May 26, 1942. A. W. KAMMERER 2,284,580

WELL DRILLING BIT

Filed Feb. 28, 1940

Fig. 1.

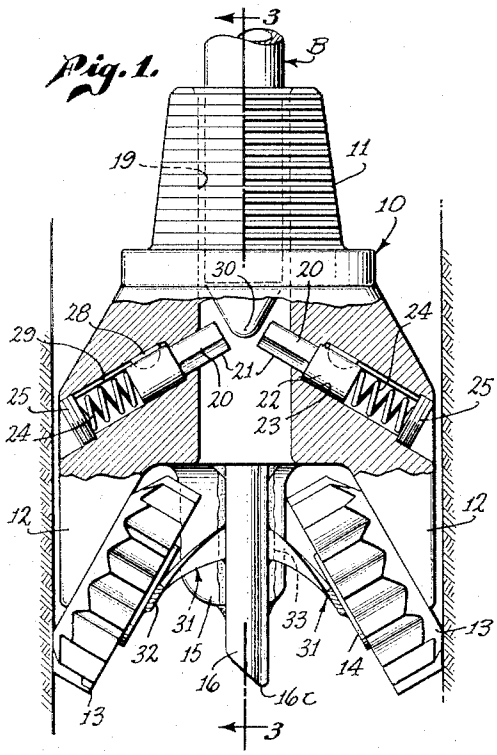


Fig. 2.

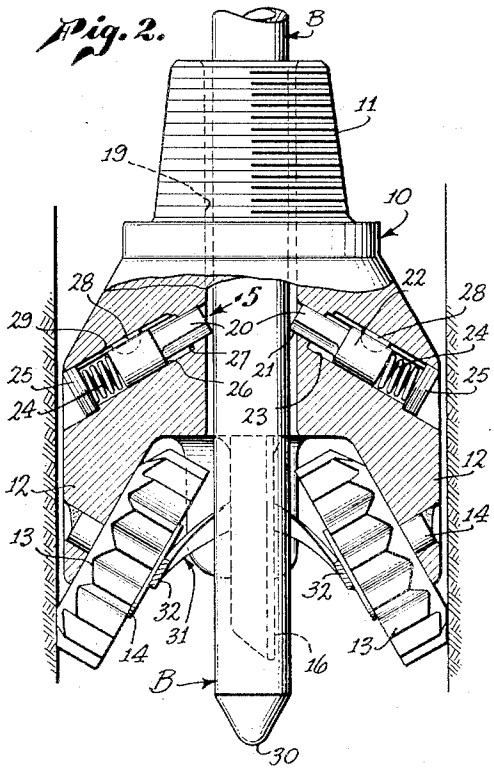


Fig. 3.

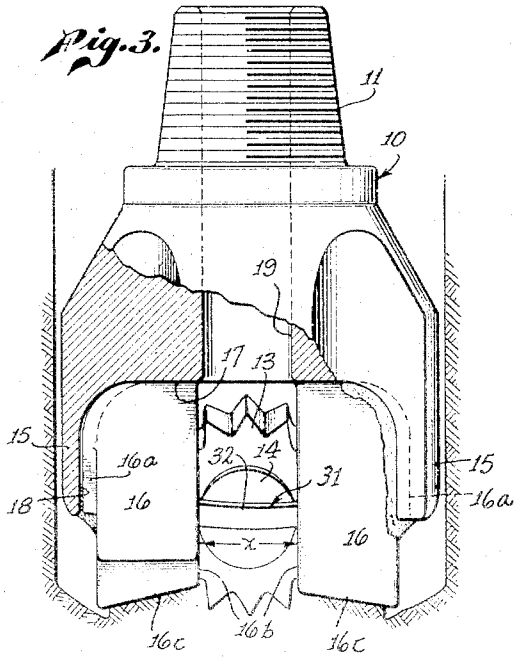
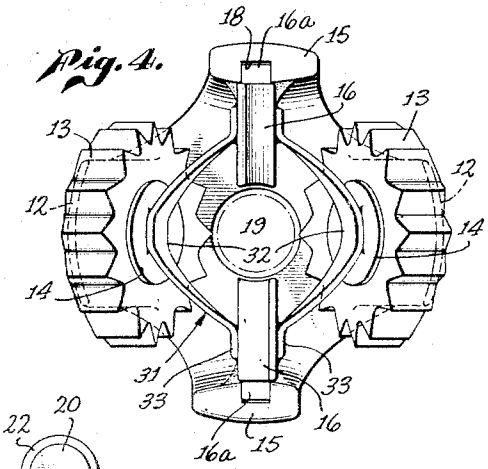


Fig. 4.



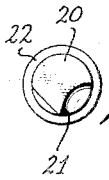


Fig. 5.

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WELL DRILLING BIT

Archer W. Kammerer, Fullerton, Calif.

