Aug. 30, 1955 J. S. McCUNE ET AL 2,716,540

BOTTOM ANCHORED DRAIN HOLE DRILLING EQUIPMENT

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Fig. 1.

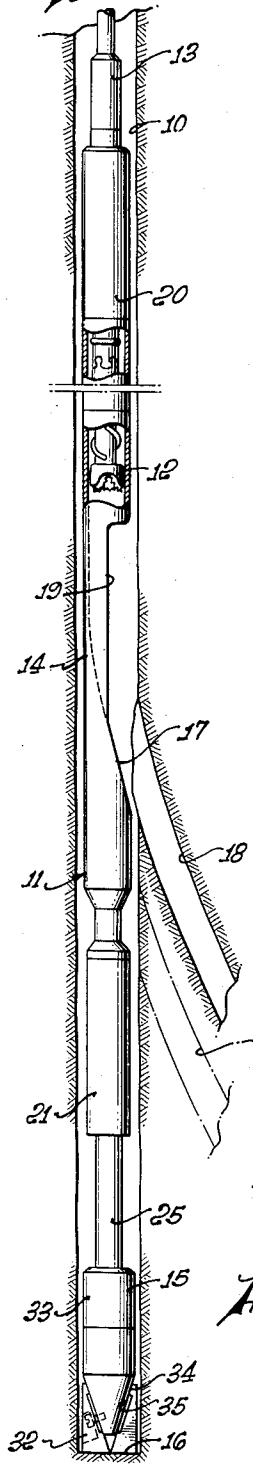


Fig. 2.

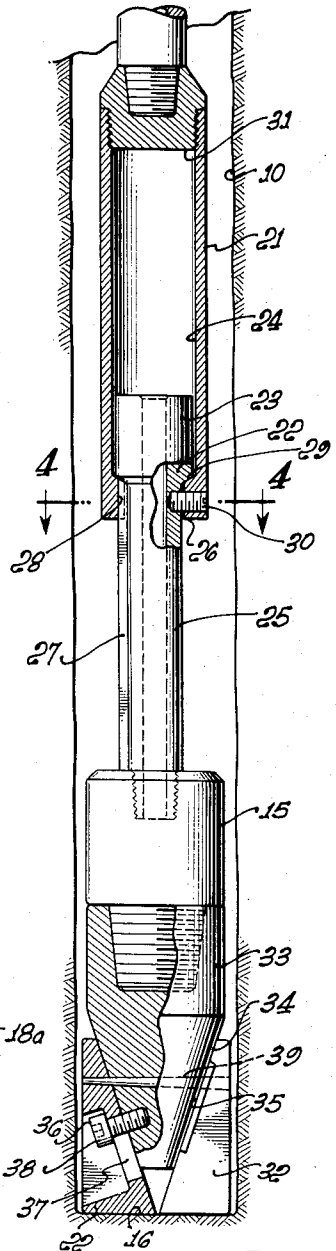


Fig. 3.

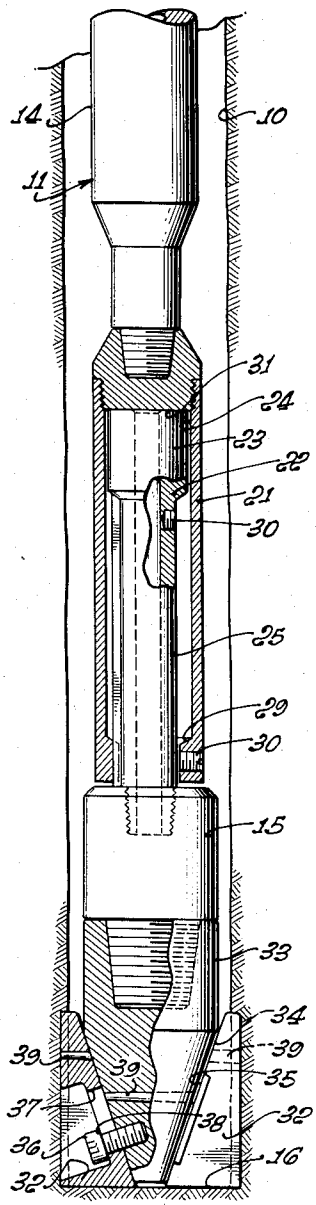
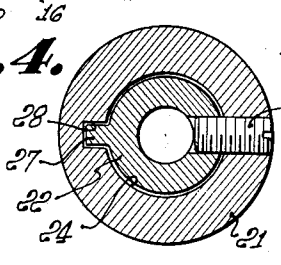


Fig. 4.



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BOTTOM ANCHORED DRAIN HOLE DRILLING EQUIPMENT

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1 Claim. (Cl. 255—1.6)

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 acting to deflect a drill bit laterally into 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 whipstock 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 specially 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 head 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 preformed 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 **18***a*. 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.

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