This invention relates to improved apparatus for drilling oil well drain holes, i. e., auxiliary holes or bores extending laterally from a main well bore into the surrounding formation.

To facilitate the flow of oil into a well bore and thus increase the production of the well, it is often desirable to drill one or more laterally extending drain holes, through which the oil may pass into the main bore. One way of forming these holes is to lower into the well and to a position resting on the bottom of the well a whipstock unit having an inclined face or actuating a deflecting face laterally to the formation. This method as heretofore practiced however, has had a decided disadvantage in that upon each lowering of a particular whipstock into such a position of support on the bottom of the well, the height of the bit deflecting face of the whipstock was definitely fixed by the well depth and the construction, and therefore determined a single height at which a drain hole could be drilled. To drill a second hole at a different elevation, it was necessary to remove the whipstock from the well and either alter its construction, substitute another whipstock, or change the depth of the well.

The general object of the present invention is to provide an improved bottom supported whipstock device which is specifically constructed for vertical adjustment in a manner permitting the drilling of a plurality of vertically offset drain holes upon a single lowering into the well. The device may be initially set for deflecting a bit into the formation at an upper location, and may then be vertically adjusted or lowered to deflect the bit into the formation at a lower location.

Structurally, the apparatus includes a bottom support or anchor section and an upper whipstock section supported on and vertically adjustable relative to the bottom section. The whipstock section may be initially maintained in an upper position by a suitable shear element or pin, which is preformed to shear after the drilling of a first and upper hole, to permit lowering of the whipstock to a location for drilling a second and lower hole.

The whipstock and support sections may be guided for their relative vertical movement by a sliding connection, typically comprising a tubular barrel carried by one of the sections, and a plunger received within the barrel carried by the other section. This connection may be so constructed as to retain the sections against vertical separation, to thus permit their elevation from the well as a unit. Such retention of the sections against vertical separation may typically be afforded by engagement of a head on the connecting plunger with a shoulder formed at an end of the barrel.

The support section is desirably anchored in some manner against rotation during a drilling operation, as by providing it with gripping elements or blades acting to dig or extend into the adjacent formation. These blades are preferably adapted for automatic injection into the formation in response to engagement of the support section with the bottom of the well. The whipstock section may be rotatively keyed to the support section, so that the direction of deflection of a bit by the whipstock is definitely fixed.

The above and other features and objects of the present invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawing, in which:

Fig. 1 is a side view partly in section of a drain hole drilling unit embodying the invention, the apparatus being shown positioned within a well; Fig. 2 is an enlarged fragmentary partially sectional view of the lower portion of the Fig. 1 device, with the whipstock section of the device being shown in its upper position; Fig. 3 is a view corresponding to Fig. 2, but showing the whipstock in its lower position; and Fig. 4 is a horizontal section taken on line 4-4 of Fig. 2.

Referring first to Fig. 1, we have shown positioned within the lower portion of well 10, a unit 11 for laterally deflecting a rotary drilling bit 12, the bit being carried at the lower end of a flexible drilling shaft 13. The bit deflecting unit 11 includes an upper whipstock section or body 14, and a lower section 15 for engaging the bottom 16 of the well and supporting the whipstock body therefrom.

The upper whipstock body or section 14 is of essentially conventional construction, having the usual inclined face 17 to be engaged by bit 12 and deflect it laterally, for forming a laterally extending drain hole 18. At a side opposite its inclined bit deflecting face 17, the whipstock body has the usual side window 19 for passing the bit along its deflected course. Above the location of deflecting face 17, whipstock body 14 has an upper tubular portion 20, through which bit 12 and flexible shaft 13 pass downwardly toward the deflecting face.

At its lower end, the whipstock body has a downwardly extending and downwardly opening cylindrical barrel 21, which slidably receives a plunger 22 projecting upwardly from the bottom support section 15 of the device, to guide the whipstock body for vertical movement relative to the support section. Plunger 22 typically has an enlarged externally cylindrical upper portion 23 vertically movable within main bore 24 of the barrel. Beneath its upper head 23, plunger 22 has an elongated reduced dimension portion 25 passing through a partially closed lower end 26 of the barrel. The upper and lower sections 14 and 15 of the device are suitably keyed against relative rotation, as by sliding reception of a vertical spline 27 on the plunger 22 within a notch 28 formed in the lower partially closed portion of the barrel.

