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CROOKED HOLE STRAIGHTENER FOR ROTARY TYPE EARTH BORING EQUIPMENT

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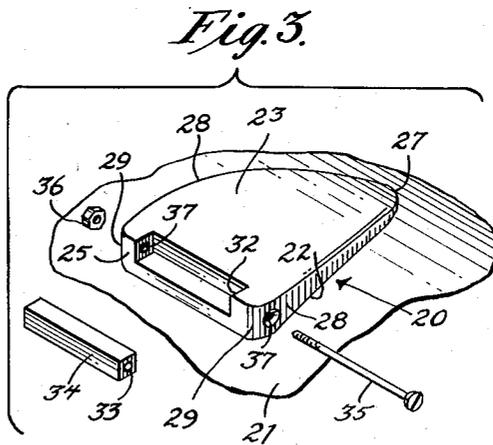
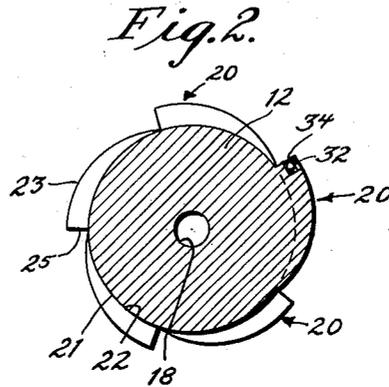
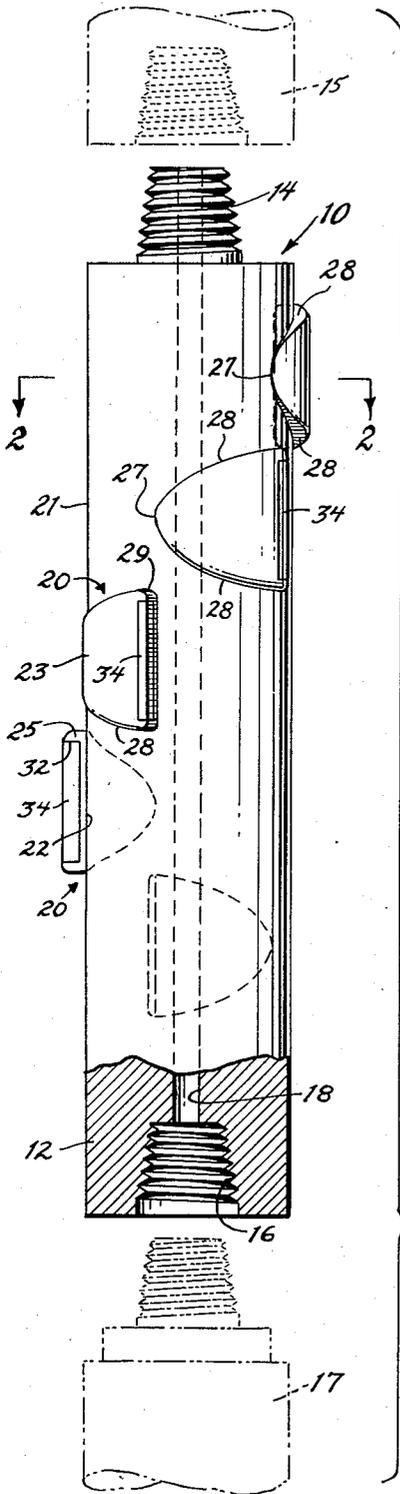


Fig. 1.

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1

2,911,195

CROOKED HOLE STRAIGHTENER FOR ROTARY TYPE EARTH BORING EQUIPMENT

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2 Claims. (Cl. 255-73)

This invention relates to rotary type drill apparatus.