Application February 28, 1940, Serial No. 321,257

5 Claims. (Cl. 255—61)

This invention relates to earth boring tools, and more particularly to bits used in the rotary drilling of wells.

In the drilling of certain types of bore holes, it is desirable to make frequent determinations of the hole characteristics, as, for example, the type formation being drilled, or the inclination of the hole from the vertical together with the direction of such inclination with respect to the magnetic North or South poles. For economic reasons, the required information should be obtainable without the necessity for removing the drilling bit from the hole. Moreover, in running surveys of the hole, it is essential that the surveying instruments pass entirely through the bit for positioning below it, in order to eliminate errors in the data obtained caused by the magnetic effects of the drill bit and of the tubular string to which it is connected.

Accordingly, an object of the present invention is to provide a drill bit normally capable of operation upon substantially the entire area of the hole bottom, but which nevertheless permits an instrument or tool to pass completely through it while positioned in the well bore.

Another object of the invention is to provide an improved combination roller and drag drill bit of rigid, sturdy and simple construction.

The cutters of drill bits designed for use in conjunction with wire line core barrels or surveying instruments do not extend to the center of the hole, removing only the outer portions of the formation material and leaving a core of substantial dimensions that passes into a longitudinal opening through the bit. Although this core usually breaks off due to its inability to sustain itself against the jarring action of the drilling tool, it serves to impede progress of the bit in making hole. It is, therefore, a further object of the invention to positively drill up or eliminate the core formed by bits of the character indicated. This is accomplished by instrumentalities in the drill bit which do not prevent passage of a tool or instrument through the pit.

Yet another object of the invention is to provide a drill bit having cutters normally positioned for operation upon the central portion of the formation material at the bottom of the hole, these cutters being removable from such operative position while the drill bit is in the hole to allow passage of a device through the bit. In this connection, it is preferred that the position of the cutters be determined automatically by the particular device employed.

This invention possesses many other advantages and has other objects which will become apparent from a consideration of the embodiment shown in the drawing accompanying and forming part of the present specification. This form will now be described in detail to illustrate the general principles of the invention, but it is to be understood that such detailed description is not to be taken in a limited sense, since the invention is best defined in the claims appended hereto.

Referring to the drawing:

Figure 1 is a longitudinal section of a drill bit embodying the present invention;

Figure 2 is a view similar to Figure 1 with parts of the drill bit disclosed in a different position;

Figure 3 is a longitudinal section taken generally along the plane 3—3 of Figure 1;

Figure 4 is a plan view of the drill bit, as seen from the bottom of Figure 1; and

Figure 5 is an end elevation of one of the cutters employed in the bit, taken in the direction of arrow 5 in Figure 2.

The drill bit shown in the drawing includes a main body or shank 10 having the usual threaded, tapered pin 11 at its upper end by means of which the bit is attachable to a tubular string of drill pipe (not shown) for rotation thereby from the surface of the hole. Depending downwardly from the main body is a pair of opposed legs 12, 12 rotatably carrying side or gauge toothed cutters 13, 13 whose purpose is to remove the outer portions of the formation material and maintain the hole to its required diameter. Each of these cutters 13 is mounted upon a suitable bearing support 14 attached to the legs 12.

Another pair of legs 15, 15 extends downwardly from the main body substantially at right angles to and between the first-mentioned pair. Opposed drag or blade cutters 16, 16 are secured to these legs and to the underside 17 of the bit body 10, as by welding. Each of these cutters 16 has a reduced portion 16a received within a longitudinal groove 18 in the inner face of an adjoining leg, the cutters extending substantially at right angles to the axes of the gauge cutters 13, tracing a path predominantly within that removed by the latter cutters. However, it will be noted that these cutters do not extend entirely across the bit body, a material space x remaining between their inner edges 16b. In effect, this space is a continuation of a longitudinal passage 19 extending completely through the threaded pin 11 and the main body 10 of the bit.

The bottom cutting edges 16c of the drag cutters are preferably inclined upwardly and inward-

ly, being disposed above the bottommost cutting portions of the side roller cutters 13. This general arrangement together with the specific mode of mounting the drag cutters do not form part of the present invention, being fully described and claimed in my copending application Serial No. 310,567, filed December 22, 1939, entitled "Well drilling bit."

The primary reason for failing to extend the drag cutters 16 to the center of the bore is to allow certain devices, such as cable tool core barrels or surveying instruments, to pass through the bit. In drilling directional oil wells (also known as slant drilling), frequent surveys are made to determine the extent of inclination of the hole from the vertical and also the orientation of such inclination. As was aforementioned, passage of the surveying instrument entirely through the bit is desired to obviate errors introduced by the magnetic effects of the drill bits and other metallic structures within the bore hole.

A surveying or other instrument B can readily be lowered on a wire line through the longitudinal passage 19 in the bit and the space x remaining between the inner edges 16b of the drag cutter for positioning at any desired distance below the bit, which, of course, has been raised from the bottom of the hole to a suitable elevation. After the necessary record has been made, the surveying instrument B is removed through the longitudinal passage 19 to the surface of the hole.

