Nov. 26, 1957 W. G. GREEN 2,814,465

DRILL BITS

Original Filed Sept. 26, 1947 2 Sheets-Sheet 1

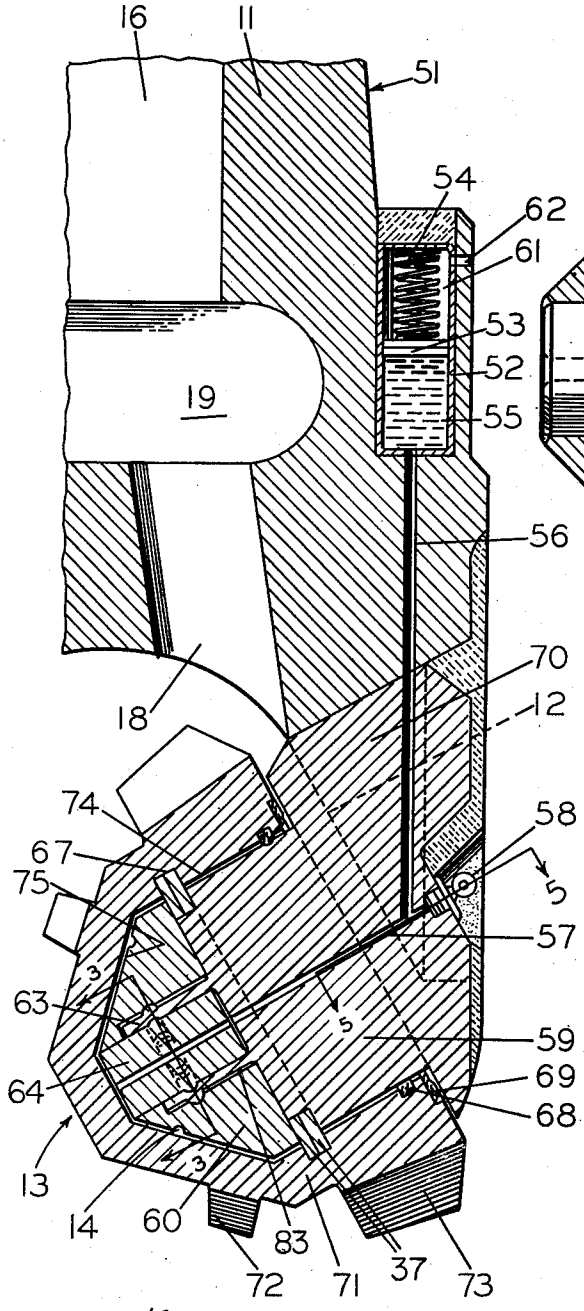
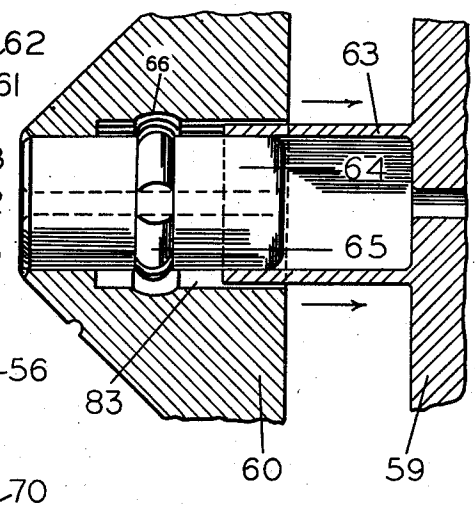


Fig. 1.

Fig. 2.



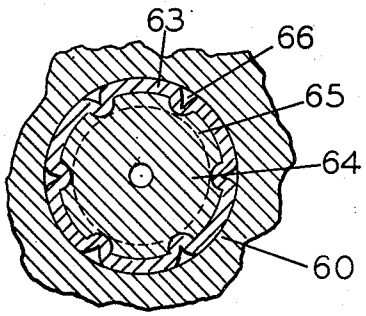


Fig. 3.

