June 24, 1930. A. L. SEGELHORST 1,767,018

SWINGING CUTTER CUTTING-OFF TOOL

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Fig. 1.

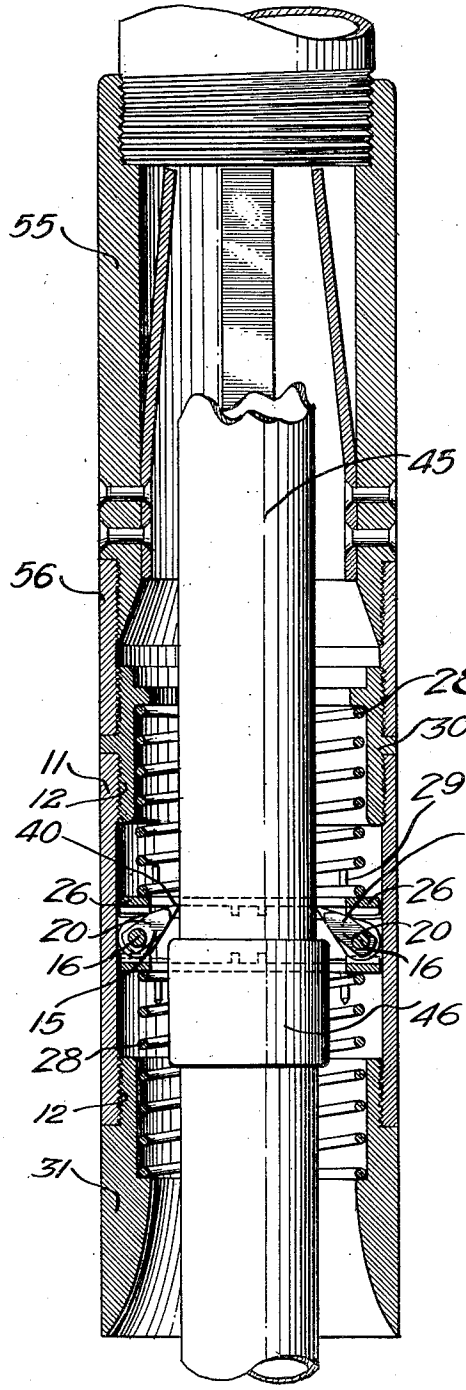
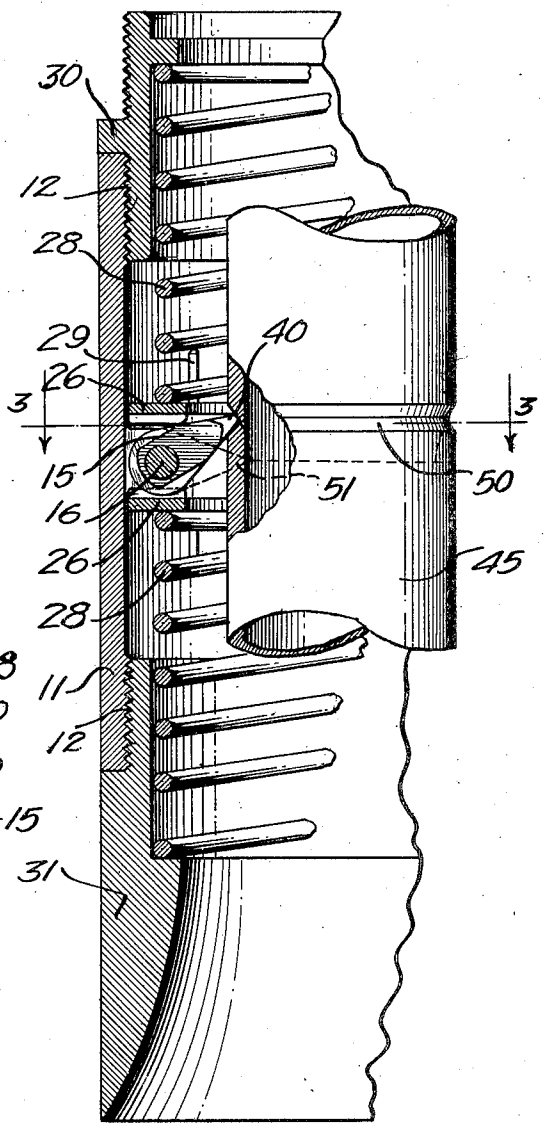


Fig. 2.



