June 17, 1958 J. S. McCUNE ET AL 2,839,270

RELEASABLE CONNECTIONS FOR DRAIN HOLE DRILLING EQUIPMENT

Filed June 1, 1954 2 Sheets-Sheet 1

Fig. 1.

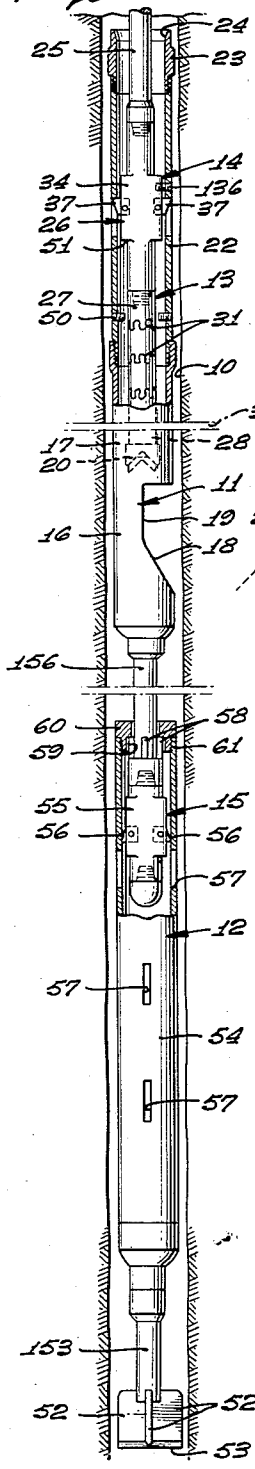


Fig. 2.

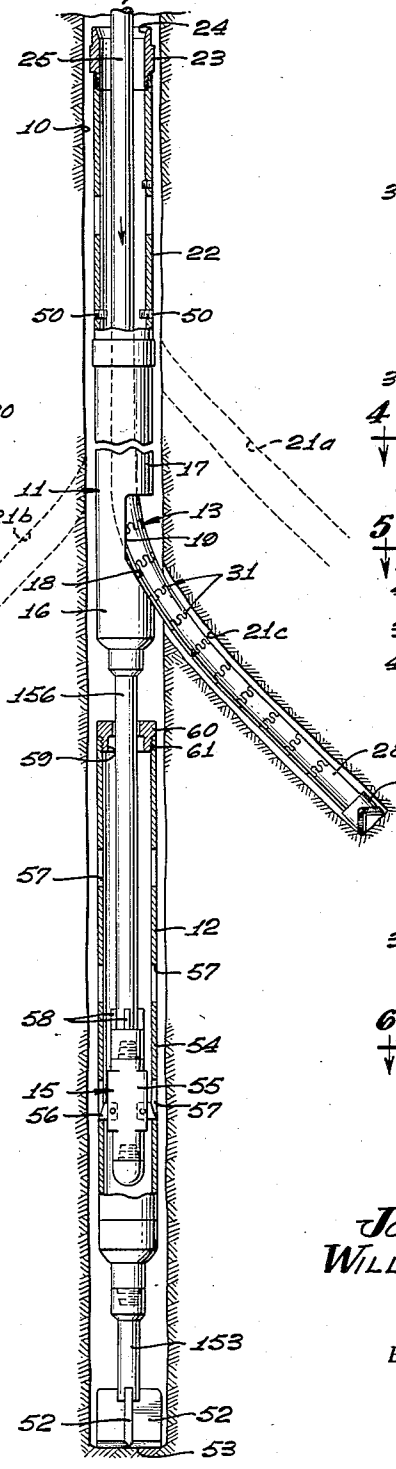
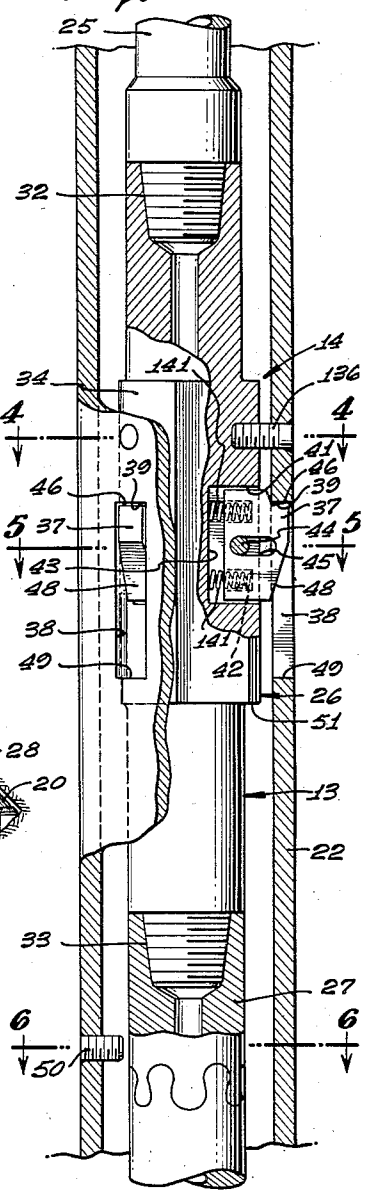


Fig. 3.



JOHN S. McCUNE,
WILLIAM E. HANKS,
INVENTORS.

BY William P. Green

ATTORNEY.

June 17, 1958 J. S. McCUNE ET AL 2,839,270

RELEASABLE CONNECTIONS FOR DRAIN HOLE DRILLING EQUIPMENT

Filed June 1, 1954 2 Sheets-Sheet 2

Fig. 4.

