

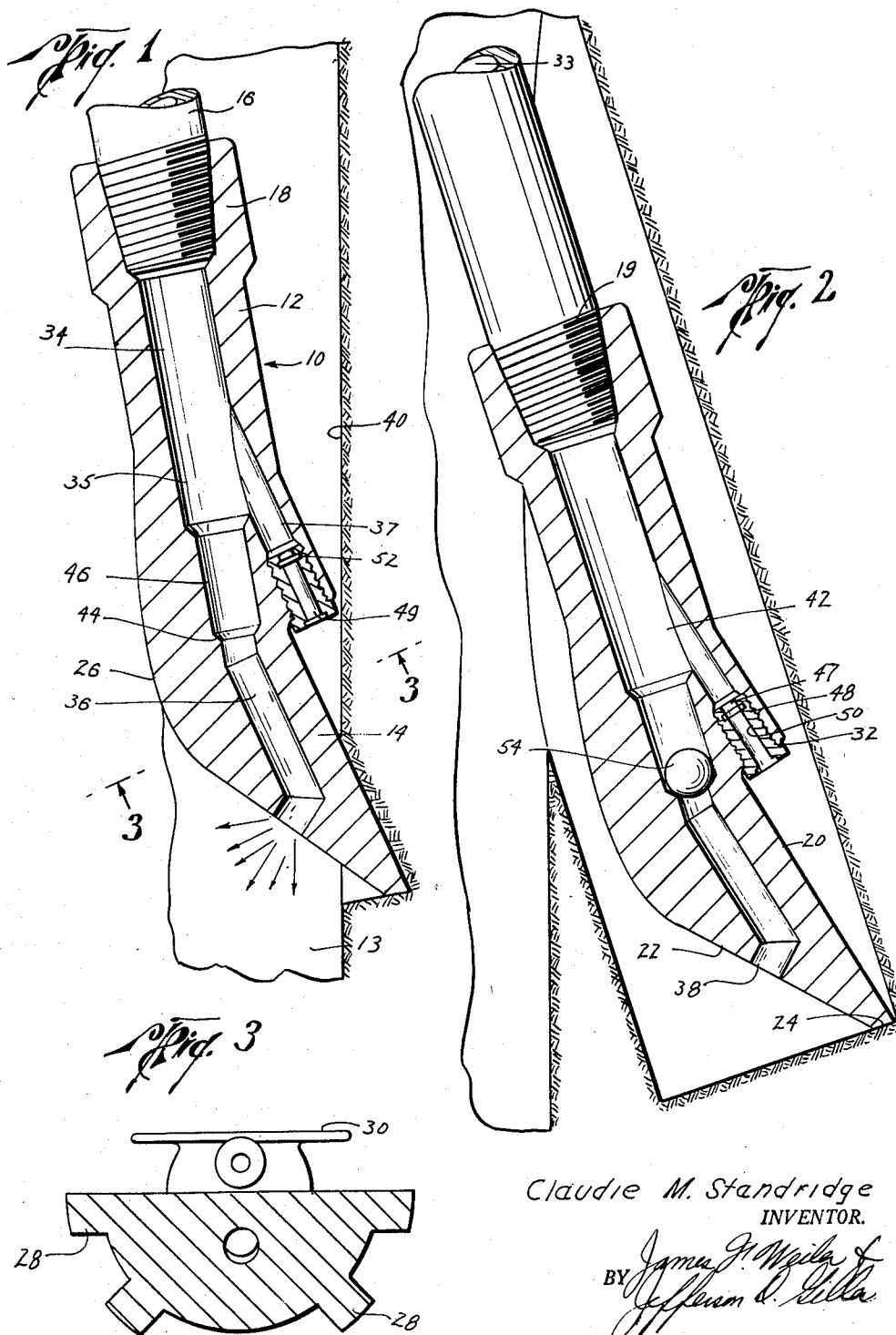
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ECCENTRIC SPUD BIT

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ECCENTRIC SPUD BIT

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This invention relates to an improved eccentric spud bit and more particularly to such a bit utilizing a fluid jet as an aid to spudding in at a side of a well bore. The initiating of a hole by a bit is known in the trade as "spudding in."

