

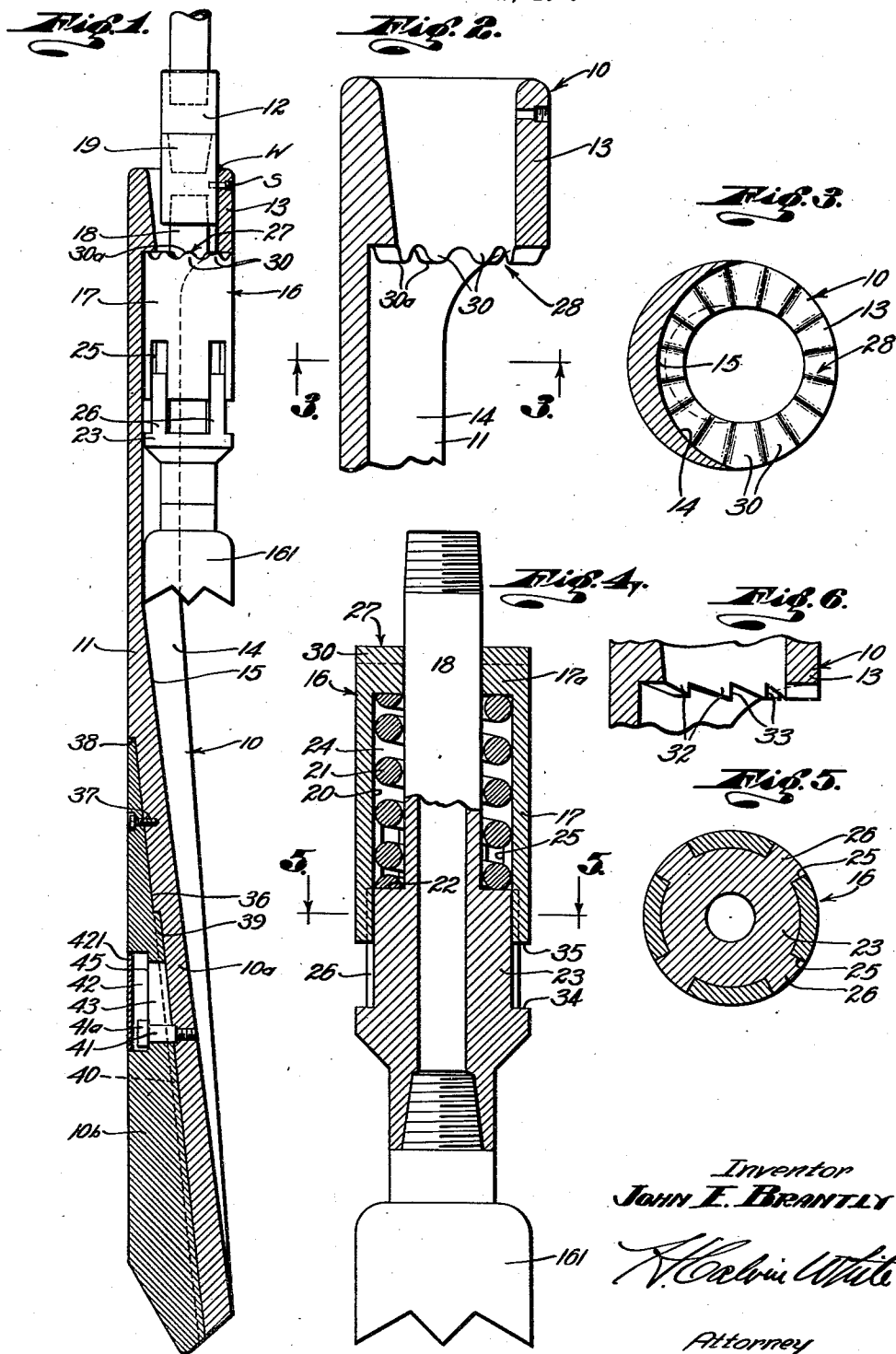
Nov. 23, 1943.

