Sept. 10, 1929. E. D. POWER 1,728,136

CASING SPEAR

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Fig. 1.

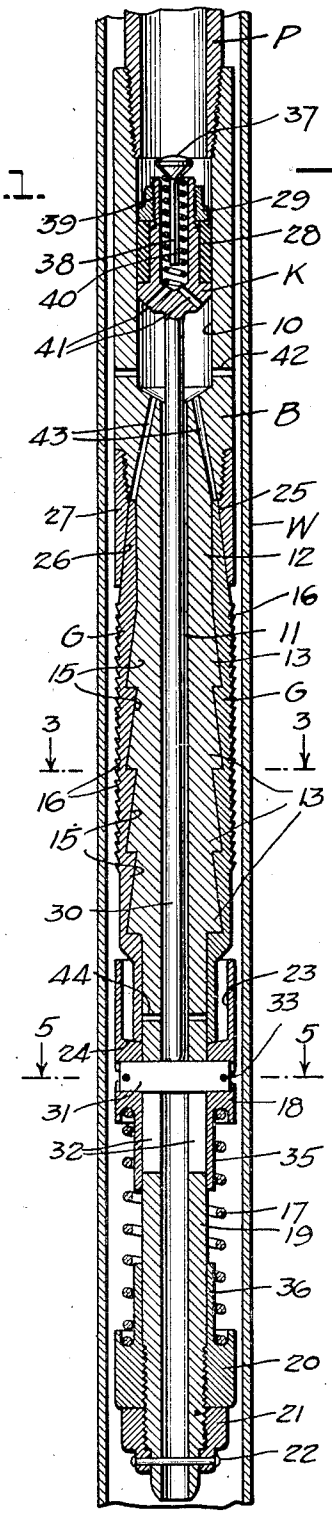

Fig. 2.

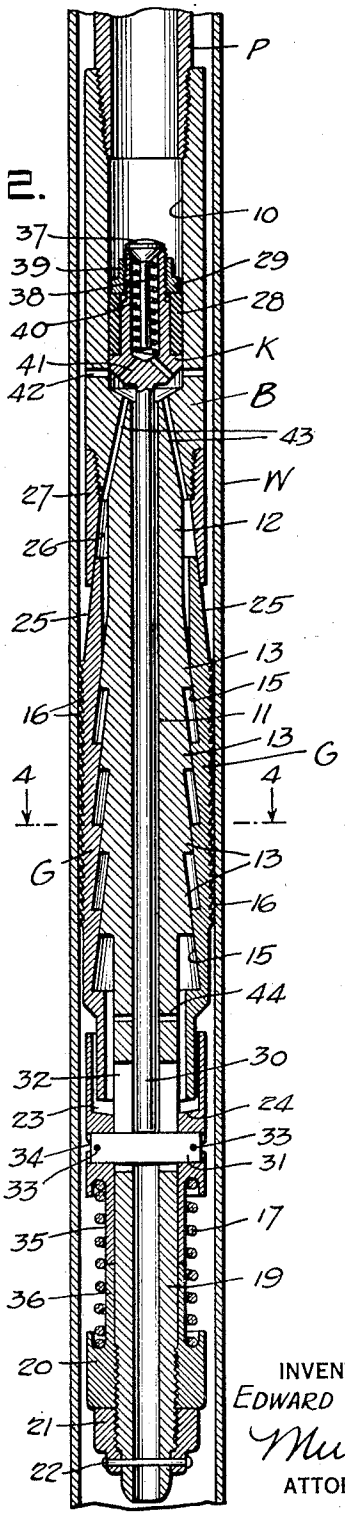

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Fig. 3.

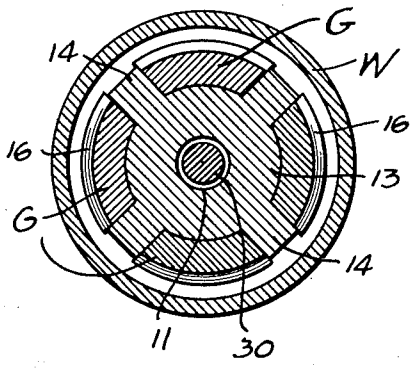


Fig. 4.