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Fig. 6.

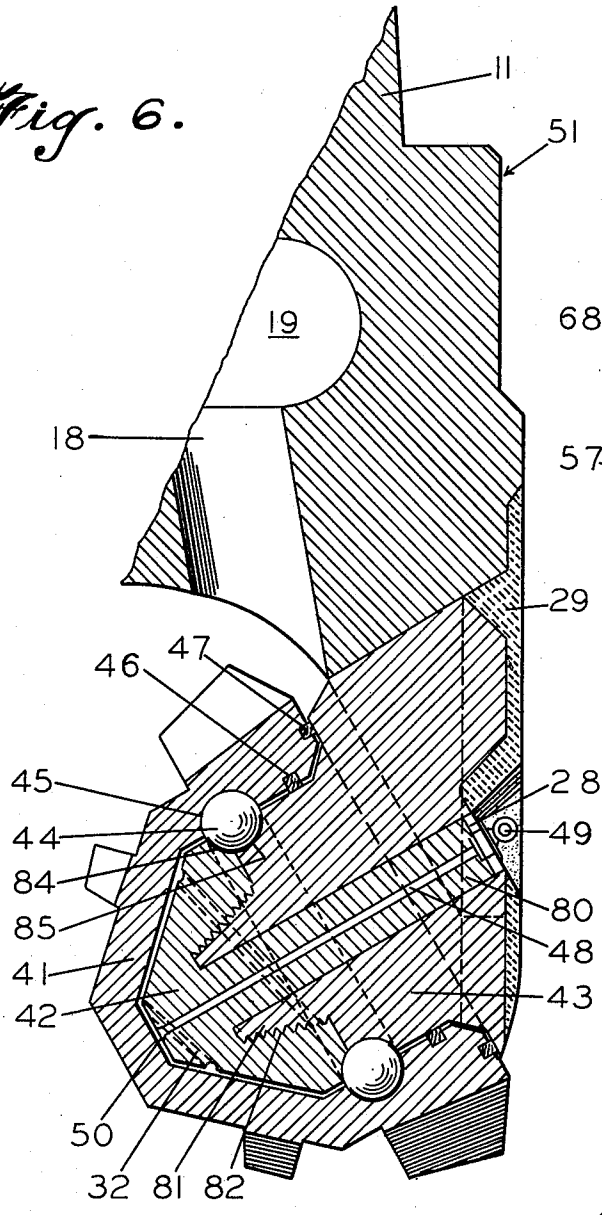


Fig. 5.

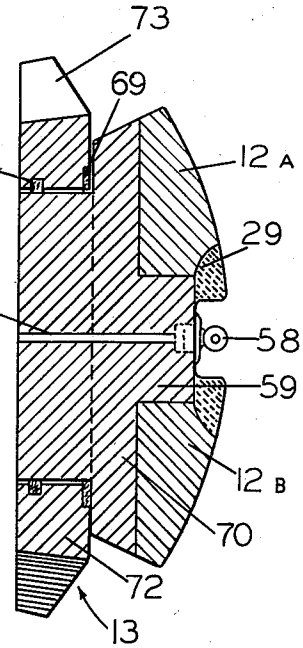
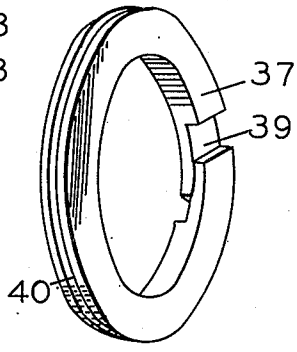


Fig. 4.



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DRILL BITS

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Original application September 26, 1947, Serial No. 776,314, now Patent No. 2,654,577, dated October 6, 1953. Divided and this application May 4, 1953, Serial No. 352,864

4 Claims. (Cl. 255—341)

This invention relates to drill bits and more particularly to deep well bits of the type which include a plurality of rotatable cone cutters mounted on the bit head.