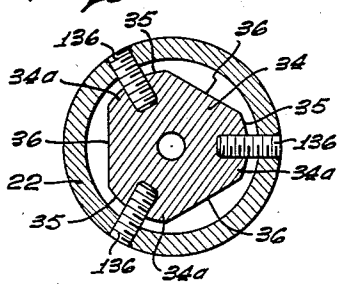


Fig. 5.

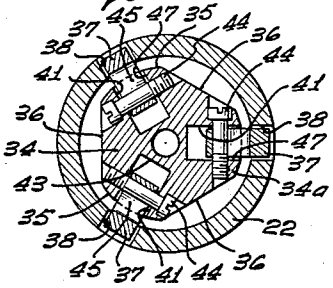


Fig. 6.

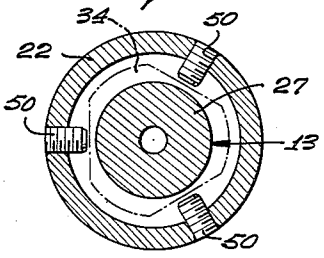


Fig. 7.

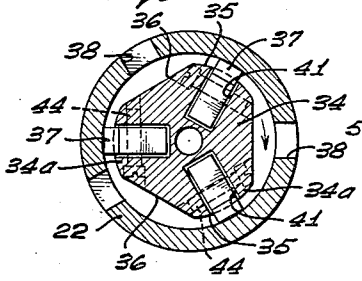


Fig. 8.

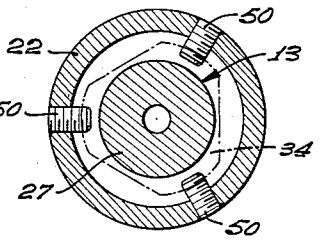


Fig. 9.

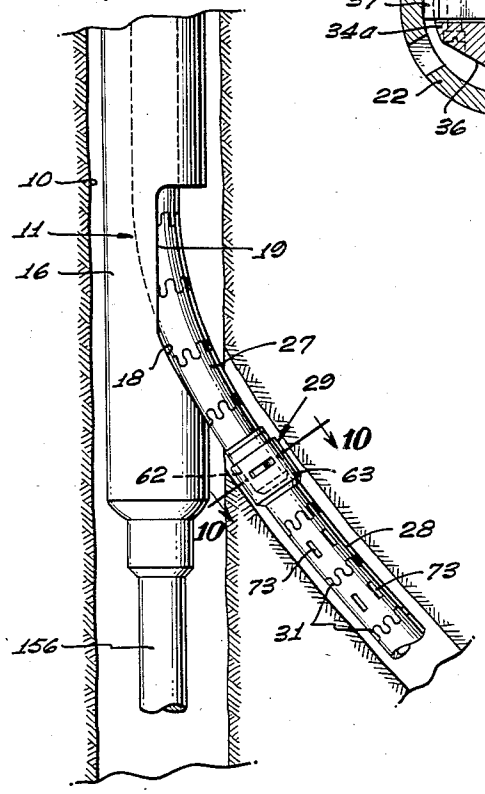
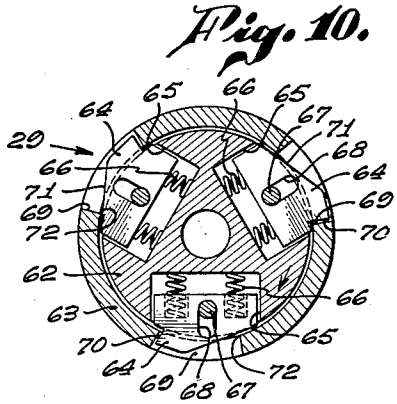


Fig. 10.



JOHN S. McCUNE,
WILLIAM E. HANKS,
INVENTORS.

BY William P. Green

ATTORNEY.

United States Patent Office

2,839,270

Patented June 17, 1958

2,839,270

RELEASABLE CONNECTIONS FOR DRAIN HOLE DRILLING EQUIPMENT

John S. McCune and William E. Hanks, Long Beach, Calif., assignors to Oilwell Drain Hole Drilling Co., Long Beach, Calif., a corporation of California

Application June 1, 1954, Serial No. 433,527

22 Claims. (Cl. 255—1.6)

This invention relates to improved well drilling tools, and particularly to tools for drilling drain holes or other holes deviating from the main bore of a well.

In the drilling of drain holes, it is customary to employ a drill string having a lower flexible portion, which is adapted to be deflected laterally from the main bore by engagement of the drilling bit with an inclined deflecting face of a whipstock. The whipstock is generally lowered into the well, and withdrawn upwardly therefrom, by means of the drill string itself, the latter being provided with means acting to suspend the whipstock from the string.

A major object of the present invention is to provide improved means for thus supporting the whipstock from the drill string, and for doing so in a manner allowing free relative movement of the string and bit relative to the whipstock when positioned in the well, to thus permit drilling of a drain hole with the string while the whipstock remains stationary. Especially contemplated by the invention is a connection of a type such that the drilling string may be removed from the well without the whipstock, for replacing a bit or effecting other repairs, and may then be relowered into the well to continue the drilling operation. After the drilling is completed, the connection between the drill string and whipstock may again be rendered effective to support the latter from the former, and to thereby allow withdrawal of the two units from the well together.

