

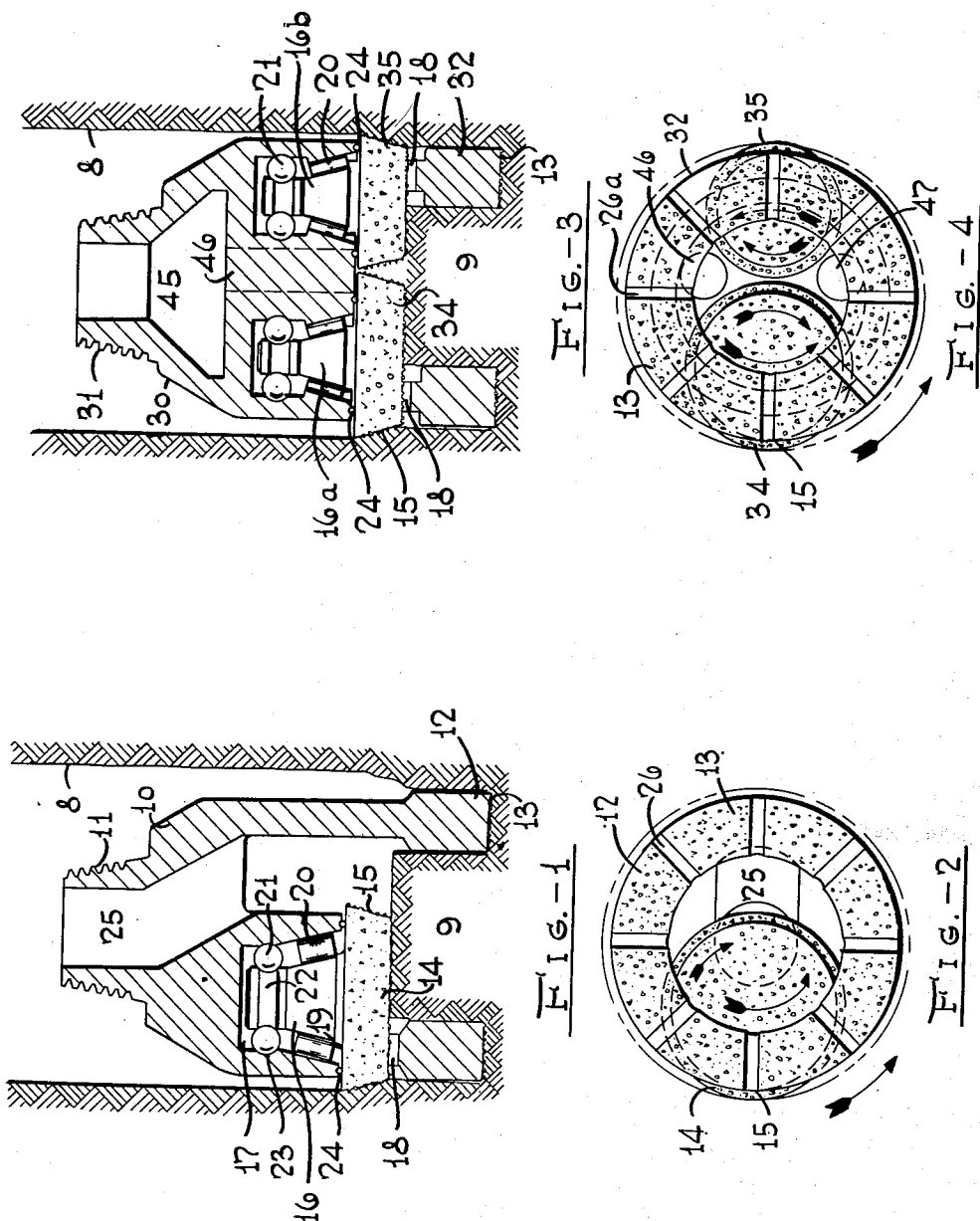
Jan. 26, 1954

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2,667,334

FULL HOLE DIAMOND BIT

Filed March 3, 1951



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UNITED STATES PATENT OFFICE

2,667,334

FULL HOLE DIAMOND BIT

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Application March 3, 1951, Serial No. 213,767

2 Claims. (Cl. 255-71)

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This invention relates to an improved type of drill bit and more particularly to a drill bit for drilling bore holes in the earth.

In present day practice the drilling of a large proportion of the bore holes in the earth for the production of crude petroleum oil from underlying oil bearing strata is accomplished by what is known as rotary drilling. In this method drill pipe is run into the full length of the bore hole and is provided with a bit at its lower end. The drill bit is rotated to accomplish the drilling by a combination of scraping, grinding and percussion forces which break up the rock ahead of the drill. A drilling fluid is circulated down through the drill pipe and back through the annulus between the drill pipe and the walls of the hole to remove cuttings and to seal the hole.

It has been observed that certain types of hard sand and chert are of such a nature that ordinary rock bits tend to wear out in a relatively short time if such formations are encountered. It has also been found that diamond coring bits will drill through such formations much more efficiently than the usual rock bits. However, the use of diamond core bits for drilling has the disadvantage that the drill pipe must be pulled out of the hole at regular intervals in order to remove the core. Although cores of up to 90 ft. in length can be taken at one time a great reduction in cost could be effected if the cored section could be drilled or ground up as the drilling progresses inasmuch as a diamond core bit can cut in excess of 500 feet of core before requiring replacement. Hence it has been proposed to employ full hole diamond bits rather than coring bits. These have usually not been very satisfactory, however, one reason being that the center portion of such a bit does not cut as efficiently as the outer portion because of its relatively slow speed of rotation. One solution that has been employed to overcome this difficulty has been to make a bit that cuts a core, which is then ground up by secondary cutters or grinders. An alternative solution to the problem has been to provide a bit having a plurality of co-planer cutters, one of the cutters being of sufficient diameter to overly the geometrical center of the hole being drilled. Such drill bits have left much to be desired however in view of the necessity for independent drives such as turbine drives or systems of planetary gearing for rotating the secondary cutters or grinders in the first solution mentioned or the plurality of cutters in the second solution mentioned.

