

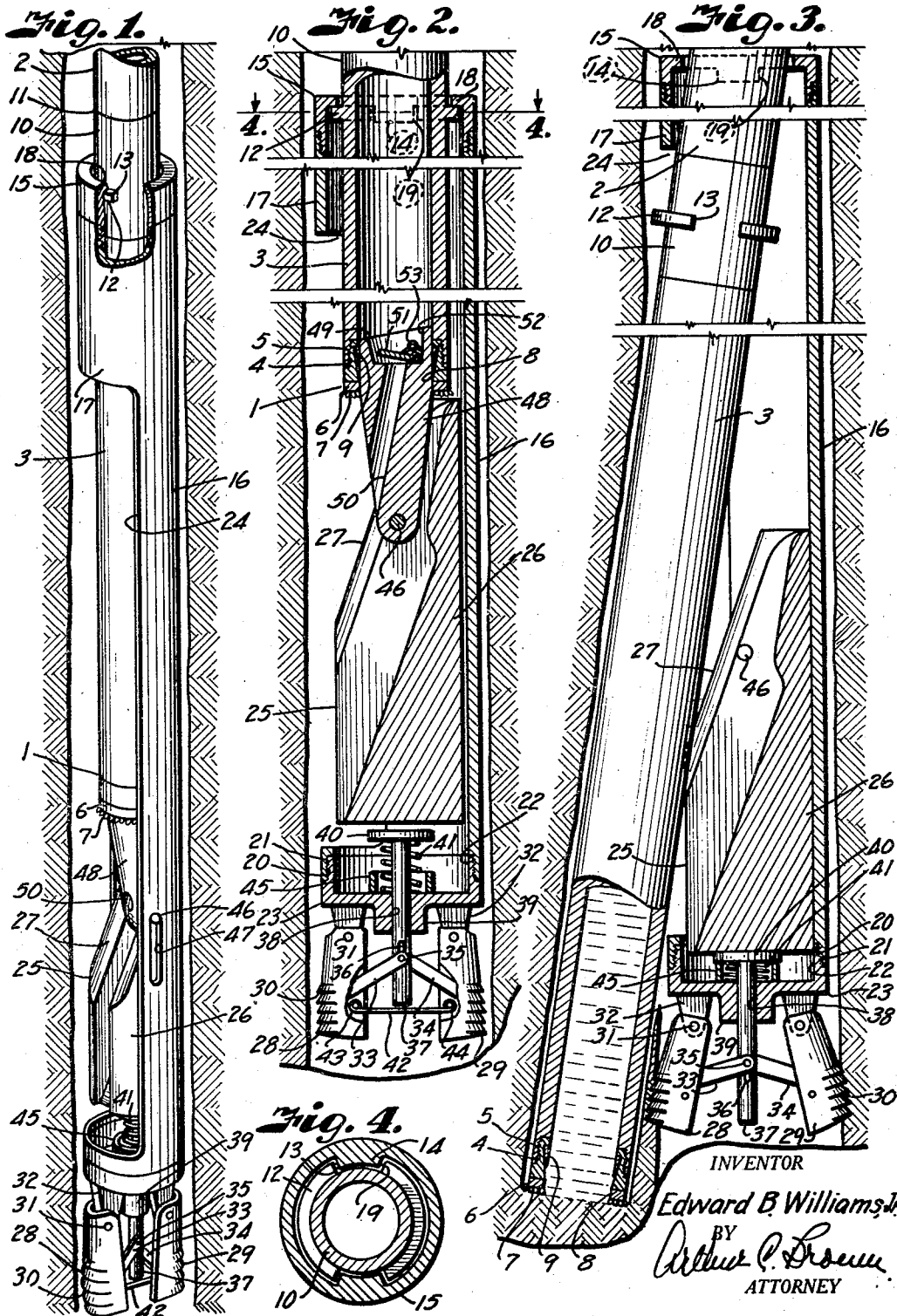
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SIDE WALL CORE BARREL

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SIDE WALL CORE BARREL

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This invention relates to core bits, particularly for taking side wall cores of wells and other boreholes to ascertain the character of earth formations through which a borehole has been drilled.

The principal object of the invention is to provide a core drill bit of this character adapted to be set at any selected depth and actuated by the usual drill rod or to make a side wall core of relatively long length.

Other objects of the invention are to provide a side wall core drill with a whipstock adapted to be set by pressure of drilling fluid within the core barrel so as to deflect the bit and core barrel into the side wall at the desired level, to provide a side wall core bit wherein the whipstock element thereof is readily withdrawn when the bit is to be removed therefrom, to provide a side wall core bit that may be readily positioned for taking a succeeding core in a different direction or at another level, and to provide a side wall core bit that is safely operated without endangering the borehole.