The connection for supporting the whipstock from the drill string preferably includes one or more latch elements, which are movably carried by one of these two units and engageable with a shoulder or shoulders on the other. For greatest facility of control, the operation of the latch elements may be controlled by movement of the drill string itself relative to the whipstock. For instance, the latch elements may be automatically wedged to inactive positions by downward movement of the string, and may be adapted to subsequently become effective again only if the string is raised while in a predetermined rotary position relative to the whipstock. Desirably, the latch elements are carried by the drill string, and are receivable in supporting relation within wall apertures formed in an upper tubular sheath portion of the whipstock section.

The whipstock may be supported in a well on a lower support section which rests on the bottom of the well. A further object of the invention is to provide a releasable latch type connection of the above discussed general type for supporting the whipstock on this lower section in any of a plurality of different vertical positions, for successively drilling two or more vertically offset drain holes. For this purpose, the support section may have an upwardly projecting portion which is slidably received within a tubular lower portion of the whipstock section, and carries latch elements receivable in holding relation within different sets of apertures in that portion of the whipstock section.

After drilling of a drain hole, it is desirable to leave a flexible liner in the hole to support its walls against collapse. In certain instances, the flexible drill collar itself may be left in the hole to serve as such a liner. In accordance with the invention, we may utilize a unique latch type connection constructed similar to those discussed above, for releasably connecting the liner or drill collar to the lower end of a supporting string, in a manner permitting the liner or collar to be easily detached and left in the well when the string is removed. In this case, the latch elements may be so constructed as to transmit right hand rotation to the lower section of the drill collar or the liner, while automatically breaking the joint in response to reverse rotation.

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 partly sectional view of a drain hole drilling unit constructed in accordance with the invention, and shown positioned within the main bore of a well;

Fig. 2 is a view corresponding to Fig. 1, but showing the whipstock lowered from its Fig. 1 position;

Fig. 3 is an enlarged fragmentary vertical section through the upper portion of the apparatus shown in Fig. 1;

Figs. 4, 5 and 6 are transverse sections taken on lines 4—4, 5—5 and 6—6 respectively of Fig. 3;

Fig. 7 is a section taken on line 5—5 of Fig. 3, but showing the latch parts in their inactive positions;

Fig. 8 is a view corresponding to Fig. 6, but showing the sheath supporting section of the drill collar in the proper rotary position for advancement downwardly past the push down lugs or studs in the sheath portion of the whipstock;

Fig. 9 is an enlarged fragmentary side view of the whipstock and flexible drill collar as positioned upon completion of the drilling of a drain hole; and

Fig. 10 is an enlarged transverse section taken on line 10—10 of Fig. 9.

In Fig. 1, we have shown a drain hole drilling assembly constructed in accordance with the invention, the assembly being shown as it appears as it is lowered into the main bore 10 of a well. The assembly includes a whipstock section 11, a lower support section 12 for supporting the whipstock on the bottom of the well, and a drill string generally indicated at 13. The whipstock section 11 is adapted to be suspended within the well from drill string 13 by means of a latch type releasable support connection 14. The whipstock 11, in turn, is supported on bottom section 12 by a similar but inverted latch type support connection 15.

The whipstock section 11 may be of essentially conventional construction, including a body 16 having an upper tubular portion 17 at the lower end of which is presented an inclined deflecting face 18 adjacent a side window 19 formed in the body. At its lower end, drill string 13 carries a conventional well drilling bit 20 which is adapted to be deflected laterally by whipstock face 18 and through window 19 to drill a drain hole 21*a*, 21*b* or 21*c* (see Fig. 2) extending laterally into the earth formation from the main well bore 10. The upper tubular portion 17 of body 16 may be of a considerable vertical length, to receive the entire extent of the later to be described lower flexible portion of the drill string 13. At its upper end, body section 16 is connected to an upper tubular element 22, which may carry a short tube 23 at its upper end, for providing a downwardly tapering bit entrance throat 24.

The drill string 13 includes at its upper end a large number of rigid drill pipe strands 25 (only one shown)

interconnected in the usual fashion to a length sufficient to lower the entire apparatus to a predetermined producing zone in the well. The lowermost rigid stand **25** is connected to a sub **26**, which acts as a portion of the suspending apparatus **14**. To the lower end of sub **26**, there is attached a longitudinally flexible drill collar, having an upper flexible portion **27** and a lower flexible portion **28**. These two upper and lower portions of the drill collar are interconnected by a releasable joint which is seen at **29** in Fig. 9. This joint between the two drill collar sections occurs at the location of break **30** in Fig. 1.

The flexible drill collar sections **27** and **28** are formed of a large number of rigid tubular segments interconnected for limited relative movement by joints **31**. All of the segments forming each section of the flexible drill collar may be formed from a single pipe, with that pipe being cut along the curved lines indicated at the joints **31** to form a number of segments having interfitting lobes and recesses, the cuts being sufficiently wide to allow looseness between successive segments, and to thereby allow the desired very limited essentially universal movement of successive segments, so that the drill collar as a whole may take a laterally curving configuration such as that indicated in Fig. 2. This type of flexible drill collar is described more specifically, and claimed, in our copending application Serial No. 279,557 filed March 31, 1952 on "Flexible Well Drill Collar," now U. S. Patent No. 2,712,436, issued July 5, 1955. The entire drill string **13** of course contains an elongated inner passage, extending entirely through the string from its upper end downwardly to bit **20**, for delivering circulating fluid to the bit during drilling.