It is one object of the present invention to pro-

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vide an abrasive type bit that will drill a full hole more efficiently than can be done with conventional full hole diamond bits.

It is another object of the invention to provide a full hole abrasive drill bit having a minimum of moving parts while nevertheless ensuring at least as great a cutting speed at the center of the hole as at the edges of the hole.

It is a further object of the invention to provide a bit which will drill a continuous core and grind up the core behind the bit with secondary grinders or cutters without the necessity for planetary gears, auxiliary turbines or similar mechanisms for actuating the secondary cutters. In accordance with the present invention there is provided a drill bit having a tubular coring head carrying abrasive particles on its leading edge and having a tapered roller cutter rotatably mounted on the shank of the bit above and adjacent the coring head, the roller cutter being mounted on a vertical axis eccentric of the central axis of the coring head and extending outwardly beyond the vertical projection of the outer periphery of the coring head and inwardly beyond the central axis of the coring head.

The nature of the invention will be more readily understood from the ensuing description when read in conjunction with the accompanying drawings in which:

Fig. 1 is an elevational view, partly in section, showing one embodiment of a drill bit of this invention in place at the bottom of a bore hole;

Fig. 2 is a bottom view corresponding to Figure 1;

Fig. 3 is an elevational view, partly in section, showing a second embodiment of the invention; and

Fig. 4 is a bottom view corresponding to Figure 3.

Referring now to Figures 1 and 2, it will be seen that the drill bit comprises a bit shank 10 having a threaded neck portion 11 to enable the bit to be removably attached to the lower end of a conventional drill string. At the bottom of the shank is an essentially tubular coring head 12 corresponding to the more or less conventional diamond coring bit carrying diamonds, tungsten carbide particles or other abrasive particles 13 on its leading edge.

Above and adjacent the coring head is rotatably mounted a secondary tapered cutter 14 carrying abrasive particles 15 on its lower face and on the tapered sides. Cutter 14 is held on a tapered shaft 16 which fits into a recess 17 in the shank of the bit. Cutter 14 extends outwardly

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through slot 18 in the bit shank so that it extends beyond the vertical projection of the outer periphery of the coring head 12. Shaft 16 is supported by tapered rollers 20 which take the thrust loads and part of the radial loads of the cutter. Ball bearings 21, which are set into groove 22 in shaft 16 and in groove 23 in shank 10, take part of the radial load and also retain the cutter in its proper position. A shoulder 19 holds rollers 20 in place. A seal 24 prevents drilling fluid from entering the bearings and thereby serves to lengthen their working life. A port 25 is provided inside shank 10 so that drilling fluid may enter from the drill pipe and pass down through water courses 26 in the coring head to aid in removing cuttings.

It will be seen that as the bit is rotated by the drill pipe the coring head 12 will penetrate the formation 8 and form a core 9. As the penetration progresses the tapered roller cutter 14 comes into contact with formation 8 and rotates on its shaft, as shown by the arrows in Figure 2. Since cutter 14 extends inwardly beyond the central axis of the coring head, it will be seen that it will cut up the entire core 9. It will be seen further that since cutter 14 extends outwardly beyond the vertical projection of the outer periphery of the coring head this cutter will not only drill away the core 9 but will also ream the hole that is being drilled, thus eliminating the necessity for additional reaming devices.

In an alternative embodiment of the invention additional tapered roller cutters may be employed for reaming and drilling up the core. One such alternative embodiment is shown in Figures 3 and 4 wherein a bit shank 30 is provided having a threaded neck portion 31 and a tubular coring head 32 carrying abrasive particles 13 as in Figure 1. Two tapered roller cutters 34 and 35 are used, each extending outwardly beyond the vertical projection of the outer periphery of the coring head as in the embodiment shown in Figure 1. Cutter 34 extends inwardly beyond the central axis of the coring head to ensure that the center of core 9 will be cut up. Cutters 34 and 35 are supported on shafts 16a and 16b which are rotatably held by roller bearings 20 and ball bearings 21 in the same manner as in the embodiment of Figure 1. An inner passageway 45 having outlet ports 46 and 47 is provided for the passage of drilling fluid to water courses 26 in cutter head 32.

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It is to be fully understood that this invention is not to be limited by the specific embodiments described above, for various changes and modifications thereof may be made without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A drill bit assembly comprising a bit shank adapted for attachment to a drill pipe, and terminating at its lower end in an essentially tubular coring head, said shank having an essentially frustro-conical recess in the body thereof above and adjacent said coring head and eccentric to the central axis of said coring head, and having a slit in the side wall in open communication with said recess, a frustro-conical shaft member disposed in said recess and defining with the inside walls thereof an annular space, said inside walls and said shaft member having cooperating circumferential grooves to receive ball bearings therebetween, a plurality of ball bearings in said grooves, a shoulder on the lower portion of said shaft member, a plurality of tapered roller bearings disposed in said annular space below said ball bearings and resting on said shoulder, a tapered roller cutter held by said shaft below said shoulder and extending outwardly through said slit beyond the vertical projection of the outer periphery of said coring head and inwardly beyond the central axis of said coring head, abrasive particles held by the lower face and tapered sides of said roller cutter, and abrasive particles held by the leading edge of said coring head.

2. Drill bit assembly according to claim 1 in which said recess in said shank body terminates in an essentially horizontal circular lip portion and in which a resilient sealing means is placed between said lip portion and the upper face of said roller cutter.

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