J. E. BRANTLY

2,334,747

VIBRATING HEAD WHIPSTOCK

Filed Nov. 12, 1940



UNITED STATES PATENT OFFICE

2,334,747

VIBRATING HEAD WHIPSTOCK

John E. Brantly, Pasadena, Calif., assignor to
Drilling and Exploration Company, Inc., Los
Angeles, Calif., a corporation of Delaware

Application November 12, 1940, Serial No. 365,142

5 Claims. (Cl. 255-1.6)

This invention relates generally to whipstocks for use in oil well drilling, and has for its primary object to provide improvements therein intended to facilitate removal of the tool in the event it becomes retained in the formation or otherwise 5

lugged in the well. The ordinary whipstock comprises an elongated body having an angular bit deflecting surface and a tubular head through which the drill pipe extends. While being lowered into or removed from the well, the whipstock is supported by a drill bit or tool shoulder against which the head of the whipstock bears. One of my principal objects is to provide in conjunction with the tubular head and the portion of the drill string passing therethrough, a device adapted to impart upwardly directed jarring or vibrating blows against the whipstock itself to cause its displacement from lodged condition in the well. Preferably, I employ a type of vibrating device capable of jarring upwardly against the whipstock while a sustained pull is exerted on the drill pipe, thus gaining the advantages of simultaneous pull and impact against the whipstock.

More specifically, the invention contemplates the provision of a vibrating device adapted to strike directly against the under-surface of the tubular head of the whipstock, and comprising a complementary striking element carried by a sub on the drill string and positioned directly beneath the whipstock head. Preferably the striking element is mounted for vertical movement on the sub, and is spring-actuated to impart a rapid succession of jarring blows as a result of continued rotation of the drill pipe from the ground surface.

It will be understood that the described vibrating device may be employed in conjunction with any suitable type or form of whipstock. In some instances it may be desirable to use the vibrating device with a collapsible whipstock of the form more specifically dealt with in my copending application on Collapsible whipstock, Ser. No. 365,141 filed on even date herewith, which form is rendered removable from lodged condition by relative movement of its parts caused by upward pull on the drill pipe.

The invention will be more fully understood and explained to better advantage from the following detailed description of a typical and illustrative embodiment. Reference is had to the accompanying drawing in which:

Fig. 1 is a longitudinal sectional view of the whipstock with the sub-carried parts of the vibrating device appearing in elevation;

Fig. 2 is a fragmentary enlargement of the whipstock head;

Fig. 3 is a bottom view of the head taken from line 3-3 of Fig. 2;

Fig. 4 is an enlarged sectional view of the parts of the vibrating device carried by the drilling string or sub;

Fig. 5 is a cross-section on line 5-5 of Fig. 4 and

Fig. 6 is a fragmentary view illustrating a variational form of irregular head surface.

The whipstock, generally indicated at 10, is shown typically to comprise an elongated body 11 adapted to be supported on the lower portion of the drill string 12 extending through the tubular head 13 of the whipstock, while the latter is being lowered and raised in the well. The whipstock body 11 has a longitudinal recess 14, the base 15 of which extends angularly or at an inclination so as to deflect the bit 16 and pipe string 12 from the course of the well bore above the whipstock as drilling proceeds after the whipstock has been set. The general functions of the whipstock in association with the bit 16 and the drill string 12, are well known and require no further explanation.