Referring now to Fig. 3, the whipstock supporting section **26** of the drill string **13** is threadedly connected at its upper end **32** to one of the rigid stands **25** of drill pipe, and is threadedly connected at its lower end **33** to flexible drill collar section **27**. Member **26** may be externally cylindrical and of a diameter considerably smaller than the surrounding pipe **22**, except at the location of a vertically central portion **34** of body **26**. This portion **34** may be of an increased transverse or horizontal dimension, to fit relatively closely within tubular member **22** and portion **17** of the whipstock, to thereby centralize body **26** within those outer tubular members. Preferably, the portion **34** has the generally triangular cross sectional configuration shown in Figs. 4 and 5, this configuration being formed by providing this portion of member **26** with three evenly circularly spaced lateral projections **34***a*, having outer cylindrical surfaces **35** lying in a common circular plane of a diameter somewhat smaller than the internal diameter of member **22** and portion **17** of whipstock **16**. Extending between surfaces **35**, portion **34** of member **26** may have three flat vertically extending surfaces **36**, forming three circularly spaced areas of substantially smaller diameter than projections **34***a*. In the condition in which the apparatus is first lowered into a well, member **26** is positively retained in its Fig. 1 position by means of three evenly circularly spaced shear pins or studs **136**, which are threadedly connected into the wall of tubular member **22** and projections **34***a* of member **26**, and are constructed to be broken by downward force exerted through the drill string from the surface of the earth after the apparatus has reached the Fig. 2 position of support on the bottom of the well.

Beneath shear pins **136**, portion **34** of member **26** carries three evenly circularly spaced latch elements or dogging parts **37**, which are removably receivable within three correspondingly circularly spaced apertures **38** formed in the side wall of member **22**. These apertures **38** are vertically elongated, and each terminate upwardly in a downwardly facing support shoulder **39**, which desirably extends directly transversely of the vertical axis of member **22**. Latch parts **37** are also desirably vertically elongated to a certain extent, and are received within guiding recesses **41** which are shaped to closely receive parts **37**, and to guide those parts for only radial sliding movement relative to body **26**. The three recesses **41** are formed at the centers of the three spaced projections **34***a* on member **26**, and allow a radial movement of parts **37** between the outer active position of Fig. 3, and an inner retracted position (see Fig. 7) in which all three of the parts **37** are capable of fitting within member **22** without extending outwardly into apertures **38**. Each part **37** is urged radially outwardly to its Fig. 3 position by a pair of springs **141** which fit into recesses **42** in the corresponding latch part **37**, and bear at their inner ends against an inner wall **43** of the corresponding recess **41**.

The radially outward movement of each latch part **37** is limited by a screw **44**, which extends through a horizontally elongated slot **45** formed in the latch part, and is threadedly connected into a horizontal bore formed in the corresponding projection **34***a* of member **26**. In their radially outer Fig. 3 positions, latch parts **37** extend into apertures **38**, and engage shoulders **39** at the upper ends of the apertures in a relation acting to support the whipstock section **11** from drill string **13**. For engaging shoulders **39**, latch parts **37** have upwardly facing shoulders **46**, which are so disposed as to prevent the supporting forces from effecting any camming of latch parts **37** radially inwardly. Preferably, shoulders **46** on the latch parts are inclined slightly upwardly as they extend radially outwardly (see Fig. 3). The portions of the latch parts received within recesses **41** may have upper and lower directly transverse surfaces slidably engageable with correspondingly spaced upper and lower walls of the recesses (see Fig. 3). The side walls **47** of recesses **41** may be parallel and extend directly vertically, and the engaging sides of parts **37** may also be parallel and extend vertically, and be spaced substantially in correspondence with walls **47** of the recesses, so that the latch parts are very effectively confined at their sides, top and bottom. As a result, the supporting forces are transmitted very effectively through latch parts **37** to member **26** and the drill string.

Each of the latch parts **37** has, at a location beneath its supporting shoulder **46** a downwardly and outwardly facing inclined wedge surface **48**, which is positioned to engage lower edge **49** of aperture **38** as the drill string is lowered from its Fig. 3 position relative to whipstock section **11** and the tubular portion **22** thereof. Upon such downward movement of the drill string, the engagement of edges **49** with surfaces **48** on parts **37** acts to wedge or cam parts **37** radially inwardly, to move them out of apertures **38**. The drill string may then be advanced downwardly relative to the whipstock section to drill a drain hole **21***a*. The latch parts **37** are retained in their inwardly retracted inactive positions at all times thereafter, as long as they are contained within any of the tubular portions **17**, **22** and **23** of the whipstock section, unless they are moved to positions to again advance outwardly into apertures **38**. If desired, the entire drill string may be withdrawn from the whipstock section **11**, by merely rotating the drill string to a position in which latch parts **37** are located circularly intermediate apertures **38**, so that the cylindrical surface areas of member **22** between apertures **38** will retain the latch parts in their inwardly retracted positions as the drill string is pulled upwardly to move the latch parts past the location of the apertures.

Downwardly beyond apertures **38**, tubular member **22** may carry three inwardly projecting pins or studs **50**, which are preferably threadedly connected into the wall of member **22** at evenly circularly spaced locations, and project radially inwardly to a distance beyond the outer extremities of projections **34***a* on member **26**. These studs **50** are provided to be engaged by the transverse undersurfaces **51** of projections **34***a*, for positively push-

ing the whipstock section downwardly to a properly seated position in the well by force exerted through the drill string. This transmission of force is effected when member **26** is in the position illustrated in Fig. 8 relative to member **22**. When the drill string is rotated through 60° to the Fig. 6 position, the reduced dimension portions of member **26** formed at the locations of flat side surfaces **36** are received opposite studs **50**, and thus the reduced dimension portions are capable of movement downwardly past studs **50**. Preferably, studs **50** are offset 60° about member **22** from the vertical locations of apertures **38**, so that when the drill string is advanced directly downwardly from its Fig. 3 position, the flat surfaces **36** of member **26** are received opposite studs **50**, to normally allow straight downward advancement of the drill string from its Fig. 3 position without interference from studs **50**.