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Fig. 3.

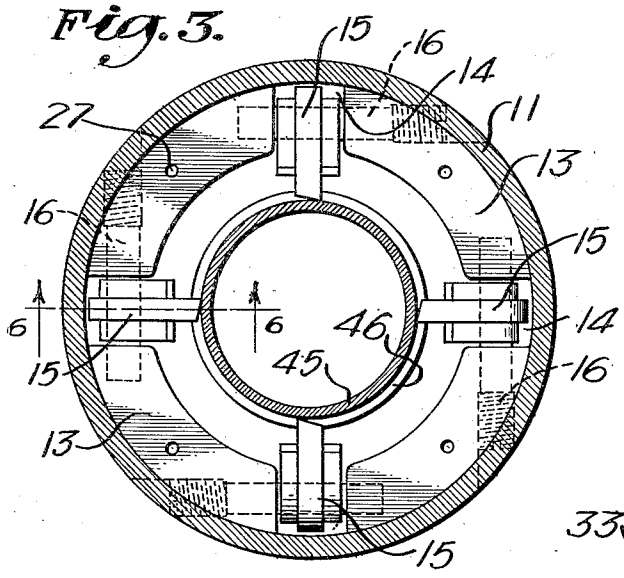


Fig. 5.

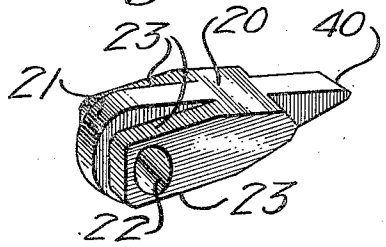


Fig. 6.

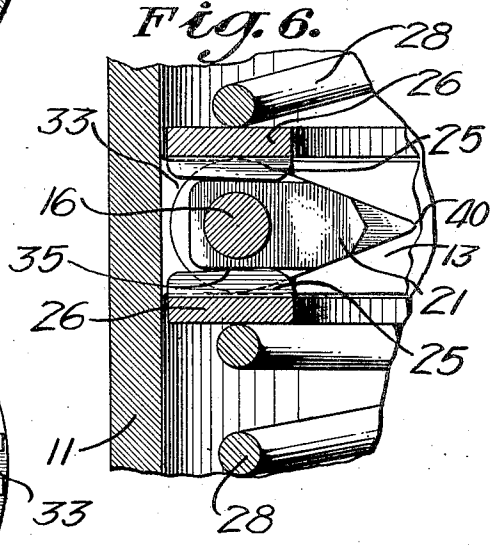
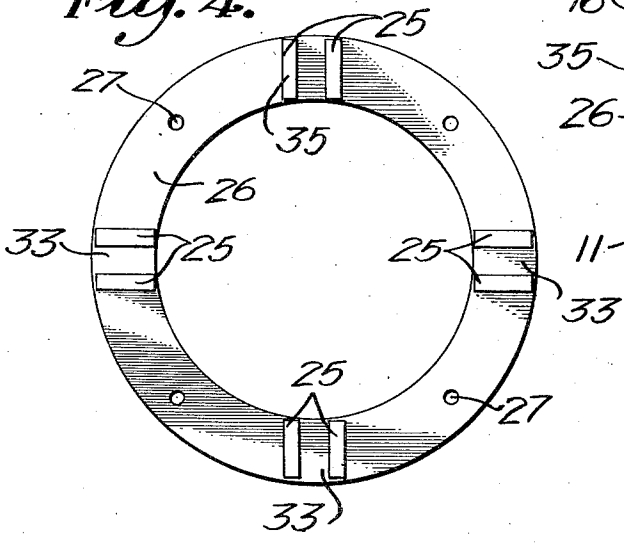


Fig. 4.



