June 19, 1951 A. F. MAYDEW 2,557,302

COMBINATION DRAG AND ROTARY DRILLING BIT

Filed Dec. 12, 1947

Fig. 1.

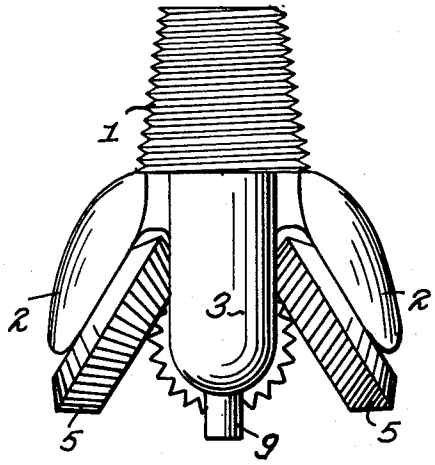


Fig. 2.

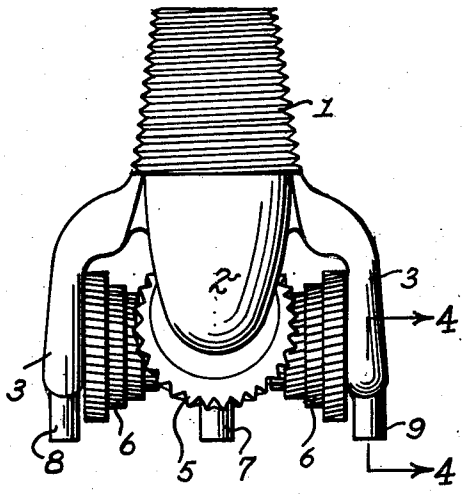


Fig. 3.

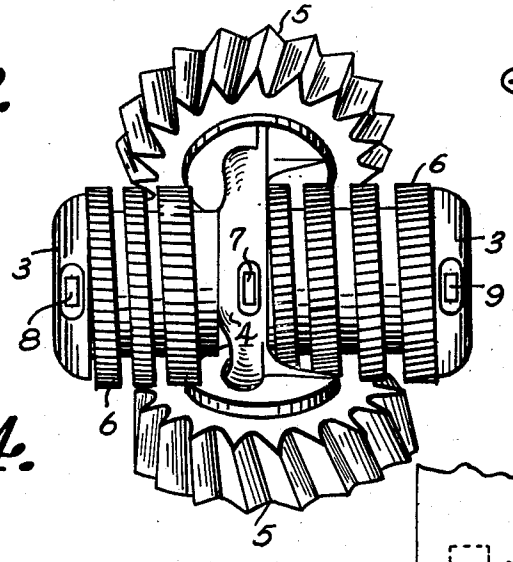


Fig. 6.

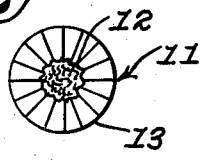


Fig. 5.

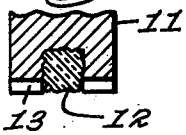


Fig. 4.

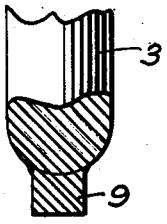
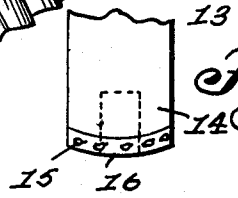


Fig. 7.



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COMBINATION DRAG AND ROTARY DRILLING BIT

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Application December 12, 1947, Serial No. 791,353

1 Claim. (Cl. 255—71)

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My present invention relates to the general class of rock drilling machines for earth boring, and more specifically to an improved rotary drilling bit of the drag type, employing multiple rotary cutters, which bit while adapted for various purposes and uses, is especially designed for oil-well drilling operations in hard rock formations. In drilling with this type of bit, if and when the gauge rollers or rotary cutters become worn and reduced in diameter, the resulting bore or cylindrical hole is also reduced in diameter, and the undersize hole frequently causes the rotating bit to drag and wedge in the bore, causing undue strains and stresses on the drill pipe. Under these conditions a succeeding bit of full gauge and size is required to perform the added function of reaming the reduced bore in order to reach the bottom of the bore for further drilling.

The primary object of my invention is the provision of means rigidly mounted on the rotating bit for maintaining a uniform gauge and for stabilizing and steadying the advancing bit against lateral drift. Thus, when using a rotary drilling bit with a twelve inch gauge, and equipped with the cutters of my invention, the twelve inch diameter of the cylindrical bore is uniformly maintained throughout the depth of the well, and a straight vertical bore or hole is formed.

For this purpose the bit is equipped with additional cutting means acting as a pilot cutter adapted to cut a central socket for the bit in the advancing bottom of the bore, together with a pair of rigid cutters adapted for forming an annular groove in the bottom of the hole for stabilizing and steadying the advancing bit.