The lower support section **12** of the apparatus may have four vertically extending fins **52** at its lower end, presenting sharpened bottom edges **53** capable of digging a short distance into the bottom of the well, to prevent rotation of support section **12** in the well. Extending upwardly from these lower fins **52**, section **12** has portion **153** carrying at its upper end a tubular portion or barrel **54** receiving a plunger-like member **55** which is attached to whipstock unit **11**. This member **55** may be connected to the whipstock unit by means of a vertically elongated rigid support rod or tail pipe **156**, which may comprise a large number of interconnected stands of pipe. The members **54** and **55** act to support the whipstock section **11** on the support **12** by means of a latch type connection **15** which is very closely similar to the latch connection **14** between the drill string and whipstock. Specifically, member **55** may carry three evenly circularly spaced latch elements **56**, which are constructed exactly the same as latch parts **37** except that they are inverted, so that the essentially transverse support shoulders corresponding to those shown at **46** in Fig. 3 face downwardly, while the wedge surfaces corresponding to those shown at **48** face upwardly. Latch parts **56** are retained for only radial sliding movement relative to member **55**, in the same manner as latch parts **37** are guided, and parts **56** are also spring urged radially outwardly. Coacting with latch parts **56**, barrel **54** of the support section **12** has several (typically three) vertically spaced sets of apertures **57**, each set being formed exactly as are apertures **38** at the upper end of the apparatus.

As will be understood, latch parts **56** are receivable within apertures **57**, and the lower transverse shoulders on the latch parts are engageable with the lower transverse end walls of apertures **57**, to support the whipstock section from bottom section **12**. This support may of course be effected at the location of any of the different sets of apertures, so that the whipstock section may be supported at different elevations for drilling the three different drain holes **21***a*, **21***b* and **21***c*. Directly above member **55**, the whipstock section may have a portion presenting a number of vertically extending circularly spaced lugs **58**, which are receivable within circularly spaced recesses **59** of an upper cap **60** on barrel **54**, in a spline relation serving to transmit rotation of the whipstock section to that cap. The cap **60** is threadedly connected into barrel **54** by means of a left hand threaded joint at **61**, so that right hand rotation of the drill string and whipstock section relative to support section **12** will act to unscrew cap **60** from barrel **54** and thereby allow withdrawal of the whipstock and drill string without the lower support section, in the event the latter becomes lodged or stuck in the well. The inclined upwardly and outwardly facing wedge surfaces of latch parts **56** allow for inward retraction of the latch parts to their inactive positions by virtue of the wedge action effected as the whipstock section **11** is pulled upwardly relative to lower support section **12**. Also, since barrel **54** is internally cylindrical except at the locations of apertures **57** (including the areas circularly between the apertures **57** of each set of apertures) the latch parts may be moved vertically past any set of apertures, by merely rotating the whipstock section and member **55** to a position in which the latch parts engage the cylindrical inter-aperture surfaces of member **54** upon such vertical movement. In this connection, it is noted that Figs. 1 and 2 are semi-diagrammatic in their showing of the latch parts, in that both the upper and lower latch parts and apertures are represented as though two of the latch parts were directly diametrically opposed, rather than being spaced 120° apart as they actually are, and as appears in the enlarged showings of Figs. 3 through 5 and 7. The same is true of the showing of studs or pins **50** in Figs. 1 and 2.

Referring now to Figs. 9 and 10, the upper and lower flexible sections **27** and **28** of the drill collar are interconnected by a releasable latch type joint which is in certain respects smoewhat similar to the previously described connections **14** and **15**. This joint or connection **29** may include a lower tubular projection **62** formed on upper section **27** of the drill collar, and telescopically receivable within a tubular end **63** formed on the lower drill collar section. The inner of these joint members **62** carries three radially movable latch parts **64**, which are effectively confined and guided within recesses **65** in member **62** for only radial movement relative to member **62**. These latch parts **64** are spring urged radially outwardly by springs **66**, with the outward movement being limited at the Fig. 10 positions by pins **67** extending through slots **68** in the latch parts. The manner of confinement and retention of the latch parts will be obvious without further discussion, in view of the more specific description of the very similar latch parts shown at **37**.

Latch parts **64** are somewhat elongated transversely of the axis of the drill string, rather than longitudinally of the axis as are parts **37** and **56**. Latch parts **64** are receivable within slots **69** in the wall of coacting tubular member **63**, the latch parts and member **63** having shoulders **70**, preferably extending directly radially with respect to the axis of the drill string, to transmit right hand rotary motion from upper drill collar section **27** to lower drill collar section **28** through the latch parts. At their trailing sides, latch parts **64** have wedge surfaces **71**, which advance radially outwardly as they advance circularly (see Fig. 10), so that left hand rotation of upper drill collar section **27** relative to the lower drill collar section **28** causes trailing edges **72** of slots **69** to cam latch parts **64** radially inwardly and out of the apertures. The latch parts are then held in their inwardly retracted positions by engagement with the cylindrical inner surface of member **63**, to free the upper drill collar section **27** for upward removal from the well without lower drill collar section **28**.