In the drilling of oil and gas wells it frequently becomes necessary or desirable to leave the original well bore and drill at an angle to this well bore for sidetracking operations or directional drilling. When this occurs the bit must be deflected from its normal path to make a cut through a side of the well bore. If the cut is to be made through the side of the well bore at the bottom of the well it is oftentimes possible to deflect the bit, such as an eccentric spud bit, through the side of the well bore by forcing downwardly on the drill string connected to the bit thereby slightly bending the drill string above the bit because the bit is resting on the bottom. Such action tends to deflect the bit to an angle from the original direction of the well bore and cause it to cut at an angle to the well bore.

However, it is difficult to cut through a side of the well above the bottom of the well without the use of a mechanical aid in the well to deflect the drill but such as the use of a whipstock. For example, an eccentric spud bit works satisfactorily at the bottom of a well for deflection but is not satisfactory for cuts through the well bore wall above the bottom of the hole without some mechanical assistance to deflecting the bit such as the use of a whipstock.

It is a general purpose of the present invention to provide an improved eccentric spud bit which may be used to cut through a wall of the well bore above the bottom of the well bore for directional drilling or sidetracking operations without the use of mechanical devices in the well to deflect the drill stem such as whipstocks and the like.

It is another object of the present invention to provide an improved eccentric spud bit which when used for sidetracking or directional drilling above the bottom of a well bore causes the blade of the eccentric bit to strike the same portion of the wall of the well bore upon each downward movement of the bit when the bit is moved upwardly and downwardly to spud in.

A still further object of the present invention is to provide an improved eccentric spud bit having a passageway in fluid connection with a jet port on the trailing surface of the eccentric blade so that fluid leaving the jet port forces the eccentric blade of the bit against a side of a well bore and which bit includes means for sealing the jet port against the passage of fluid once the bit has been spudded in and permits a circulation over the leading surface of the bit during further drilling operations.

And still a further object of the present invention is to provide such an improved eccentric spud bit in which the circulation port which causes drilling fluid to circulate over the leading surface of the eccentric blade is

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releasably plugged while fluid from the jet port forces the blade against the side of the well bore and thereafter the plug may be expelled by fluid pressure from the drill string by sealing off the jet port.

Other objects and advantages will be more apparent from the following description of a preferred example of the invention, given for the purpose of disclosure, and taken in conjunction with the accompanying drawing, where like character references refer to like parts throughout the several views, and where

Fig. 1 is a sectional elevation of the improved eccentric spud bit of the present invention illustrating the initial spudding in of the bit at a side of a well bore,

Fig. 2 is similar to Fig. 1 and illustrates the improved bit after the spudding in and with circulation at the leading surface of the blade, and

Fig. 3 is a view along the line 3—3 of Fig. 1.

Referring now to the drawings, and particularly to Figs. 1 and 2, the improved eccentric spud bit, indicated generally by the numeral 10, includes an elongate generally tubular body 12 adapted to be fitted into a well bore 13, an eccentric cutting blade 14 at the lower end of such body 12 and means at the upper end of body 12 for securing the bit 10 to a string of conventional drill pipe 16 having a fluid passage 33 therein. This means for securing the body 12 to the drill string 16 may take any conventional form such as the internally threaded box 18 adapted to internally receive the pin member 19 at the lower end of the drill string 16. The body 12, the box member 18, and the eccentric blade 14 are all normally formed from a single casting.

As illustrated in the drawings, the eccentric blade 14 is directed at an angle from the axis of the body 12 and has a leading surface 20 and a trailing surface 22 opposite the leading surface 20 and terminates at the toe 24 which extends outwardly from the body 12. Formed on the bit 10 at the upper end of the trailing surface 22 is the convex exterior surface 26 on which are a plurality of generally vertical guide ribs 28 (see Fig. 3) for a purpose which will be made clear later.