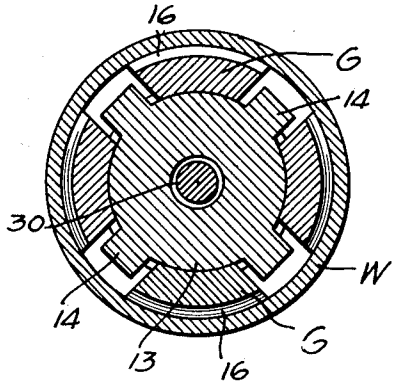
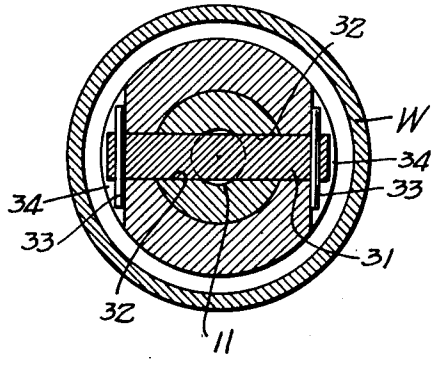


Fig. 5.



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CASING SPEAR.

Application filed October 21, 1926. Serial No. 143,230.

My invention relates to, and has for a purpose the provision of a casing spear, which is capable of being operated from the top of a well to grip a casing at any point within its length in the hole and in such manner that the casing can be pulled from the hole, or the sections thereof unscrewed or screwed together, the spear being so constructed that it can be released and reset as many times as desired without removing the spear from the hole for resetting, as has been necessary in devices of this character heretofore proposed.

A further purpose of my invention is the provision of a casing spear which is particularly adapted, although not necessarily for use in wells employing the rotary method of drilling, the spear being applied to the drill pipe and having gripping elements normally inactive but capable of being rendered active to move into engagement with the casing upon the pumping of mud fluid into the drill pipe, so that upon elevation of the pipe the casing will be gripped internally and an upward pull exerted on the latter.

I will describe only one form of casing spear embodying my invention and will then point out the novel features thereof in claims.

In the accompanying drawings,

Figure 1 is a view showing in longitudinal vertical section one form of casing spear embodying my invention, and inserted into a well casing with the gripping elements in normal or inactive position,

Figure 2 is a view similar to Figure 1 and showing the gripping elements in active position in gripping relation to the casing,

Figures 3 and 4 are horizontal sectional views taken on the lines 3—3 and 4—4 of Figures 1 and 2 respectively, and

Figure 5 is a horizontal sectional view taken on the lines 5—5 of Figure 1.

Referring specifically to the drawings, in which similar reference characters designate similar parts in each of the several views, my invention in its present embodiment comprises a body of elongated form designated generally at B and having a relatively large bore at its upper end to provide a chamber 10 communicating at its lower end with a central passage 11 extending longitudinally through the body. The body is threaded internally at its upper end to receive the end of a drill pipe P by means of which the body can be lowered into a well casing W to the point at which it is desired to grip the casing. The body is reduced in diameter as shown at 12 and is formed with a series of concentric cams 13 of frustro-conical form arranged in end to end relation with the larger end of the cams downmost and confronting the smaller end of the adjacent cam.

Gripping elements designated generally at G in the present instance of elongated form and arcuate cross-section are arranged in surrounding relation to the cams 13 and are maintained in definite spaced relation by means of guide ribs 14 extending lengthwise of the body at circumferentially spaced intervals. It will be noted that four gripping elements have been illustrated but it will be understood that a greater or less number can be used depending on the size of the device. The gripping elements are formed on their inner peripheral portions with a series of cam surfaces 15 corresponding in contour and number with the cams 13 while their outer peripheral portions are formed with a multiplicity of transversely extending teeth 16.

The gripping elements are normally urged upwardly on the body B by means of a coil spring 17 interposed between a collar 18 slidably mounted on the reduced extension 19 of the body and a second collar 20 threaded on the lower end of the extension and locked against movement by means of a nut 21 which in turn is positively maintained in definite position by a headed pin 22, extending through registering openings in the extension 19 and nut 21. The lower ends of the gripping elements are loosely received in a pocket 23 formed in the collar 18 and engage the conical bottom 24 of the pocket. The upper ends of the elements are beveled to provide cam

surfaces 25 and are received in the correspondingly tapered bore 26 of a sleeve 27 threaded on the body, the cam surfaces 25 and bore 26 cooperating to move the upper ends of the elements inwardly to the inactive or contracted position shown in Figure 1 as they are urged upwardly by the spring 17. By virtue of the conical bottom 24 the lower ends of the elements are simultaneously urged inwardly so that the elements will snugly engage the cams 13 to permit insertion into the casing W.

