being secured therein by a shouldered plug inserted into said hole.

3. A roller drilling tool, embodying a connecting joint, a bearing head having a bearing pin angularly disposed with respect to the axis of said joint projecting downwardly therefrom, and a cutter rotatably mounted upon said pin, said cutter being of such dimensions that it cuts upon diametrically opposite sides of the borehole simultaneously, said pin extending through the bottom of said cutter, and a second rotatable cutter mounted in said pin extension.

4. A roller drilling tool, embodying a connecting joint, a bearing head attached thereto, a bearing pin having its axis inclined to the axis of said joint and projecting downwardly from said head and extending through a cutter rotatably mounted upon said pin, said cutter being of such dimensions that it cuts upon diametrically opposite sides of the borehole simultaneously, and a second cutter rotatably mounted in said pin extension in a position so as to cut around and assist in forming a core in the center of said borehole as the tool rotates.

5. A roller drilling tool, embodying a bearing head having a central cylindrical opening adapted to receive a core, a cutter rotatably mounted upon a pin mounted in said bearing head, said pin being provided with a shoulder at its base for the purpose of limiting its forward movement, and a removable sleeve inserted into said central cylindrical opening and in contact with the base

of said pin for the purpose of securing said pin in said housing.

5 6. A roller drilling tool, embodying a connecting joint, a bearing head attached thereto, said bearing head having a bearing face inclined to the axis of the said joint and having a bearing pin extending downwardly with its axis at a right angle to said bearing face, and said pin extending through an annular cutter rotatably mounted thereon, said connecting joint having a central fluid chamber connecting with side channels formed in the walls of said joint, said side channels connecting with an annular channel formed between the contacting shoulders of the said joint and said bearing head, the said bearing head having a fluid channel extending from the said annular channel to the lower face of the bearing pin, for the purpose of conducting the fluid below the said cutter.

20 7. A roller drilling tool, embodying a connecting joint, a bearing head attached thereto, said bearing head having a bearing face inclined to the axis of said joint and having a bearing pin extending downwardly with its axis at a right angle to said bearing face, and extending through an annular cutter rotatably mounted thereon, said connecting joint having a central fluid chamber and side channels formed in the walls of said joint which connect with an annular channel formed between the contacting shoulders of said joint and said bearing head, the said bearing head having a fluid channel extending from said annular chan-

nel to the bearing surfaces between the said cutter and the bearing head, for the purpose of lubricating the bearing and preventing the cuttings entering the bearing.

5 8. A roller drilling tool, embodying a connecting joint, a tubular bearing head attached to said connecting joint, said bearing head having a tubular bearing pin having an outer bearing surface inclined to the axis of said connecting joint and extending downwardly through an annular cutter rotatably mounted upon said pin, said pin having a projection extending below said cutter, and an auxiliary cutter mounted in said projection, both of said cutters being positioned so as to cut around a central core so as to permit said 15 core to pass up through said bearing head into a core barrel attached to the inside wall of said connecting joint.

9. A roller drilling tool, embodying a connecting joint, a bearing head attached to said joint, 20 a bearing pin inclined to the axis of said joint attached to said head and extending into a cutter rotatably mounted upon said pin, a fluid duct extending through said connecting joint and having branch ducts leading through said bearing 25 head, one through the bearing pin below the lower face of said cutter, one through the bearing pin to the cutter bearing, and one leading out through the bearing head above said cutter, all of said ducts being out of alignment with and away from 30 the axis of said cutter and said pin.

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