In the art of deep well drilling it is customary to rotate in the bore hole a hollow drill bit having a head portion provided with forks in each of which is mounted a spindle for supporting, for free rotation, a cutter cone having serrated faces for cutting or abrading the ground or rock in which the well is being drilled. Mud is supplied centrally to the drill bit and is discharged over the cutters to wash away the cuttings and to lubricate the exterior of the cutters. In view of the great weight which is transmitted to the cutters through their respective spindles, a bearing problem of considerable magnitude is presented. In attempts to solve this problem resort has been had to various bearing arrangements. While some of the bearing arrangements involve anti-friction elements which render the cutters more freely rotatable, the resistance of these to heavy shock has not been heretofore entirely satisfactory, with the result that frequent and costly replacements of the cutter cone assemblies have been necessary.

Another problem related to the bearing structure is that of lubricating the bearing surfaces between the cutter and spindle. These are customarily lubricated during assembly and are not susceptible of subsequent lubrication without disassembly. Thus it may be that some of the bearing failures heretofore frequently encountered were due to failure of lubrication.

It is an object of the present invention to provide a drill bit having a cutter and spindle assembly which is characterized by ease of assembly and installation, great mechanical strength, adequate turning freedom on the part of the cutter, very high resistance to shock and high resistance to bearing failure.

It is contemplated, according to the present invention, to provide an improved cutter assembly which is susceptible of easy lubrication without disassembly and which may be lubricated during use.

The primary object of this invention, which is a division of copending application No. 776,314, filed September 26, 1947, now Patent No. 2,654,577, granted October 6, 1953, is to provide a drill bit of the type described which includes a novel means of assembly between the spindle and spindle head.

Other objects and advantages of the invention will be apparent upon consideration of the following detailed description of several embodiments thereof in conjunction with the annexed drawings wherein:

Fig. 1 is a fragmentary view in vertical section of a drill bit and cutter cone assembly of this invention.

Fig. 2 is a view in vertical section illustrating a step in the assembly of the apparatus of Fig. 1.

Fig. 3 is a sectional view taken along the lines 3—3 of Fig. 1.

Fig. 4 is a detail view of the compressible ring employed as an auxiliary bearing means in the drill bit of this invention.

Fig. 5 represents a view in section corresponding to the line 5—5 in Fig. 1.

Fig. 6 is a fragmentary sectional elevational view of another embodiment of this invention.

Referring now more particularly to the characters of reference on the drawing, in Fig. 1, a drill bit assembly employing the invention at hand is represented by numeral 51. This assembly is seen to consist basically of a tapered threaded shank portion 11 adapted for attachment to the mud pipe of the drill rig and three forks 12, supporting cutter cone assemblies 13. The forks 12 are provided respectively with tines 12*a* and 12*b*, defining between them a space for the reception of wedge-shaped spindle lip 70. The bit head is hollow and is provided with a mud channel 16, a manifold 19, mud discharge conduits 18, for serving the several cutter cone assemblies to be mounted on the drill head.