The elements are adapted to gravitate to the active or expanded position shown in Figure 2 in engagement with the inner wall of the casing upon the pumping of mud fluid into the drill pipe P. To this end a piston K is mounted in the chamber 10 and is provided with a packing sleeve 28 adapted to be compressed by a nut 29 into fluid sealing engagement with the wall of the chamber. Projecting from the lower end of the piston is a rod 30 extending into the passage 11 with its lower end engaging a rectangular shaped key 31 extending transversely of the body through diametrically opposed slots 32 formed in the extension 19. The ends of the key project into diametrically opposed openings in the collar 18 and the key is maintained against longitudinal displacement by means of pins 33 extending through the key into grooves 34 formed in the collar. It will thus be clear that any movement of the piston downwardly will cause a corresponding downward movement to be transmitted to the collar 18 through the medium of the rod 30 and key 31 to thus compress the spring 17 and leave the gripping elements free to gravitate and be simultaneously moved outwardly to the expanded position shown in Figure 2 by the cams 13. As clearly shown in this figure the downward movement of the collar 18 is limited by the abutting of tubular extensions 35 and 36 formed on the confronting sides of the collars 18 and 20 respectively.

To permit free circulation of the mud fluid through the body during lowering or raising of the gripping device into or out of the hole, the piston K is provided with a valve 37 having a depending stem 38 and normally urged upwardly to the open position shown in Figure 1 by a coil spring 39 received in a pocket 40 formed in the piston, which pocket communicates through ports 41 with the chamber 10 below the piston. It will thus be seen that the fluid will be free to circulate through the piston K, chamber 10 and thence through the passage 11 into the casing. Other ports 42 are formed in the body to provide additional vents, while ducts 43 lead from the lower end of the chamber 10 to the interior of the sleeve 27 and ports 44 extend through the body B adjacent the lower ends of the gripping elements to permit fluid to work between the elements and cams 13 and thus flush out any accumulation of sand or other foreign substance.

The operation of the device is as follows:

The device is secured to the drill pipe P and lowered into the casing W to the point at which it is desired to grip the latter, the gripping elements, piston, and valve 37 occupying the positions shown in Figure 1, which is termed in the art the set position of the spear. The valve springs 39 is of sufficient strength to maintain the valve 37 in its open position against the normal circulation pressure of the mud fluid so as to permit the fluid to be circulated in the same manner as when employed in drilling operations. When desiring to release the spear the pressure of the fluid is increased, thus overcoming the tension of the spring 39 and closing the valve. The fluid now acts upon and moves the piston K downwardly, and through the medium of the rod 30 and key 31 the collar 18 is moved correspondingly downward to thereby compress the spring 17, thus permitting the gripping elements G to gravitate and expand into engagement with the casing W as is clearly shown in Figure 2. With the spear released the drill pipe P is now elevated by the usual elevating mechanism (not shown) thus causing the cams 13 to further expand the gripping elements until the teeth 16 thereof have biting engagement with the casing to thus grip and exert an upward pull upon the latter. The pressure upon the fluid may now be cut off as the upward pull upon the casing is sufficient to maintain the gripping elements in gripping engagement with the casing. By continuing the upward pull upon the casing and rotating the drill pipe in one direction or the other by the usual mechanism (not shown) casing sections may be screwed together or unscrewed as desired. It will be noted in this connection that the ribs 14 function to prevent rotation of the elements on the body B during rotation of the latter by the drill pipe so that the rotative movement of the body will be transmitted through the elements to the casing.

To reset the spear the upward pull on the pipe P is first discontinued, then the pipe is lowered slightly to free the gripping elements from the cams 13 after which the spring 17, due to the previous cutting off of the pressure on the mud fluid, functions to return the elements and piston to the position shown in Figure 1.

From the foregoing operation it will be clear that the spear can be released and reset from the top of the well as often as desired without removing the spear from the hole. It will also be noted that due to the relatively large gripping surface of the ele-

ments G, the expansion pressure exerted on the casing is distributed over a large area so that the liability of bursting the casing during "jarring" operations is materially lessened.

Although I have herein shown and described only one form of casing spear embodying my invention, it is to be understood that various changes and modifications may be made herein without departing from the spirit of the invention, and the spirit and scope of the appended claims.