In accomplishing these and other objects of the invention, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawing, wherein:

Fig. 1 is a perspective view of a side wall core bit embodying the features of the present invention and shows the bit being lowered into a borehole.

Fig. 2 is an enlarged longitudinal section through the bit.

Fig. 3 is a similar section showing the sleeve-like body of the bit supported at a fixed level in a borehole and illustrating the whipstock supporting the drill in deflected position for taking a side wall core.

Fig. 4 is a horizontal section through the bit on the line 4-4 of Fig. 2.

Referring more in detail to the drawing:

1 designates a side wall core bit constructed in accordance with the present invention and which is adapted for attachment to the lower end of a drill pipe 2 whereby the bit is lowered into the well and rotated to take a side wall core. The bit includes a core barrel 3 of a length to contain the desired length core therein. The lower end of the core barrel is internally threaded as at 4 to accommodate the threaded shank 5 of a cutter 6 having an annular cutting face 7 as in standard core bit construction. The cutter has a central opening 8 registering with the axis of the core barrel to pass the core therein, the core being the portion of the earth formation within the annular cut produced by the annular

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cutting face 7 of the cutter. The core is retained within the core barrel by a conventional core catcher as indicated at 9, Figs. 2 and 3. The upper end of the core barrel includes a coupling section 10 that is threadedly connected with the lower portion of the barrel as at 11 and has the usual connection for attachment to the end of the drill pipe.

Projecting laterally from the coupling section 10 on opposite diametrical sides thereof are arcuate lugs 12 having adjacent ends 13 thereof spaced apart to engage interfitting lugs 14 on the head 15 of a sleeve-like body 16 which is positioned over the core barrel and which is suspended therefrom when the drill bit is lowered into a borehole. The sleeve-like body 16 includes an annular wall 17 of slightly larger diameter than the outer diameter of the core barrel to accommodate the lugs 12 so that the sleeve-like body is freely movable downwardly within the sleeve-like body as later described. The upper end of the sleeve-like body is internally threaded to mount the head 18, which head is provided with an inwardly extending flange 19 encircling the core barrel and which is adapted to seat upon the lugs 12. The lugs 14 are formed on the under side of the flange 19 at a point intermediate the ends of the lugs 12, each having ends 13 adapted to abut the ends 13 of the lugs when the flange is seated on the lugs so that the sleeve-like body may be rotated with the drill pipe when desired. The lower end of the sleeve-like body is internally threaded as at 20 to receive the external threads 21 on the flange 22 of a cap 23. The side wall of the sleeve-like body has an elongated opening or passageway 24 through which the core barrel is deflected to drill into the side wall of a formation as later described.

The sleeve-like body contains a whipstock 25 having a substantially cylindrical body 26 freely contained within the sleeve-like body 16 and having its upper end sloping upwardly and inwardly from the opening 24 at an angle; for example, approximately 15°, to provide a deflecting face and guide 27 for directing the core bit into the side wall of the bore hole when the sleeve-like body is set within the bore hole.

The sleeve-like body is set by gripping means which is carried by the cap 23. The gripping means includes a pair of jaws 28 and 29 of substantially arcuate cross section and having a plurality of downwardly facing teeth 30 adapted to bite within the wall of the borehole and prevent movement of the sleeve-like body therein. The upper ends of the jaws are pivotally sus-

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pendent on cross pins 31 carried by lugs 32 projecting downwardly from the cap 23. The inner sides of the jaws have inwardly projecting toggle arms 33 and 34 interconnected by a cross pin 35 which is operable within a slot 36 of a plunger rod 37. The plunger rod is reciprocable through a bore 38 extending axially of a boss 39 that is formed on the lower face of the cap 23 as best shown in Figs. 2 and 3. The upper end of the plunger rod projects into the sleeve-like body and has a head 40 thereon for seating the lower end of the whipstock 25. The plunger rod is normally retained in position to effect retraction of the gripping jaws by means of a coil spring 41 having one end seated against the cap 23 and its other end bearing under the head 40 as best shown in Fig. 2. The jaws are retained in retracted position by means of a friction clamp 42 having one end pivotally engaging a pin 43 on one of the jaws and its other end latchingly engaging a pin 44 on the other jaw. The end of the plunger when in retracted position is positioned directly under the clamp so that the first movement thereof effects disengagement of the clamp.