At the upper end of the leading surface 20 is the tapered plate 30 at the lower end of which is a circulation port 32 in fluid communication with the fluid passageway 33 in the drill pipe 16. This circulation port 32 combined with the plate 30 serves to provide circulation for the leading surface 20 to wash cuttings aside and prevent balling of earth around the blade 14.

The foregoing structure is conventional in an eccentric spud bit and needs no further explanation or description.

Drilled in the bit 10 is the inverted Y-shaped fluid passageway 34 including in the body 12 the trunk 35 in fluid communication at its upper end with the fluid passageway 33 in the drill string 16 and having a first downwardly directed branch 36 in the blade 14 and a second downwardly directed branch 37 in communication with the circulation port 32. Located in the trailing surface 22 of the blade 14 is a jet port 38 which is in fluid communication with the first branch 36 and thereby in fluid communication with the fluid passage 33 in the drill pipe 16. This jet port 38 is drilled in the eccentric blade 14 at an angle to the axis of body 12 so that the reaction of drilling fluid coming out of this jet port 38 into the well bore 13 forces the leading edge 20 and toe 24 of the eccentric blade 14 against a side 40 of the well bore 13 as best illustrated in Fig. 1. This jet port 38 is preferably located on the bit 10 as close to the toe 24 as is practical in the drilling of the first downwardly directed branch 36 as this jet port 38 may be used to aid in washing the blade 14 on the initial rotations of the bit 10 after spudding in has been accomplished as will be made clear later.

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Above the jet port 38 and below the point of juncture 42 of the first branch 36 and the second branch 37, the first branch 36 is counterbored forming the tapered ball seat 44 and the enlarged diameter portion 46 immediately above the ball seat 44. This enlarged diameter portion 46 is preferably of such diameter that it closely receives the ball 54 as shown in Fig. 2 to prevent fluid turbulence from reaching the seated ball 54. Approximate the point of juncture 42 of first branch 36 and second branch 37 the first branch 36 is again counterbored to make it the same diameter as the trunk 35 of the fluid passageway 34.

Referring now to the second branch 37, there is provided in the circulation port 32 the expellable plug assembly 47 which includes the gland 48 threadedly secured in circulation port 32 and the expellable plug 49 releasably held within the bore 50 extending the length of the gland 48. While this expellable plug 49 may be of various material, preferably it is cast from molten lead poured into the gland 48 before the gland 48 is inserted in the circulation port 32. Provided at the upper end of the bore 50 of the gland 48 as this gland is viewed in Figure 1 there is provided the annular space 52 which is filled with molten lead at the time of the forming of the expellable plug 49 and which holds the expellable plug 49 within the gland 48 until sufficient fluid pressure is placed on the upper end of the expellable plug 49 to shear the lead filling the annular ring 52 and force this expellable plug 49 out the gland 48. By varying the size of the annular space 52 the amount of fluid pressure needed to expel the plug 49 can be varied.

Other types of expellable plugs may be used and if desired the gland 48 may be entirely omitted and an expellable plug of shearable material may be inserted directly into the circulation port 32. However, the particular expellable plug assembly 47 illustrated is preferred.

At the point of juncture 42 of the first and second branches 36 and 37 respectively, the second branch 37 is less in diameter than the ball 54 so that when the ball 54 is dropped down drill string 16 it will sealingly seat on the ball seat 44 and will not lodge in the second branch 37. Obviously, any other desired means may be used in connection with the second branch 37 which will prevent the ball from seating in the second branch 37 but will not prevent the passage of fluid, for example, the means illustrated in United States Patent No. 2,191,702, granted February 27, 1940 on the application of O. P. Yowell for a Bypass Fitting, although other means may be used.

In operation the plug assembly 47 including the expellable plug 49 is threaded into circulation port 32. The bit 12 is then secured to the lower end of the drill string 16 and lowered into the well bore 13 until it reaches the desired place for cutting through a side 40 of the well bore 13. During this lowering the ball 54 is not in use and circulation from trunk 35 passes out the jet port 38 as the circulation port 32 is closed by the plug assembly 47. During this lowering of the bit 10 the pressure of the drilling fluid is kept sufficiently low so that the toe 24 of eccentric blade 14 is not forced against a side of the well bore 13.