The cutter cone assembly 13 illustrated in Figures 1 and 5 is comprised of a catter cone 71 provided with cutter teeth 72 and 73 arranged in rows about the outer surface. The exterior surface of the cutter cone and teeth thereof are conventional. The interior of cutter cone 71 has cylindrical wall 74 terminating in a frusto-conical surface 75. The cutter cone is supported from a bearing assembly comprising a portion of the spindle head 59 and spindle 60. The parts 59 and 60 are joined by a novel means as will best be seen by reference to Figs. 2 and 3. A sleeve 63 on spindle head 59 extends in an annular recess or opening 83 between the spindle proper and a central, generally cylindrical core member 64 attached thereto, or integral therewith. The core 64 is provided with a series of spaced radial projections 65 disposed in an annular path about its outer surface. The surfaces of the members 65 are curved and a complementary curved groove 66 is cut in the spindle 60. The circumferential spacing of the projections 65 allows for the distortion of the sleeve 63 which is indicated in Figure 3. It is now apparent that when the spindle 60 is to be attached to spindle head 59, it is only necessary that the two be hammered together in the direction of the arrow indicated in Fig. 2 to cause the sleeve 63 to be distorted in its passage around the spaced members 65 of the core 64. This effects a relatively permanent locking of the core member 64 to the wedge member while the locking of the cutter cone 71 against axial movement relative to the supporting assembly is effected as in Fig. 1 by the use of a dual ring assembly in a recess designated in the drawings at 67 which is comprised of two rings 37. Each ring 37 is split at 39, as shown in Fig. 4, to facilitate its insertion into the annular recess 67 within the cutter cone 71. Each ring 37 also may be provided on its outer surface with a groove or channel 40 which serves as an oil retention groove and further to prevent the too rapid migration of the oil from the end of the channel 14 to the packing rings 68 and 69. The oil distribution grooves 14 and packings are also shown in Fig. 1.

It will be noted that the sealing gaskets 68 and 69 are so located that the thrust incident to the rotation of the cutter cone tends to compress them to improve their efficacy in preventing outleakage of lubricant.

Lubrication of the bearing surfaces 74 and 75 is accomplished by the arrangement shown in Fig. 1. Within the bottom portion of the drill hit assembly 51 there is provided a pressure accumulator 52 comprising a storage tank divided into two working spaces by a piston 53. The piston is urged downwardly by a spring 54 and is moved upwardly by liquid in the working space 55 which communicates through a passageway 56 in the drill head and spindle head with a passageway 57 extending from a lubrication fitting 58 through the spindle head 59 and the spindle 60. The working space 61 having therein the

spring 54 of the pressure accumulator 52, is provided with an air vent at 62. It can now be seen that when lubricant is provided under pressure at fitting 58, not only will it be pumped through the passageway to the bearing between the cutter cone and spindle and spindle head, but it will also be forced upwardly through the passageway 56 to the working space 55, causing the piston 53 to move upwardly against the thrust of spring 54 until the space 55 is completely filled with the lubricant. Thereafter when the drill is put into use, it is apparent that as the lubricant works out from underneath the cutter cone, an additional supply is rendered available by the stored energy in the spring 54 which will pump lubricant from the space 55 through the passageways 56 and 57 into the bearing space between the cutter cone and its supporting structure.

Referring now to Fig. 6, there is shown a modified form of a drill bit unit of this invention involving a cutter cone 41, a spindle 42, a spindle head 43, and ball bearings 44. The cutter cone 41 corresponds generally in configuration to the cutter 71 except that instead of having a groove such as the groove 67 therein, it has an arcuate groove 45 defining a portion of a ball race. Complementary portions of the ball race are formed in the spindle 42 and in the spindle head 43, and the resulting ball race accommodates the balls 44 about which the cutter cone 41 can rotate and prevent axial displacement of the cutter head during operation. The attachment of the spindle head 43 to drill head 51 corresponds to that shown for spindle head 59 in Fig. 1. Packing rings 46 and 47 are provided to prevent the escape of lubricant. The core 80 of spindle 42 is provided with a central passageway at 48 having a grease fitting 49 and an open end at 50 discharging into the bearing space between the cutter cone and the spindle. The assembly of the embodiment of Fig. 6 is similar to that shown in Fig. 1 except that projecting threads 81 on spindle head 43 engage internal threads 82 of spindle 42 in lieu of the projecting sleeve 63 engaging the opening 83 in spindle 60. Additionally balls 44 are inserted in the ball race defined by groove 45 and cojoining grooves 84 and 85 in the spindle and spindle head respectively. The embodiment shown in Fig. 6 also differs from the embodiment of Fig. 1 in the absence of the lubricant pressure accumulator 52, and associated parts. Helical groove 32 provides for the distribution and retention of lubricant within the conical section of the cutter cone, and through the ball grooves 45, 84, and 85. A screw driver slot 28 in the end of core 80 permits assembly or disassembly of the drill bit unit.