The invention is primarily concerned with the upwardly jarring or vibrating device, generally indicated at 16, by means of which it is made possible to impart directly against the whipstock itself, a rapid succession of upwardly directed blows or vibrations while a sustained pull is exerted on the drill pipe 12, to withdraw the whipstock in the event it becomes lodged in the well. The vibrating device 16 comprises a striking member 17 which may take the form of a sleeve movable vertically on the drill string 12, or more specifically, on a sub 18 interconnecting the drill bit 16 with pipe coupling 19. Striking member 17 has a counter-bore 20 containing a strong or stiff coil spring 21 confined between the head 17a of the striking member and an annular shoulder 22 on the sub. The lower portion of the striking member extends downwardly about the enlarged diameter portion 23 of the sub to prevent open access of circulating mud and solids to the counter-bore chamber 24 containing the spring. Any suitable means may be provided for preventing rotation of sleeve 17 on sub 18, as by forming in the sleeve, slots or ways 25, see Fig. 5, which receive splines 26 on the outer surface of the sub portion 23.

The top surface 27 of the striking member head 17a, and the under surface 28 of the whipstock head 13, have suitable interfitting irregularities

which cause the striking element 17, upon rotation of the drill string within the whipstock head, to become displaced downwardly against the resistance of spring 21, and then released to impact upwardly against the head, repeatedly and at a rate in accordance with the rate of drill string rotation. Preferably the irregularities formed on the surfaces 27 and 28 comprise a circular series of interfitting and uniformly spaced projections 30 having rounded ends 30a and shaped, as illustrated in Fig. 1, so that normally the projections on the two surfaces 27 and 28 will interfit, with the ends of the projections on one surface engaging the bases of the recesses on the complimentary surface.

Instead of forming surfaces 27 and 28 with curved contour projections as illustrated, the projections may be shaped differently, as in Fig. 6, to give sharper vibratory blows against the whipstock by release of the striking element from the slip-off points of angularly formed teeth. Here the projections on both the striking element and the whipstock head may consist of circular arrangements of toothed projections 32 having substantially vertical shoulders 33 along which the teeth on the striking element move at the point of release.

The tool assembly is lowered in the well with the parts positioned as shown in Fig. 1, the whipstock being supported by the engagement of the head under-surface 28 with the top of the striking element 17. The whipstock may be set and offset drilling carried on in the usual manner, after which the pipe string may be elevated to engage surfaces 27 and 28 to pull the whipstock from the well. Should the whipstock have become so tightly lodged as to interfere with its ready removability, the device 16 may be operated to simultaneously pull and vibrate the whipstock from its lodged condition. Upon rotation of the pipe string, the striking sleeve 17 is cammed downward by the relative rotation of projections 30 on the sleeve and whipstock head, and as the engaging projections pass their crests, releasing the striking element for upward movement, spring 21 operates to impact surface 27 against the whipstock head. Using the form of projections 30 shown in Figs. 1 to 4, the drill string may be rotated in either direction. Where the projections consist of angularly formed teeth as in Fig. 6, relative movement of the teeth to produce the described vibratory effect, can occur only by clockwise or right-hand rotation of the drill string. As will be apparent, the frequency of the vibrations depends upon the rate of drill string rotation. The intensity of the vibratory blows or impacts against the whipstock may be varied in accordance with the upward pull exerted on the drill string, and therefore the state of compression of spring 21. Normally it is preferred to operate with the spring under predetermined maximum compression, maintained by raising the sub 18 to the point of engagement between shoulder 34 and the lower end 35 of the striking element.

Reference heretofore has been made to the possible desirability, in some instances, of employing the described vibrating head assembly in conjunction with a whipstock, the body of which has collapsible characteristics to facilitate its extraction from lodged condition in the formation. The whipstock body structure shown in Fig. 1 may be taken as typical of the more complete and varied showings of transversely contractible whipstocks appearing in my copending applica-

tion identified in the introduction. The body of the whipstock may be regarded as comprising a main section 10a formed integrally with the head 13, and a relatively vertically movable section 10b, the two sections being in interengagement along inclined or wedge surfaces 36. Section 10b normally is held in the position illustrated and against shoulder 38, by a shear pin 37, and is provided with a dovetail spline or key 39 slidable within an undercut way 40 formed in the adjacent face of section 10a to guide the sections in their relative movement and maintain them in engagement along surfaces 36. Upon release of the two sections for relative longitudinal movement, they are held in engagement along surfaces 36 by a suitable key, such as a pin 41, inserted through slots 42 and 43, and threaded at 44 into section 10a. As illustrated, the flanged head 41a of the pin bears against and is slidable longitudinally on shoulder 45 between slots 42 and 43.