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UNITED STATES PATENT OFFICE

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SWINGING CUTTER CUTTING-OFF TOOL

Application filed September 30, 1922. Serial No. 591,543.

My invention relates to rotary well drilling equipment and relates particularly to cutting off tools by which pipe may be cut off within a well.

It occurs in the drilling of wells by rotary system that the drilling tool and a portion of the drill pipe are sometimes lost in the well. This losing of the tool and drill pipe may be due either to the twisting off of the pipe or its becoming disconnected within the well, the former being of most common occurrence. When a drill pipe twists off, or becomes otherwise disconnected, the sand will flow around the lower end thereof and the lubricating mud settle, owing to the loss of circulation, before an overshot can be lowered over the twisted off pipe to raise it from the well. This collection of sand prevents the lifting of the casing so that in order to remove the drill pipe and tool it becomes necessary to wash out around the submerged pipe and cut that portion thereof projecting above the collected sand and then proceed to wash out another portion of the sand, thereupon cutting off another portion of the drill pipe; thereafter continuing this washing and cutting process until the drill bit is reached and the sand washed away therefrom so that it can be removed.

It is a principal object of my invention to provide a simple yet effective form of cutting off tool which may be lowered into the well, down over the submerged drill pipe to any desired point, and then rotated to accomplish the cutting off of the pipe.

It is a further object of my invention to provide a device of this character having pivoted blades which are deflected by contact with obstructions upon the drill pipe such as couplings or collars so that the tool may be lowered over the drill pipe to the desired point of cutting.

The especial advantages of my invention and further objects thereof will be made evident hereinafter.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a sectional view illustrating the manner in which the cutters of the tool are deflected by contact with a collar as the tool is lowered over a submerged string of drill pipe,

Fig. 2 is a fragmentary section illustrating the movement of one of the cutters upon its pivot as the cutting off of a pipe progresses,

Fig. 3 is a section taken upon a plane represented by the line 3—3 of Fig. 2,

Fig. 4 is a face view of one of the annular plates employed in the device,

Fig. 5 is a perspective view of one of the cutting tools, and

Fig. 6 is a fragmentary enlarged section taken upon a plane represented by the line 6—6 of Fig. 3 for the purpose of clearly illustrating the manner in which the cutting tool is engaged by the annular plates and thereby resiliently maintained in cutting position.

In the construction of my invention I employ a tubular shell member 11 having the ends thereof internally threaded as indicated at 12. In the center of the member 11 an annular projection 13 formed integral with said member extends inwardly into the bore thereof, having notches or channels 14 cut therein as best illustrated in Fig. 3, in which notches cutters 15 are pivoted upon pins 16 which lie in a plane perpendicular to the axis of the member 11. The cutters 15, as shown in Fig. 5, are made from self-hardening tool steel in a form which provides a central blade portion 20, having elongated cam shaped hubs 21 symmetrically extending from each side therof, and are drilled as indicated at 22 to accommodate the pins 16 upon which they are pivoted in their respective slots 13. The hubs 21 are provided with lateral converging faces 23 which are engaged by lugs 25 formed upon annular plates 26 which are situated above and below the annular projection 13 and are held resiliently, but forcibly, in engagement with the cutters 15 by stiff helical springs 28, which are compressed by the upper coupling member 30 and the guide shoe 31 which are threaded into the ends of the member 11, as shown in Figs. 1 and 2. The lugs 25 are formed in pairs as shown at 33 in Fig. 4 and are so placed as to straddle the blade portion 20 of each of the cutters 15, thus allowing the flattened faces 35 thereof to bear directly

upon the faces 23 of the cutting tool hubs 21. The plates 26 are provided with hole 27, adapted to pass over centering pins 29, mounted in the inwardly projecting ring, 13.