The resulting pattern on the bottom of the bore includes a right cone with a central hole or socket and a surrounding annular gauge groove.

The auxiliary cutting means includes a minimum number of parts that may with facility and low cost of production be manufactured, and assembled with convenience on the bit or a unitary supporting structure of the bit, to insure durable and efficient tool for the purposes desired. The invention consists in certain novel features of construction and combinations and arrangements of parts as will hereinafter be described and particularly pointed out in the appended claim. In the accompanying drawings I have illustrated a complete example of a physical embodiment of my invention wherein the parts are combined and arranged in accord with one mode I have devised for the practical application of the principles of my invention. It will however, be understood that various changes and alterations are contemplated and may be made in these exemplifying drawings and mechanical structures, within the scope of my claim, without departing from the principles of the invention, as is evidenced by the modified forms of the invention illustrated in the drawings.

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Figure 1 is a view in elevation of a rotary bit having multiple rotary cutters and equipped with the auxiliary cutters or abrading devices of my invention; and Figure 2 is a similar view as seen from the right or left of Fig. 1.

Figure 3 is a bottom plan view of the bit.

Figure 4 is a detail view partly in section showing one of the auxiliary gauging devices as a hard metal stud or blade.

Figure 5 is a sectional detail view of the central pilot or abradant for forming the socket in the bottom of the bore; and Figure 6 is a face view of this cutter.

Figure 7 shows a lateral face view of an abrading cutter with diamond inserts.

In the assembly views of the drawings I have illustrated a conventional type of rotary bit having an upper threaded stud 1 for attachment to the drill rod or pipe of a well drilling appliance; and this stud forms an integral part of a forged steel structure that includes four diametrically arranged outwardly or laterally spaced arms arranged in opposed pairs for use in supporting the multiple rollers or rotary cutters of the bit. Two short opposed bearing arms 2, 2, are arranged diametrically of the two longer gauging arms 3, 3, that also are utilized as bearings, and the four arms are forged integrally with a uniting cross bar or bridge 4.

Between the respective arms 2, 2, and the bridge suitable rotary cutters, as 5, 5, are located and journaled; and between the opposed gauge arms 3, 3, and the bridge two gauging cutters 6, 6, are located and journaled. These multiple rotary cutters may be of different sizes and shapes as desired, and as here illustrated the staggered and stepped cutters are designed to fashion a pattern on the bottom of the bore simulating a right cone.

By the use of the auxiliary cutters of my invention the conical bottom is fashioned with a central cylindrical socket and a surrounding annular gauge groove, both of predetermined depth and width.

For cutting the central pilot socket a short blade or stud 7 of hardened steel is shown in Figures 2 and 3 and to form the gauge groove the two gauge arms 3, 3, are equipped with similar short blades or studs 8 and 9. The cutting

blade or stud 7 is welded to the bridge, and the blades or studs 8 and 9 are welded to the gauge arms rigid with the frame of the bit project downwardly in advance of the multiple rotary cutters, to form the pattern in the bottom of the bore, and the two gauge cutters 8 and 9 form the annular groove in the pattern with the outer wall of the groove the exact gauge or diameter corresponding to the gauge of the bit. The pilot cutter 7 which forms the guide socket in the pattern is of predetermined depth and width to fashion the desired socket; and these three cutters work in advance of the main rotary cutters of the bit.

In Figs. 5 and 6 a modified form of pilot cutter is illustrated where the solid cylindrical stud 11, united as by welding, or integral with, the bridge, is provided with a central socket to accommodate a diamond insert 12 that cooperates with a series of radiating teeth 13 surrounding the diamond insert, and this composite cutter rigid with and rotating with the bit produces the pilot socket in the pattern.

In Fig. 7 a further modified form of auxiliary cutter, which cuts and abrades the hard rock similar to the auxiliary cutter in Figs. 5 and 6, is provided on the beveled blade or stud 14, and the abrading diamond inserts 15 are rigidly mounted in the beveled edge 16. These composite cutting and abrading auxiliary devices are adapted for use in various rock formations, and the auxiliary cutters, as well as the main rotary cutters, of the bit may be interchanged as desired to meet varying conditions in earth boring.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

The combination with a rotary drill bit having a pair of spaced gauge arms and a central bridge supported between and on the gauge arms, multiple rotary cutters journaled between the arms and the bridge, and opposed bearing arms supporting the rotary cutters, of a pair of gauging cutters projecting forwardly from said arms for forming a gauge groove in advance of the bit, a central stud on the bridge projecting in advance of the bit, said stud having a central socket, a central diamond insert in the socket in the stud, and a series of radiating cutter teeth on the lower edge of the stud surrounding said insert.

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