Upon reaching the desired elevation for sidetracking or directional drilling to begin, the bit 10 is oriented by any conventional method used in the art so that the toe 24 points in the direction desired. Once oriented, the fluid pressure in the drill string 16 is increased so that the action of the fluid leaving the jet port 38 forces the toe 24 against the side 40. Downward movement of the bit 10 by the drill string 16 then causes the toe 24 to cut into the side 40 causing resistance to downward movement of the bit 10 which deflects the bit 10 from the axis of the well bore 13 as is illustrated in Fig. 1. This causes the convex surface 26 opposite the leading surface 20 to bear against the opposite side of the well

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bore 13 forcing the toe 24 in the same direction as it is urged by fluid from the jet port 38 thus also aiding in spudding in. To insure that the bit 10 is thoroughly spudded in before rotation begins it may be necessary to raise the bit 10 slightly and then lower it to jam it through the wall 40. In this raising and lowering operation the guide ribs 28 cut in the wall on the opposite side from the leading edge 20 helping to keep the bit 10 properly oriented as to direction. Further, the convex surface 26 tends to ride in the same place in the well bore opposite the side 40, which action combined with the action of fluid from jet port 38, deflects the toe 24 into the cut it originally made.

After the bit 10 is spudded in it may then be rotated for a few turns through the action of drill pipe 16 with fluid from the jet port 38 washing around the blade 14 to carry away cuttings. As shown in Figures 1 and 2 this jet port 38 is directed at less than right angles to the axis of body 12 and preferably at approximately 45° thereto and as has been heretofore stated is also located close to toe 24 so the fluid from this jet port 38 is directed toward the cutting area of toe 24 and helps in removing the cuttings in addition to forcing the blade 14 in the direction desired on originally spudding in. While the jet port 38 may be directed at right angles to the axis of body 12, this reduces the circulation around the toe 24 when circulation is through jet port 38 and also in such construction there would be more danger of the circulation through the bit 10 while it was being lowered causing accidental hanging of the toe 24 in a side of the well bore.

After the bit 10 has been spudded in and, if desired, after a few turns have been made the ball 54 is dropped down the fluid passageway 33 in the drill pipe 16 and seats on the ball seat 44 in sealing engagement therewith thereby preventing any fluid from reaching the jet port 38. The counterbored portion of 46 immediately above the ball seat 44 being of approximately the same diameter as ball 54 prevents turbulence of the drilling fluid from reaching the ball 54 and unseating it. Because of the pressures involved a temporary unseating of the ball 54 can cut away the ball seat 44 and prevent a sealing engagement from forming between the ball 54 and the ball seat 44.

As soon as the ball 54 has seated the fluid pressure in the fluid passageway 34 then expels the expellable plug 49 from circulation port 32 permitting drilling fluid under pressure to pass along the leading surface 20 of blade 14 so that cuttings are removed in a more efficient manner than by fluid leaving the bit 10 at the trailing surface of the blade 14. Thereafter drilling continues in the normal manner of an eccentric spud bit and the bit 10 may be removed from the well bore when desired in the same manner as a conventional eccentric spud bit.

It is to be noted that in cutting through the side 40 no whipstock or other external mechanical aid in the well bore 13 was necessary to make the cut.

If it should be desired to make the cut in the well bore at the bottom of the well bore, the same bit 10 may be used and in the same manner so the same bit 10 performs the sidetracking or directional drilling operation whether at the bottom of a well bore 13 or up from the bottom.

The present invention is, therefore, well suited to carry out the objects and attain the advantages mentioned as well as others inherent therein. Changes in details and rearrangements of parts will suggest themselves to those skilled in the art and accordingly it is desired to be limited only by the spirit of the invention as defined by the scope of the appended claims.