I claim as my invention:

1. In combination, a drill pipe and a casing spear secured to the pipe and having movable gripping elements, means for normally urging the gripping elements to a collapsed position for insertion into a well casing, and means operable upon the pumping of mud fluid into the pipe for actuating the first means to render the elements free to gravitate to an expanded position for engagement with the casing in such manner that upon upward movement of the pipe, the elements will grip and exert an upward pull on the casing.

2. A casing spear comprising a body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements movable on the body, means for normally urging the elements upwardly on the body to occupy a collapsed position, and means responsive to the action of mud fluid pumped into the drill pipe for rendering the first means inactive, to thereby permit the elements to gravitate to an expanded position in engagement with the inner wall of the casing, whereby upon upward movement of the pipe, the elements will grip and exert an upward pull on the casing.

3. A casing spear comprising a tubular body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements on the body, co-acting means on the body and elements operable upon movement of the latter in one direction to cause the elements to be expanded, a sleeve on the body having a cam surface internally thereof and receiving one end portion of said elements so as to cause the latter to be collapsed upon movement of said elements in the other direction, a collar fixed to the body, a second collar slidable on the body and receiving the other end portion of said elements, a coil spring interposed between the collars and normally urging said elements to collapsed position, the body having a transverse slot, a key in the slot and operatively connected to the slidable collar, and a piston in the body having a rod engaging said key for actuating the slidable collar.

4. A casing spear as embodied in claim 3 wherein said piston is provided with a valve normally urged to open position, and ports are provided in the piston and body for the purpose described.

5. A casing spear comprising a body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements movable vertically on the body, means operable upon upward movement of the elements for causing the latter to move to a collapsed position, means operable upon downward movement of the elements for causing the latter to be expanded into engagement with the inner wall of the casing, means for normally urging the elements to collapsed position, means responsive to the action of mud fluid pumped into the drill pipe for rendering the last means inactive, to thereby permit the elements to move to expanded position, and a valve in the last means normally urged to open position so as to permit mud fluid at a predetermined pressure to pass through the body, a valve being movable to closed position under the action of mud fluid above the predetermined pressure so as to allow the last means to respond to the action of the fluid.

6. A casing spear comprising a body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements movable on the body, means responsive to fluid pressure in the drill pipe for controlling movement of the gripping elements to one position, and means normally operating to allow fluid at a predetermined pressure in the drill pipe to discharge from the body without acting on the first means, and operable under the action of the fluid when at a pressure in excess of the predetermined pressure, to prevent the discharge of the fluid from the body so that the fluid will act upon the first means.

7. A casing spear comprising a body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements movable on the body, means responsive to fluid pressure in the drill pipe for controlling movement of the gripping elements to one position, the body having an outlet, and a valve controlling the outlet, normally urged to an open position to allow fluid at a predetermined pressure in the drill pipe to discharge from the body through said outlet without acting on the first means, the valve being movable to close the outlet under the action of the fluid when at a pressure in excess of the predetermined pressure so that the fluid will act upon the first means.

8. A casing spear comprising a body adapted to be connected to a drill pipe for insertion into a well casing, gripping elements movable on the body, means including a piston in the body responsive to fluid pressure in the drill pipe for controlling movement of the elements to one position, the piston and body having communicating

outlets, and a valve in the piston controlling the outlet therein and normally urged to an open position to allow fluid at a predetermined pressure in the drill pipe to discharge from the body through said outlets without acting upon the piston, the valve being movable to close said outlet in the piston, under the action of the fluid when at a pressure in excess of the predetermined pressure so that the fluid will act upon the piston.

9. A casing spear adapted to be secured to a drill pipe and having movable gripping elements, means normally acting to maintain the gripping elements in a collapsed position for insertion into a well casing, and means operable in response to the pumping of mud fluid into the drill pipe for rendering the first means ineffective and thereby allow the gripping elements to gravitate to an expanded position for engagement with the well casing in such manner that upon upward movement of the pipe the elements will grip and exert an upward pull upon the pipe.

10. A casing spear adapted to be secured to a drill pipe for insertion into a well casing and having movable gripping elements, fluid pressure responsive means for actuating the gripping elements, and means by which fluid at a predetermined pressure will be rendered ineffective to act upon the first means, yet incapable of preventing fluid at a pressure in excess of the predetermined pressure from acting on the first means so that fluid at the excess pressure will be free to act upon the first means and actuate the gripping elements.

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