Downward movement of the plunger is limited by an annular stop 45 encircling the spring 41 as shown in Fig. 4. The upper end of the whipstock is guidedly supported within the sleeve-like body by means of a transverse pin 46 having its ends extending through slots 47 formed in opposite diametrical sides of the sleeve-like body and which are of a length to accommodate ample movement of the whipstock in effecting setting of the gripping jaws.

Mounted on the portion of the pin 46 that extends across a slot or groove 47 in the whipstock is the lower end 48 of a piston element 49 extending into the lower end of the core barrel to close the end thereof. The piston element is preferably formed of some readily disintegrable material such as cork, wood or the like and which may form a sufficiently tight contact with the inner surface of the core barrel to provide a substantially leak-tight joint therebetween but which will accommodate movement of the piston element from the lower end of the core barrel when sufficient pressure is applied on the drilling fluid by way of the drill pipe.

In order to facilitate insertion of the piston in the end of the core barrel, ample space is provided above the head 40. After insertion of the piston, the piston may be retracted sufficiently to allow the whipstock to seat on the head 40, or if desired, the fit of the piston will support the whipstock above the head 40 as shown in Fig. 2.

In order to facilitate lowering of the drill into a borehole, the piston-like element 49 has a bore 50 therethrough which is closed at the upper end by means of a flap valve 51 seated within a counterbore 52 in the upper end of the piston. The flap valve is normally retained in valving position by a spring 53 yieldable under pressure of fluid in the well when the bit is being lowered thereinto for equalizing pressure within and without the drilling string so that the piston keeps its position in the core barrel.

In using a core bit constructed and assembled as described, the drill bit assembly is mounted on the lower end of the drill pipe 2 and lowered within the borehole to a position at which a core is to be taken. During downward movement of the assembly into the well, the sleeve-like body carrying the gripping jaws is depending from the lugs 12 and the piston element is positioned within the bore of the cutter. Well fluid flows

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upwardly through the bore and into the drill pipe to accommodate any liquid that is displaced in the borehole. When the device reaches the position at which a side wall core is to be taken, pressure of the drilling fluid in the drill pipe is increased to the point where the piston-like element 49 is forced downwardly within the core barrel to effect downward movement of the whipstock and corresponding movement of the plunger rod 37, the initial movement of which effects disengagement of the friction clamp 42 that holds the jaws in retracted position. Further downward movement of the plunger brings the upper end of the slot 36 into engagement with the pin 35 to effect movement of the jaws 28 and 29 into gripping engagement with the walls of the borehole to support the sleeve-like body 16 of the drill in fixed relation therewith. The drill pipe is then lowered so that the bit engages the deflection end of the whipstock and the bit is caused to move outwardly therealong and through the passageway 23 to engage the wall of the borehole. During this movement, the lugs 12 clear the lugs 14 on the head 15 whereupon the drilling rod and core barrel may be rotated to cause the cutter to produce a channel-like annular recess within the formation with the intermediate portion of the formation contained within the core barrel to form the core, which core is retained therein by the core catcher 9. The drilling is continued until a core of desired length is taken whereupon the drill pipe 2 is raised within the borehole so that the lugs 12 again engage the flange on the head 15. Continued upward movement of the drill pipe lifts the sleeve-like body 16 and pulls the gripping jaws loose from the wall of the well so that they drop to released position. If necessary, the drill pipe may be rotated in either direction to assist in loosening the jaws since the ends of the lugs 12 engage the ends of the lugs 14 on the flange of the head 15. When the lugs are in engagement, the cutter 8 has cleared the whipstock whereupon the whipstock may move upwardly responsive to action of the spring 41 which assists in releasing the jaws and keeps the jaws in retracted position as the drill is brought to the top of the borehole. When the core is removed, a new piston element may be applied to the whipstock and the upper end positioned within the lower end of the core barrel so that pressure may again be reestablished to effect setting of the jaws as previously described.

From the foregoing it is obvious that I have provided a side wall core drill which may be positively operated to take a side wall core at any selected position within a borehole and which is readily withdrawn from the borehole after the core has been taken. It is also obvious that I have provided a side wall core drill which may be rotated within the borehole to position the cutter for deflection in the desired radial direction.