The telescopic connection formed by barrel 21 and plunger 22 permits vertical movement of the whipstock body 14 relative to support section 15 between its upper position of Fig. 2 and its lower position of Fig. 3. Relative upward movement of the whipstock body is limited in the upper position of Fig. 2 by engagement of plunger head 23 with a transverse shoulder 29 formed at the lower end of the barrel. As the apparatus is initially lowered into the well, the whipstock body is retained in the Fig. 2 upper position by a shearable screw 30 extending through the lower partially closed portion 26 of the barrel and into the reduced dimension portion 25 of the plunger. After the drilling of a first drain hole, with the whipstock body in its upper Fig. 2 position, screw 30 is sheared to permit the whipstock body to fall downwardly to its Fig. 3 position. The whipstock is then supported on the lower section of the device by engagement of an upper wall 31 of barrel 21 with the upper end of plunger 22.

The lower section 15 carries at its lower end a number of gripping elements or blades 32, which are actuable outwardly to their Fig. 3 positions of gripping engage-
ment with the well bore, to positively retain section 15 against rotation. Preferably, these elements are so constructed as to be automatically actuated into such gripping engagement with the well bore upon engagement of the apparatus with the bottom of the well. For this purpose, lower section 15 of the apparatus may include a bottom wedge member 33, having a downwardly tapering wedge surface 34 engageable with similarly tapering wedge surfaces 35 on the gripping elements 32. The gripping elements are movably fastened to wedge member 33 by screws 36, which pass through vertical slots 37 in the gripping elements to guide the elements for sliding movement relative to member 33 between the Fig. 2 and Fig. 3 positions. As will be understood, the enlarged heads 38 of screws 36 engage shoulders formed at the outside of slots 37, to retain the gripping elements against separation from member 33. The gripping elements are initially retained in their Fig. 2 inwardly retracted positions by a shear pin 39, extending horizontally through the gripping elements and member 33. Pin 39 is performed to easily shear as the elements 32 engage the bottom 16 of the well, to permit wedging of the gripping elements outwardly against the bore wall.

In using the apparatus, sections 14 and 15 are first lowered into the well in their Figs. 1 and 2 condition. As elements 32 engage the bottom of the well, they are wedged outwardly in the previously described manner, to dig into the bore wall and maintain bottom support section 15 against rotation. With the shearable screw 30 maintaining whipstock body 14 in its upper position, bit 12 is actuated to drill a first and upper drain hole 18, the bit being deflected along the illustrated lateral path by inclined whipstock face 17. The bit and shaft 13 are then withdrawn from hole 18, and a downward force is in some manner exerted against whipstock body 14, to shear screw 30 and move the whipstock downwardly to its Fig. 3 position. The drill bit and shaft are then again lowered against the whipstock face 17, by which they are deflected laterally to drill a second and lower lateral drain hole 18a. Thus, the single unit 11 serves upon a single lowering in the well to direct bit 12 in the drilling of two vertically offset drain holes.

The force for shearing pin 30 may be exerted against whipstock body 14 in any convenient way. For example, the bit may then be withdrawn from the well, and a string of pipe lowered into the well carrying a pipe or other element whose diameter is great enough that it cannot enter the tubular upper portion 20 of the whipstock unit, so that the weight of the string will rest on the upper edge of the tubular portion of the whipstock, and thereby exert a downward force for shearing pin 30.

We claim:

Drain hole drilling apparatus comprising a whipstock section adapted to be lowered into a well and having an inclined face for deflecting a drill bit laterally of said well, a bottom support section carried by and beneath said whipstock section during lowering and adapted to rest on the bottom of said well and support the whipstock section therein, said whipstock section being movable vertically relative to said support section between a pair of upper and lower positions for drilling drain holes at a pair of different elevations, a sliding connection between said sections guiding them for said relative vertical movement and comprising a tubular barrel carried by one section and a plunger carried by the other section and slidably received within said barrel, an enlarged head on said plunger within the barrel, a shoulder on said barrel engageable by said plunger head to prevent vertical separation of the sections, a shear pin extending into said barrel and plunger and initially supporting said whipstock section from said support section in said upper position, said pin being preformed to shear by force exerted against the whipstock section, and shoulders on said sections engageable to support the whipstock section in said lower position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,170,284 Eastman ------------ Aug. 22, 1939
2,495,439 Brimble ------------ Jan. 24, 1950
2,506,799 Livingston --------- May 9, 1950