While being lowered and set within the well, the whipstock may be releasably held against rotation about the pipe string by suitable means such as a spot weld W or shear pin S adapted to be severed by lowering the drill pipe. Slot 42 may be closed by a plate 421 welded in place to prevent entry of solids that might interfere with movement of pin 41. In the event the body 10 has become lodged in the formation after whipstock drilling, pin 37 may be sheared by an upward pull on the pipe string, causing section 10a to move upwardly relative to section 10b, thereby laterally contracting or collapsing the body to facilitate its withdrawal from the formation. As section 10a is raised, pin 41 comes into engagement with the upper ends of slots 42 and 43 to then cause the two sections 10a and 10b to be withdrawn together.

If for any reason the body sections 10a and 10b are not freely releasable for relative movement as described, the vibrating device 16 may be employed to supplement the upward pull on the drill string to cause contraction of the body 10. Then, should the whipstock tend to remain lodged in the formation, its withdrawal likewise may be facilitated by operation of the vibrating device.

I claim:

1. The combination comprising a whipstock having a tubular head and adapted to be carried by a pipe string extending through said head, a tubular striking member movable vertically relative to the pipe string below said head, and yielding means urging said member against the head, said member being operable by rotation of the pipe string to impart a rapid succession of vibratory blows directed upwardly against the under surface of said head.

2. The combination comprising a whipstock having a tubular head and adapted to be carried by a pipe string extending through said head, the under surface of said head having a circular series of spaced irregularities, a tubular striking member movable vertically relative to the pipe string below said head and having on its upper end irregularities corresponding to those on the under surface of the head, means preventing rotation of said member about the pipe string, and a spring urging said irregularities on the head and striking member into engagement, said member being operable by rotation of the pipe string to impart a rapid succession of vibratory blows directed upwardly against the head.

3. The combination comprising a whipstock

having a tubular head and adapted to be carried by a pipe string extending through said head, the under surface of said head having a circular series of spaced irregularities, a tubular striking member movable vertically on the pipe string below said head and having on its upper end irregularities corresponding to those on the under surface of the head, means preventing rotation of said member about the pipe string, and a spring concealed within a counter bore in said member and urging said irregularities on the head and striking member into engagement, said member being operable by rotation of the pipe string to impart a rapid succession of vibratory blows directed upwardly against the head.

4. The combination comprising a whipstock having a tubular head, a tubular sub extending through said head and having its upper and lower ends connected to a pipe string and drill bit, respectively, the under surface of said head having a circular series of uniformly spaced irregularities, a tubular striking member movable vertically on said sub below said head and having on its upper end irregularities corresponding to those on the under surface of the head, means preventing rotation of said member about the sub, a shoulder on the sub, and a spring confined between said member and the shoulder and urging said ir-

regularities on the head and striking member into engagement, said member being operable by rotation of the pipe string to impart a rapid succession of vibratory blows directed upwardly against the head.

5. The combination comprising a whipstock having a tubular head, a tubular sub extending through said head and having its upper and lower ends connected to a pipe string and drill bit, respectively, the under surface of said head having a circular series of uniformly spaced irregularities, a tubular striking member movable vertically on said sub below said head and having on its upper end irregularities corresponding to those on the under surface of the head, means preventing rotation of said member about the sub, a shoulder on the sub and overlapped at the outside by a depending skirt portion of the striking member, and a spring confined between said member and the shoulder and concealed within a counter bore in the member, said spring urging said irregularities on the head and striking member into engagement, and said member being operable by rotation of the pipe string to impart a rapid succession of vibratory blows directed upwardly against the head.

JOHN E. BRANTLY.