To describe now the manner of use of the apparatus shown in the drawings, the apparatus is first assembled at the surface of the earth to the condition illustrated in Fig. 1, and is then lowered into the well to a point at which fins **52** of the bottom support section **12** rest on the bottom of the well. When the support section thus reaches the bottom of the well, the lowering operation is continued for a very short distance until latch parts **56** move into the upper set of apertures **57** of barrel **54**, causing latch parts **56** to engage barrel shoulders **57** and thereby positively support whipstock section **11** in the well at a predetermined location relative to support section **12**. The initial positioning of member **55** within barrel **54**, which positioning is retained during lowering by the spline connection **58**, **59**, may be such as to position latch parts **56** directly above the upper set of apertures **57**, to assure and facilitate the initial support of the whipstock by the upper set of apertures. It is also noted that the latch parts **56**, and particularly their side surfaces, are so formed that the latch parts positively retain the whipstock section against rotation rela-

tive to support section **12**, when the latch parts are received within any of the apertures **57**.

With the whipstock supported in its upper position, the drill string is forced downwardly with a force sufficient to break shear pins **36**, these pins purposely being formed weaker than any other portion of the apparatus against which such downward force is exerted. The drill string is then free to advance downwardly past studs **50**, to cause bit **20** to be engaged and deflected laterally by whipstock face **18** for drilling the upper drain hole **21***a* laterally from the main bore. The downward movement of the drill string after breaking of shear pins **36** causes lower edges **49** of apertures **38** to engage wedge surfaces **48** on latch elements **37**, and thus cam the latch elements inwardly to positions in which they are no longer received within apertures **38**. If it is desired to force support section **12** downwardly against the bottom of the well, to assure its effective support in the well, the drill string may be turned through 60 circular degrees just after inward retraction of latch element **37**, to cause projections **34***a* to engage studs **50**, and thereby exert the desired downward force against the whipstock and support sections **11** and **12**.

The drilling of the drain hole may be continued until the joint **29** reaches the location illustrated in Fig. 9. At that point, the drilling may be stopped, and the drill string may be turned in a counterclockwise direction, to wedge latch elements **64** radially inwardly and thus break the joint **29**. All of the drill string except for its lower section **28** may then be withdrawn upwardly, leaving that lower section in the well as a liner. If it is desired to leave this portion of the drill collar in the well as a liner, the various segments of that section may be provided with wall apertures **73**, for passing well fluid into that drill collar section, for flow upwardly therethrough into the main bore.

During drilling of a drain hole, it may be necessary to withdraw the drill string from the drain hole and well, to replace a worn bit **20**. In that case, the drill string is first withdrawn upwardly to a position at which projections **34***a* engage studs **50**, this point being determinable by the increase in load on the drill string as the studs are engaged, and the drill string is then rotated to the Fig. 6 position in which the projections **34***a* and latch parts **37** may move upwardly past the studs. The string may then be rotated through 60°, so that the latch parts may be moved upwardly past apertures **38**, the latch parts being held in retracted position by engagement with the cylindrical interaperture surfaces of member **22**. The entire drill string is thus free for withdrawal upwardly from the well, for replacement of the bit, following which the string may be again lowered into the well, advanced downwardly past apertures **38** and studs **50** by proper manipulation of the string, to allow completion of the drilling operation.

After the first drain hole **21***a* has been drilled, the drill string may be withdrawn upwardly to the Fig. 1 position, maneuvering projections **34***a* past studs **50** and to positions at which latch parts **37** enter apertures **38** in supporting relation. The drill string may then be utilized to raise whipstock section **11** to the Fig. 1 position, thus causing lower latch parts **56** to be cammed inwardly to their retracted positions, following which the drill string and whipstock section may be rotated through 60° to lower latch parts **56** past the first apertures **57** and to the predetermined known elevation of the second set of apertures **57**, at which the drill string and whipstock may be rotated again through 60° to cause the latch parts **56** to advance outwardly under spring pressure into the second set of apertures **57**, to support the whipstock in a second position. In this position of the whipstock, the drill string may be manipulated in the previously described manner to drill the second drain hole **21***b*. If the lower section **28** of the drill collar was left in the first drain hole as a liner, a second lower section must of course be attached to the drill string before drilling of the second hole. After the second hole has been drilled, the whipstock may be lowered to a position of support by the third set of apertures, for drilling the third hole **21***c*. Thus, any number of drain holes may be formed at any number of predetermined spaced locations, with spacing being set by proper formation of the different sets of support apertures **57** before lowering of the apparatus into the well.

We claim:

1. Apparatus comprising a whipstock unit adapted to be lowered into a well and having an inclined face for deflecting a drilling bit laterally to drill a laterally extending drain hole, a support unit adapted to support said whipstock unit in the well, said whipstock unit being movable vertically relative to said support unit between a plurality of different elevations for drilling a plurality of drain holes, a latch element carried by one of said units, means forming a plurality of shoulders on the other unit engageable by said latch element in a relation to support said whipstock unit at said different elevations respectively relative to the support unit, and means operable to retract said latch element, while the apparatus is in a well, to an inactive position in which the latch element no longer supports said whipstock unit.

2. Apparatus as recited in claim 1, in which a first of said units has a tubular vertically extending portion containing wall apertures at a plurality of different elevations, and a second of said units has a portion received in said tubular portion of said first unit and movably carrying said latch element, said latch element being selectively receivable within said different apertures, said shoulders comprising edges of said apertures engageable by the latch element in a relation to support the whipstock at said different elevations.