What I claim and desire to secure by Letters Patent is:

1. A side wall core drill including a sleeve-like body having a core barrel passageway in a side thereof, a core barrel, means for suspending the sleeve-like body on the core barrel, gripping means carried by the sleeve-like body, a whipstock having limited movement in the sleeve-like body and arranged to deflect the core barrel through the passageway, an actuating connection between the whipstock and the gripping means to move the gripping means into gripping position responsive to movement of the whipstock,

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a piston element in the core barrel and movable when pressure is applied to fluid admitted to the core barrel, and means connecting the piston element with the whipstock to effect said movement of the whipstock.

2. A side wall core drill including a sleeve-like body having a core barrel passageway in the side thereof, a core barrel, means for suspending the sleeve-like body on the core barrel, gripping means carried by the sleeve-like body, a whipstock having limited movement in the sleeve-like body and arranged to deflect the core barrel through the passageway, a core bit on the core barrel, an actuating connection between the whipstock and the gripping means to move the gripping means into gripping position responsive to movement of the whipstock, a frangible piston element in the core barrel and movable when pressure is applied to a fluid admitted to the core barrel, means connecting the piston element with the whipstock to effect said movement of the whipstock, said piston being disintegrated through rotation of the core barrel when the core barrel is deflected through the passageway responsive to lowering of the core barrel after setting of gripping means.

3. A side wall core drill including a sleeve-like body having a core barrel passageway in a side thereof, a core barrel, means for slidably and rotatably supporting the sleeve-like body on the core barrel, gripping jaws having pivotal support by the sleeve-like body, means normally retaining the gripping jaws in retracted position, a plunger slidably supported by the sleeve-like body and having an end arranged to engage said retaining means, means connecting the gripping jaws with the plunger including a pin and slot connection for effecting disengagement of the retaining means upon an initial movement of the plunger, a whipstock in the sleeve-like body and supported by said plunger, and a piston element connected with the whipstock and movable in the core barrel upon application of pressure in the core barrel for effecting actuation of the gripping jaws through the whipstock and plunger so that the jaws are adapted to support the whipstock in fixed position for deflecting the core barrel through said passageway when the core barrel is lowered after setting of the gripping means.

4. A side wall core drill including a sleeve-like body having a core barrel passageway in the side thereof, a core barrel, means supporting the sleeve-like body on the core barrel, a core bit carried on the lower end of the core barrel, gripping jaws pivotally suspended from the sleeve-like body, a plunger movable in said sleeve-like body, means connecting the plunger with the gripping jaws, a whipstock movably mounted in the sleeve-like body in position to engage the plunger, a piston-like element having pivotal connection with the whipstock and having an upper end within the lower end of the core barrel,

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said piston being movable in the core barrel responsive to pressure applied to the core barrel to effect setting of the gripping jaws for supporting the whipstock in fixed position within a borehole to effect deflection of the core barrel through the core barrel passageway.

5. A side wall core drill including a sleeve-like body having a core barrel passageway in a side thereof, a core barrel, means supporting the sleeve-like body on the core barrel, gripping jaws having pivotal support by the sleeve-like body, a clamp normally retaining the gripping jaws in retracted position, a plunger slidably supported by the sleeve-like body and having an end arranged to engage said clamp, means connecting the gripping jaws with the plunger including a pin and slot connection for effecting disengagement of the clamp upon initial movement of the plunger, a whipstock supported in said sleeve-like body by said plunger, and a piston element connected with the whipstock and having a portion in the lower end of the core barrel and movable upon application of pressure fluid through the core barrel to effect actuation of the gripping jaws through the whipstock and plunger.

6. A side wall drill including a barrel having a passageway for fluid under pressure, a whipstock carrier having a lateral opening through which the barrel is adapted to be deflected, inter-engaging releasable means between the whipstock carrier and the barrel for supporting the whipstock carrier on the barrel, a whipstock movable in said carrier, wall gripping means on the whipstock carrier, a plunger engaged with the whipstock, an operating connection between the plunger and the gripping means, means closing the passageway in the barrel and movable responsive to pressure of said fluid, and means connecting said closing means with the whipstock for moving the whipstock in the carrier for actuating the plunger for setting said gripping means.

7. A side wall core barrel including a body member having a core barrel passageway in a side thereof, a core barrel, means carrying the body member from the core barrel, gripping jaws having pivotal support on the body member, means having disengageable connection with the gripping jaws for normally retaining the gripping jaws in retracted position, a plunger slidably supported by the body member and arranged to disengage said retaining means, a whipstock movable in said body member and engageable with said plunger, a piston element connected with the whipstock and movable in the core barrel when pressure is applied on fluid admitted into the core barrel to effect actuation of the gripping jaws through the whipstock and plunger, and valve means for admitting fluid into the core barrel when said core barrel is lowered into a borehole.

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