What is claimed is:

1. In an eccentric spud bit including an elongate body adapted to fit into a well bore, an eccentric cutting blade at the lower end of the body including a leading surface extending outwardly from the body and a trailing sur-

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face opposite the leading surface, and first fluid passageway in the body establishing fluid communication at the upper end of the body with a string of drill pipe, the improvement comprising a second fluid passageway in the bit in fluid communication with the first passageway, a jet port in the trailing surface in fluid communication with the second passageway and directed at an angle to the axis of the body, a ball seat in the second passageway above the jet port adapted to sealingly receive a ball dropped down the drill string, a third fluid passageway in the bit in fluid communication with the first passageway above the ball seat, said third passageway being of lesser diameter at its point of communication with the first passageway than the ball, a circulating port approximate the leading surface in fluid communication with the third passageway, and an expellable plug in the circulating port whereby drilling fluid passing downwardly through the first and second fluid passageways and leaving the jet port forces the leading edge of the cutting blade against a wall of the well bore until the ball is seated whereupon the expellable plug is forced out by fluid pressure.

2. The improvement of claim 1 in which the second fluid passageway is reduced in diameter from that of the first fluid passageway above the ball seat.

3. The improvement of claim 1 in which the jet port directs fluid at approximately 45° to the axis of the body.

4. The improvement of claim 1 in which the expellable plug comprises lead.

5. In an eccentric spud bit including an elongate body adapted to fit in a well bore, an eccentric cutting blade at the lower end of the body including a leading surface extending outwardly from the body and a trailing surface opposite the leading surface, and a first fluid passageway in the body establishing fluid communication at the upper end of the body with a string of drill pipe, the improvement comprising a convex surface on the exterior of the bit at the upper end of the trailing surface, a second fluid passageway in the bit in fluid communication with the first passageway, a jet port through the trailing surface in fluid communication with the second passageway and directed at an angle to the axis of the body, a ball seat in the second passageway above the jet port adapted to sealingly receive a ball dropped down the drill string, a third fluid passageway in the bit in communication with the first passageway above the ball seat, said third passageway being of lesser diameter at its point of communication with the first passageway than the ball, a circulating port approximate the leading surface in fluid communication with the third passageway, and an expellable plug in the circulating port whereby drilling fluid passing downwardly through the first and second fluid

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passageways and leaving the jet port forces the leading edge of the cutting blade against a wall of the well bore until the ball is seated whereupon the expellable plug is forced out by fluid pressure.

6. The improvement of claim 5 including at least one generally vertical guide rib on the convex surface.

7. An eccentric spud bit comprising, an elongate body adapted to fit in a well bore, an eccentric cutting blade at the lower end of the body including a leading surface extending outwardly from the body and a trailing surface opposite the leading surface, an inverted generally Y-shaped fluid passageway in the bit establishing fluid communication at its upper end with a drill string and having first and second downwardly directed branches, a jet port in the trailing surface in fluid communication with the first branch directed at an angle to the axis of the body, a ball seat in the first branch above the jet port adapted to sealingly receive a ball dropped down the drill string, means associated with the second branch preventing the ball from sealing the second branch, a circulation port proximate the leading surface in fluid communication with the second branch, and an expellable plug in the circulation port whereby drilling fluid passing downwardly through the fluid passageway and through the jet port forces the leading edge of the cutting blade against a side of the well bore until the ball is seated whereupon the drilling fluid forces out the expellable plug.

8. An eccentric spud bit comprising, an elongate body adapted to fit in a well bore, an eccentric cutting blade at the lower end of the body including a leading surface extending outwardly from the body and a trailing surface opposite the leading surface, a fluid passageway in the bit establishing fluid communication at its upper end with a drill string and having first and second downwardly directed portions, a jet port in the trailing surface in fluid communication with the first portion directed at an angle to the axis of the body, a ball seat in the first portion above the jet port adapted to sealingly receive a ball, means associated with the second portion preventing the ball from sealing the second portion, a circulation port proximate the leading surface in fluid communication with the second portion, and an expellable plug in the circulation port whereby drilling fluid passing downwardly through the fluid passageway and out the jet port forces the leading edge of the cutting blade against a side wall of the well bore until the ball is seated whereupon the drilling fluid forces out the expellable plug.

References Cited in the file of this patent

UNITED STATES PATENTS

2,324,102	Miller	July 13, 1943
2,350,986	Collins	June 13, 1944