3. Drain hole drilling apparatus comprising an elongated tubular structure to be lowered into a well and including an upper section and a separable longitudinally flexible lower section to be advanced into a laterally extending drain hole, and a connection releasably attaching said lower section to said upper section, said connection including a latch element carried by one of the sections for movement relative thereto between active and released positions and releasably engageable with the other section in said active position in a relation attaching the sections together, and camming surfaces on said latch element and said other section operable in response to rotary movement of the upper section relative to the lower section to retract said latch element relative to said one section while in the well and to thereby detach the sections and permit upward removal of the upper section while leaving the lower one in the well.

4. Drain hole drilling apparatus as recited in claim 3, including a shoulder on said other section engageable by said latch element to transmit right hand rotation between the sections.

5. Drain hole drilling apparatus as recited in claim 3, in which said other section has a tubular portion containing a wall aperture and removably receiving a portion of said one section, means mounting said latch element to said portion of said one section for generally radial movement relative thereto into and out of said aperture, interengageable shoulders on said latch element and on said other section adjacent said aperture for transmitting right hand rotation from the upper section to the lower one, said camming surfaces including a surface on said latch element movable against an edge surface of the aperture in a relation camming the latch element inwardly out of said aperture in response to left hand rotation of the upper section relative to the lower section, to thereby detach the sections.

6. Drain hole drilling apparatus comprising a flexible drill string unit, a whipstock unit having an inclined

face adapted to deflect said string unit laterally to drill a drain hole, said whipstock unit having an upper tubular portion extending vertically above said face and disposed about said string unit, said string unit being rotatable in and relative to said whipstock, lug means extending inwardly from said tubular portion of the whipstock unit, and lateral projection means on said string unit engageable downwardly against said lug means in one rotary position of the string unit relative to the whipstock unit to transmit downward force from the string unit to the whipstock unit for forcing the latter downwardly, in a well, said projection means and lug means being movable out of vertical alinement in a second rotary position of the string unit relative to the whipstock unit, and said units in said second position of the string unit being free of any obstruction to downward movement of said projection means past said lug means so that the string unit can then be advanced into a drain hole.

7. Drain hole drilling apparatus as recited in claim 6, including latch means movably carried by said projection means on said string unit, and shoulder means on said tubular portion of the whipstock unit releasably engageable by said latch means in a relation supporting the whipstock unit from the string unit.

8. Drain hole apparatus comprising a first and lower unit adapted to be lowered into a well, a second and upper unit connectable to said lower unit and adapted to be rotated and moved axially relative thereto by manipulation of said upper unit from the surface of the earth, and a connection between said units for releasably retaining said units against relative axial movement, said connection comprising a latch element carried by one of said units for movement relative thereto between active and retracted positions, means for actuating said latch element to said active position, the other of said units having a shoulder engageable with said latch element in one rotary position of the upper unit relative to the lower unit and acting by said engagement to retain the units against said relative axial movement, said latch element and shoulder being relatively displaceable, by rotation of the upper unit, to relatively circularly offset positions in which the latch and shoulder cannot interengage to prevent said relative axial movement.

9. Drain hole apparatus as recited in claim 8, including retracting means responsive to relative movement of the units to retract the latch element.

10. Drain hole apparatus as recited in claim 8, in which said other unit has a tubular portion disposed about a portion of said one unit and containing a wall aperture for receiving said latch element in an active position thereof, said shoulder being defined by an edge of said aperture, said latch element and said one unit having camming means interengageable to retract the latch element inwardly out of said aperture and away from operative blocking relation with said shoulder in response to relative movement of the units.

11. Drain hole apparatus comprising a whipstock unit, a support unit adapted to support said whipstock in a well, said whipstock unit being rotatable relative to said support unit and being movable vertically relative thereto between a plurality of different elevations for drilling a plurality of drain holes, and a releasable support connection between said units, said connection comprising means forming shoulders on the units interengageable in one rotary position of the whipstock unit relative to the support unit to support the whipstock unit from the support unit in a first of said elevations, said shoulders on the units being relatively movable, by said rotation of the whipstock unit, to relatively circularly offset positions in which the shoulders cannot interengage to support the whipstock unit and are movable axially past each other to allow downward movement of the whipstock unit past said first elevation relative to the support unit.

12. Drain hole apparatus as recited in claim 11, in which said shoulders comprise a releasable latch element movably carried by one of the units and engageable in supporting relation with a shoulder on the other unit.

13. Apparatus comprising a whipstock unit adapted to be lowered into a well and having an inclined face for deflecting a drilling bit laterally to drill a laterally extending drain hole, a support unit adapted to support said whipstock unit in the well, said whipstock unit being movable vertically relative to said support unit between a plurality of different elevations for drilling a plurality of drain holes, interengageable means on said units for supporting said whipstock unit from the support unit at said different elevations relative thereto, an element threadedly carried by said support unit and limiting upward movement of the whipstock unit relative to the support unit at an upper position, and interengageable shoulders on said whipstock unit and said element for transmitting rotary motion therebetween in said upper position of the whipstock unit and in a direction to unscrew said element from the support unit and permit free withdrawal of the whipstock unit from the well without the support unit.