While various types of drill bits and cutting tools have been provided for facilitating the drilling of a well, such as an oil well, by rotary drill equipment, one of the difficult problems facing all well drillers is that it is difficult to drill a straight hole. Regardless of how well the cutting tool cuts the various layers of earth, the actual cutting tool inherently tends to follow the line of least resistance so that it actually follows a tortuous path throughout the entire length of the hole, thereby imposing severe strains upon the cutting tool and drilling pipe. This, in turn, requires frequent costly and time consuming repairs and the necessity of having to drill a much greater distance than the actual distance between the opposite extremities of the tortuous path hole. Accordingly, it is an object of the present invention to provide a device that is simple in construction, efficient in operation, and which may be conveniently used in association with a cutting tool to overcome the aforementioned difficulties.

Another object of the present invention is to provide a straight hole device that is applicable to a drilling string which is of simple, sturdy, and dependable construction, and which can be used for performing various functions as may be desired. This straight hole device can be particularly used as a stabilizer for the drill pipe as well as a centralizing device for the drill pipe so that it may be used to advantage in drilling the straight hole from the very start, straightening a crooked hole, and for preventing deflection, side tracking, or whipstocking of the cutting tool.

A still further object of the present invention is to provide a straight hole device of the above type having integral cutting dies arranged in a predetermined manner along the body of the device, each die of which being provided with a cutting face having a replaceable cutting edge of novel design for facilitating any repairs necessary to the device.

Other objects of the invention are to provide a straight hole device bearing the above objects in mind which is of simple construction, has a minimum number of parts, is inexpensive to manufacture and efficient in operation.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawing, in which:

Figure 1 is a side elevational view, with parts broken away, of a straight hole device for rotary drill equipment made in accordance with the present invention;

Figure 2 is a transverse cross sectional view taken along line 2-2 of Figure 1; and

Figure 3 is an exploded perspective view showing one of the cutting dies forming a part of the present invention.

Referring now more in detail to the drawing, and more particularly to Figures 1 and 2, a rotary crooked

2

hole straightener 10 made in accordance with the present invention is shown to include a circular cylindrical body member 12. One end of the body member 12 is provided with a longitudinally outwardly projecting taper threaded stud 14 for engagement with one part of a drilling string, such as a drill pipe 15, while the opposite end thereof is provided with a taper threaded bore 16 for engagement with another member of a drilling string, such as the cutting tool 17. A longitudinal bore 18 communicates with both extremities of the device so as to permit the passage of a fluid therethrough in a conventional manner.

The exterior circular cylindrical surface 21 of the main body member 12 is provided with a plurality of radially outwardly extending dies 20. These dies are helically arranged in a predetermined longitudinally and circumferentially spaced relationship throughout the length of the body member and around the entire circumference thereof so that adjacent dies do not overlap in longitudinal or transverse planes. It will be noted that each die 20 is provided with a substantially flat front face 25 which defines a working edge with an outer segmental cylindrical surface 43 that is rotated into cutting engagement with the sides of the drilled hole. The base wall 22 of the die is integral with the outer cylindrical surface of the main body member, while the outer segmental-cylindrical surface 23 of each die is eccentrically arranged with respect to the longitudinal axis of the main body member. A pair of arcuate side walls 28 converge toward an intersecting point 27 in a direction away from the flat front face 25. The corners 29 between the side walls 28 and front face 25 are rounded so as to permit the movement of material freely between adjacent dies and to prevent any of the associated equipment, such as the well casing, from being caught on an otherwise sharp corner. Since each die is spaced circumferentially from each next adjacent lug, and since there is no longitudinal overlap of adjacent lugs, the cutting edges of the lugs are used most efficiently and sufficient space is thus provided to permit the passage of drilled material between adjacent dies. As shown in Figure 2, the dies are well distributed around the circumference of the main body member in a helix so that true balance is attained with a minimum number of parts, while providing a substantially long line of front faces that are used for cutting purposes.