The requirement of the longitudinal passage through the drilling bit necessarily prevents extension of the fixed cross or blade cutters 16 to the center of the hole. As a result, a central core formed by the drilling action of those cutters extends upwardly from the bottom of the hole into the passage. While this core under most conditions of operation breaks off due to its inability to sustain itself, the rate at which drilling progresses is impeded by its presence. It is preferred to remove this core positively through the use of cutting instrumentalities, which do not prevent passage of a surveying instrument or other device entirely through the bit.

To accomplish the above purpose, one or more cutters 20, 20 are retractably mounted in the main body 10 of the drilling tool with their cutting portions formed with sharpened or chisel-like lower edges 21, 21 projecting into the longitudinal passage 19 for action upon any core located therewithin. These cutters 20 are inclined upwardly and inwardly toward the bit axis, being secured to or made integral with plungers 22 slidable within holes 23 provided in the bit body. The cutters are normally maintained projected into the longitudinal passage by helical springs 24 engaging the plungers 22 and reacting against plugs 25 closing the outer ends of the holes 23. The innermost positions of the cutters are limited by engagement of the inner end 26 of each plunger with a shoulder 27 in the bit body, and proper downward direction of the cutter edges is insured by preventing their rotation through the provision of a key 28 fixed to each plunger for sliding within a keyway 29 extending lengthwise of each hole.

While the drilling bit is being rotated in order to make drilling progress, the side roller cutters 13 and cross drag cutters 16 remove the formation material at the bottom of the hole, any central core remaining being disintegrated by the cutters 20 extending into the longitudinal passage. The action of the helical springs 24 urging these cutters into the passage is supplemented by the core itself, which always tends to force the cutters into the passage 19, because of their upward inclination.

Whenever it is desired to run a surveying instrument B through the drill bit, the entire drilling string is elevated a sufficient distance from the bottom of the hole and the surveying instrument lowered thereinto on a wire line. Engagement of its guiding nose 30 with the core cutters 20 will forcibly retract them from the longitudinal bit passage 19 against the action of the helical springs 24, the exterior of the instrument holding them in this position. Subsequent removal of the instrument from the passage 19 permits the springs 24 to reposition the cutters 20 into the bore 19 for operation once again upon the central portion of the formation material at the bottom of the hole.

The rigidity of the entire bit structure is enhanced by a pair of webs 31, 31 extending between the drag cutters 16 and the bearing supports 14 for the side cutters. The central portion 32 of each web is welded or otherwise secured to a bearing support 14, its wings 33 diverging towards the opposite faces on the drag cutters, to which they are welded or otherwise attached at a material distance above the cutting edges 16c, so as not to impede their drilling action on the formation. It is apparent that the webs 31 are so disposed as not to interfere with the passage of the surveying instrument B through the drilling bit.

I claim:

1. A rotary well drilling bit, which includes a main body having a pair of opposed depending legs, a bearing support secured to each leg, a cutter rotatably mounted on each bearing support, a second pair of legs depending from the main body between and substantially at right angles to said first-named pair, a drag cutter secured to each of said second pair of legs and extending inwardly therefrom toward the bit axis, and a web extending between and fixed to each bearing support and an opposed face on each drag cutter.

2. A rotary well drilling bit, which includes a main body having a central longitudinal passage therethrough and a pair of opposed depending legs, a bearing support secured to each leg, a cutter rotatably mounted on each bearing support, a second pair of legs depending from the main body between and substantially at right angles to said first-named pair, drag cutters secured to said second pair of legs and spaced from the bit axis on opposite sides thereof to provide a continuation of said central passage extending entirely through the drilling bit, and a web extending between and fixed to each bearing support and an opposed face on each drag cutter, said webs being laterally clear of said longitudinal passage.

3. A rotary well drilling bit as defined in claim 2, one or more cutters normally extending into said passage, and means mounting said one or more cutters for retraction from said passage.

4. A rotary well drilling bit, which includes a main body having a pair of opposed depending legs, a bearing support secured to each leg, a cutter rotatably mounted on each bearing support, a second pair of legs depending from the main body between and substantially at right angles to said first-named pair, a drag cutter

secured to each of said second pair of legs and extending inwardly therefrom towards the bit axis, and a web extending between and fixed to each bearing support and drag cutter.

5. A rotary well drilling bit, which includes a main body having a central longitudinal passage therethrough and a pair of opposed depending legs, a bearing support secured to each leg, a cutter rotatably mounted on each bearing support, a second pair of legs depending from the main body between and substantially at right angles to said first-named pair, drag cutters secured to said second pair of legs and spaced from the bit axis on opposite sides thereof to provide a continuation of said central passage extending entirely through the drilling bit, and a web extending between and fixed to each bearing support and drag cutter, said webs being laterally clear of said longitudinal passage.

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