14. Drain hole drilling apparatus comprising a drill string unit having a lower flexible portion, a whipstock unit having an inclined face adapted to deflect said string unit laterally to drill a drain hole and having a tubular portion above said face adapted to contain said lower flexible portion of the drill string unit, said drill string unit being rotatable relative to said whipstock unit, a latch element carried by one of said units and movable relative thereto between active and retracted positions, the other unit having a shoulder engageable by said latch element when in said active position in a relation to support the whipstock unit from the drill string unit with said lower portion of the string unit contained in said tubular portion of the whipstock unit, said latch element being ineffective in said retracted position to effect said support of the whipstock unit, and means operable to retract said latch element in response to movement of the string unit relative to the whipstock unit, said latch element being engageable with said shoulder to support the whipstock unit from the drill string unit in one relative rotary position of the two units, said latch element in a second relative rotary position of said units being offset circularly from said shoulder in a relation such that the latch element can not engage the shoulder in supporting relation in that relative rotary position, said latch element and shoulder being relatively movable axially past one another in said rotary position, and said drill string unit then being unobstructed against withdrawal upwardly from the whipstock unit and therefore from the well without the whipstock unit.

15. Drain hole drilling apparatus as recited in claim 14, including a spring yieldingly urging said latch element toward said active position, said means operable to retract said latch element including camming means on said latch element and said other unit operable to retract said latch element in response to movement of the string unit in a predetermined direction relative to the whipstock unit.

16. Drain hole drilling apparatus as recited in claim 14, including means mounting said latch element to said string unit for generally radial movement relative thereto, said tubular portion of the whipstock unit disposed about said string unit containing an aperture for receiving said latch element when in said active position, said shoulder being formed at an upper end of said aperture for engagement by the latch element, a spring urging said latch element outwardly into said aperture, said last mentioned means of claim 14 including camming means on said latch element and whipstock unit act-

ing to deflect said latch element inwardly and out of said aperture in response to downward movement of the string unit, said whipstock unit having a wall surface circularly offset from said aperture and engageable by said latch element to hold it in inwardly retracted position as the latch element is moved upwardly therealong and past the location of said aperture, to thereby allow removal of the string unit upwardly without the whipstock unit.

17. Drain hole drilling apparatus as recited in claim 14, in which said latch element is movably carried by said drill string unit at a location above said lower flexible portion thereof, there being a spring yieldingly urging said latch element to said active position.

18. Drain hole drilling apparatus as recited in claim 14, in which said latch element is movably carried by said drill string unit at a location above said lower flexible portion thereof, there being a spring yieldingly urging said latch element to said active position, said tubular portion of the whipstock unit disposed about said string unit containing an aperture for receiving said latch element when in said active position, said shoulder being formed by an edge of said aperture.

19. Drain hole drilling apparatus comprising a flexible drill string unit, a whipstock unit having an inclined face adapted to deflect said string unit laterally to drill a drain hole, said drill string unit being rotatable relative to said whipstock unit, and a releasable support connection between said units comprising means forming shoulders on the units interengageable in one rotary position of the drill string unit relative to the whipstock unit to support the whipstock unit from the string unit, said interengageable shoulders on the units being movable, by said rotation of the drill string, to relatively circularly offset positions in which the shoulders can not interengage to support the whipstock and are movable axially past each other, the drill string unit being free for withdrawal upwardly from the well without the whipstock unit when said shoulders are in said relatively circularly offset positions, there being means for retracting said latch element.

20. Drain hole drilling apparatus as recited in claim 19, in which said interengageable shoulders on the units comprise a releasable latch element movably carried by one of the units and engageable in supporting relation with the shoulder on the other unit.

21. Drain hole drilling apparatus as recited in claim 19, in which said whipstock unit had a tubular portion disposed about said string unit, and said interengageable shoulders comprise a spring pressed latch element movably carried by said drill string unit and movably receivable within a wall aperture in said tubular portion of the whipstock unit, said tubular portion of the whipstock unit having an imperforate wall surface circularly offset from said aperture adapted to hold the latch element retracted as it moves upwardly therealong past the location of said aperture.

22. Apparatus comprising a whipstock unit adapted to be lowered into a well and having an inclined face for deflecting a drilling bit laterally to drill a laterally extending drain hole, a support unit adapted to support said whipstock unit in the well, said whipstock unit being movable vertically relative to said support unit between a plurality of different elevations for drilling a plurality of drain holes, a latch element carried by one of said units, means forming a plurality of shoulders on the other unit engageable by said latch element in a relation to support said whipstock unit at said different elevations respectively relative to the support unit, and means operable to retract said latch element, while the apparatus is in a well, to an inactive position in which the latch element no longer supports said whipstock unit, a first of said units having a tubular vertically extending portion containing wall apertures at a plurality of different elevations, and the second unit having a portion received in said tubular portion of said first unit and movably carrying said latch element, said latch element being selectively receivable within said different apertures, said shoulders comprising edges of said apertures engageable by the latch element in a relation to support the whipstock at said different elevations, and a wedge surface on said latch element acting to wedge said latch element inwardly to retracted position upon movement thereof against an edge of one of the apertures resulting from upward movement of the whipstock relative to the support unit.

References Cited in the file of this patent

UNITED STATES PATENTS

2,101,185	Monroe	Dec. 7, 1937
2,105,722	Barrett et al.	Jan. 18, 1938
2,298,706	Kothny	Oct. 13, 1942
2,331,293	Ballard	Oct. 12, 1943
2,397,070	Zublin	Mar. 19, 1946
2,506,799	Livingston	May 9, 1950
2,642,267	Zublin	June 16, 1953
2,762,438	Naylor	Sept. 11, 1956