Referring now to Figure 3 of the drawing, a cavity 32 is formed within the top and front of each die for removably receiving a rectangular prismatic cutting tool 34 therein. This tool 34 is preferably of tool steel or carbide composition so as to provide a very efficient cutting surface. The cavity 32 is of such dimensions that the tool 34 is received with one side in flush engagement with the outer surface 23 of the die and another side of the tool is in flush engagement with the front face 25 of the die. The edge between these two intersecting surfaces provide the cutting edge for the die as the entire device 10 is rotated. The tool is secured within the cavity by means of a bolt 35 that extends through aligned longitudinal bores 37, 33 in the die and tool, respectively. The head of the bolt 35, as well as the securement nut 36 thereof are recessed below the surface of the side walls 28 so as not to interfere with the smooth surface continuity of the dies and to prevent the tearing or snagging of the associated drilling equipment. This mounting also provides a simple device for quickly renewing the cutting edge of the tool 34. As one edge of the tool 34 becomes worn, the tool may be removed from the cavity and rotated 90 degrees and replaced therewithin so that a completely new cutting edge is provided. Thus, each tool is provided with four cutting

edges that may be selectively rotated into cutting engagement upon the die so that the entire life of the device is substantially prolonged without having to make a single replacement.

The particular shape of each lug provides satisfactory results without sacrificing strength or rigidity, while interference with the associated drilling equipment is also minimized. A minimum number of dies are provided without sacrificing the balance of the device and without impeding the operating efficiency thereof.

While various changes may be made in the detail construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. A crooked hole straightener for rotary drill apparatus comprising, in combination, a circular cylindrical main body member having securement means for attachment to sections of rotary drill pipe, a plurality of spaced apart cutting die members secured to the outer cylindrical surface of said main body member, said die members each extending only partially around said main body member and being longitudinally and circumferentially spaced apart upon said cylindrical surface, each of said die members comprising a substantially flat front face extending radially outwardly from said cylindrical surface, a pair of arcuate side walls converging at a point in a direction perpendicularly away from said flat face, an arcuate outer wall spaced from said cylindrical surface adjacent to said flat front face defining a working edge therewith and extending into common surface engagement with said cylindrical surface at said converging point of said side walls, each said die member being widest in a direction parallel to the longitudinal axis of said main body member and thickest in a direction normal to said axis adjacent to said working edge, said arcuate outer wall of each said die member defining a segmental cylindrical surface eccentric with said cylindrical surface of said main body member, said flat front face and said arcuate outer wall of each die defining a substantially prismatic cavity, a prismatic cutting tool having a plurality of cutting edges adjustably supported within each said cavity, each cutting edge of said cutting tool being selectively rotatable into a position lying along the same line as said working edge, and releasable means removably securing each said cutting tool in a fixed position within said cavity.

2. A crooked hole straightener for rotary drill apparatus comprising, in combination, a circular cylindrical main body member having securement means for attachment to sections of rotary drill pipe, a plurality of spaced apart die members secured to the outer cylindrical surface of said main body member, said die members each extending only partially around said main body member and being longitudinally and circumferentially spaced apart upon said cylindrical surface, each of said die members comprising a substantially flat front face extending radially outwardly from said cylindrical surface, a pair of arcuate side walls converging at a point in a direction perpendicularly away from said flat face, and an arcuate outer wall spaced from said cylindrical surface adjacent to and defining a working edge with said flat front face and extending into common surface engagement with said cylindrical surface at said converging point of said side walls, said working edge defining a cylindrical surface concentric with said main body member in response to rotation of said main body member about a longitudinal axis, each of said die members being widest in a direction parallel to the longitudinal axis of said main body member and thickest in a direction normal to said axis adjacent to the point of intersection of said flat front face of said outer wall, said arcuate outer wall defining a segmental cylindrical surface eccentric with said cylindrical surface of said main body member, said flat front face and said outer wall of each die defining a substantially prismatic cavity, a prismatic cutting tool supported upon said cavity, one longitudinal edge of said cutting tool defining a cutting edge lying along the same line as said working edge of said die, and releasable means comprising a bolt extending through said prismatic cutting tool and engaged with said die removably securing each said cutting tool within said cavity.

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