From the foregoing description it will be readily seen that there has been produced a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of this invention, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention as defined in the appended claims.

Having thus described the invention, what is claimed as new and useful and is desired to be secured by Letters Patent is:

1. A drill bit comprising a head portion, a fork extending from said portion, a spindle head secured to said fork, a spindle, said spindle and spindle head having respectively complementary core and sleeve members for connecting said spindle and spindle head together, said sleeve member being telescoped in the spindle around at least a portion of the core, said spindle head and spindle defining a large bearing surface interrupted by a groove, a cutter having a bearing surface complementary to that of the spindle and spindle head and a groove registering with the groove of the spindle and spindle head, said cutter being mounted for rotation on the spindle and spindle head, and

annular means lying in said grooves to absorb the axial thrust of the cutter, said core being provided with a radially enlarged circumferentially interrupted projection, said sleeve being deformable to permit distortion of said cylinder in passing over said core, whereby a permanent grip between the spindle head and spindle is effected by pressing them together.

2. A drill bit comprising a head portion, a fork extending from said portion, a spindle head secured to said fork, a spindle, said spindle head having an integral axially projecting sleeve thereon having a relatively thin annular wall of deformable material, said spindle having a cylindrical recess therein in matching alignment with said spindle head sleeve, a cylindrical core attached to said spindle and occupying said recess, said core including spaced radial projections on its circumference, said spindle including a curved groove complementary to but spaced from said projections, said core and projections defining an annular recess with said spindle and curved groove, said spindle adapted to be firmly attached to said spindle head by forcing said annular wall into engagement with said radial projections and thereby deforming said annular wall around said spaced projections and into said curved groove; said spindle head and spindle defining a large bearing surface interrupted by a groove, a cutter having a bearing surface complementary to that of the spindle and spindle head and a groove registering with the groove of the spindle and spindle head, said cutter being mounted for rotation on the spindle and spindle head, and annular means lying in said grooves to absorb the axial thrust of the cutter and provide additional bearing means for said cutter cone.

3. A drill bit comprising a head portion, a spindle head carried by the head portion, a sleeve member extending axially from one end of the spindle head, a spindle surrounding the sleeve member and separate therefrom, a core member extending from the spindle and telescoped in the sleeve member, means forming an annular groove in one of said sleeve and core members and a rib on the other of said sleeve and core members interfitting in the groove and securing said members against relative axial movement, and a cutter surrounding the spindle and spindle head and journaled relative thereto.

4. In a drill bit, a head portion having a spindle head thereon, said spindle head having a sleeve portion extending from an end thereof, a spindle surrounding the sleeve, a core member extending from the spindle in the sleeve, a cutter surrounding the spindle and spindle head and journaled relative thereto, said cutter and spindle having a lubricant passage therebetween, and means for supplying lubricant to said passage including a passageway through the core member axially of the spindle to the end thereof remote from the spindle head, and a device connected with said means for supplying lubricant to said passageway.

References Cited in the file of this patent

UNITED STATES PATENTS

Re.15,194	Patin	Sept. 13, 1921
930,759	Hughes	Aug. 10, 1909
959,539	Hughes	May 31, 1910
1,238,757	Gardner	Sept. 4, 1917
1,305,489	Patin	June 3, 1919
1,649,858	Reed	Nov. 22, 1927
1,909,128	Scott et al.	May 16, 1933
2,009,300	Reed	July 23, 1935
2,065,742	Reed	Dec. 29, 1936
2,076,002	Reed	Apr. 6, 1937
2,513,634	Francis	July 4, 1950