It will be seen due to the symmetrical formation of the cam shaped hub 21, that the pressure of the springs 28 against the plates 26 holds the cutters normally inwardly extended as shown in Fig. 6, and provides a resistance against the cutting tools being rotated upon the pivot pins 16. The springs acting through the plates 26, do not, however, prevent the cutters from rotating either upwardly or downwardly when sufficient pressure is exerted upon the extending, or cutting ends, 40 thereof. This rotatable feature of the cutters is of particular utility when the cutting off tool is being lowered over the drill pipe, as shown in Fig. 1. When, in lowering the tool into the well upon the lower end of a string of pipe, the submerged drill pipe is encountered, the drill pipe is directed into the member 11 by the guide shoe 31. The upper end of the drill pipe 45 comes against the ends 40 of the cutters and deflects them upwardly, causing them to rotate upwardly upon the pivot pins 16. The ends 40 of the cutters then ride along the surface of the drill pipe 45 in the partially rotated positions shown in Fig. 1. Upon striking a collar 46, they are further deflected upwardly and pass on over the collar; dropping back into the position, in which they are shown, against the drill pipe, after the collar 46 is passed. In this manner the tool may be lowered over the drill pipe to any desired point. When the point at which it is desired to cut off the drill pipe is reached, the line of pipe to which the cutting off tool is attached is gripped in the rotary table and rotated, which causes the rotation of the member 11 upon the pipe 45.

It will be perceived from an inspection of Fig. 2, that with the pressure of the plates 26 against the cutters 15 under pressure of the springs 28, a force is continually exerted from both above and below which tends to return the cutters 15 to their inwardly pointed positions as shown in Fig. 6; thus the cutting ends 40 of the blade portions 20 are maintained in forcible contact with the surface of the drill pipe 45, with the result that, when the member 11 is rotated, the cutting members 15 perform a cutting action upon the drill pipe and cut into the pipe in the form of a ring, as indicated at 50 in Fig. 2. As the material is removed in the cutting of the drill pipe, the cutters 15 under the pressure of the springs 28 are gradually rotated into the inwardly extending position indicated by the dotted lines 51, the length of the cutting ends 40 being so proportioned that the drill pipe 45 will be cut entirely through, upon the cutting tools reaching this position.

For the purpose of lifting the severed portion of the drill pipe from the well, an overshot 55 may be inserted at any desired point in the length of pipe supporting the member 11. In the illustration I have shown the overshot 55 installed directly above the member 11, and connected thereto by means of a coupling collar 56.

I have found that with the cutters in upwardly deflected position against the outside of a submerged pipe, the upward movement of the member 11 will cause the cutting ends 40 of the cutters to penetrate the casing and swing downwardly upon the pins 16, thereafter sliding along the face of the casing and over collars as the member 11 is lifted upwardly, in the same manner as when the device was lowered over the drill pipe.

A cutting off tool of this character may be very cheaply manufactured and the blades thereof, as required for renewal purposes, may be very economically produced. The springs 28 may be provided of such strength as to give a very strong cutting pressure of the tool against the casing without preventing the cutters from rotating, as described, to permit the passage of the tool up or down over a string of drill pipe. In illustrating and describing my invention I present a form having springs operating from both above and below. In my experiments I have ascertained that such a tool will operate satisfactorily with a single spring only, placed above or below; but in order to provide additional cutting pressure to the cutters, I desire to employ two springs, as shown.

I claim as my invention:

1. In a cutting-off tool: the combination of a rotatable tubular body; a series of inwardly extending cutters pivotally mounted on said body in substantially the same horizontal plane and opposed compression springs mounted in said body for resiliently holding the cutting edges of said cutters inwardly in engagement with the pipe to be cut.

2. In a cutting-off tool: the combination of a rotatable tubular body; pivot members mounted in said body in positions transverse with relation to the axis of said body at substantially the same horizontal level; a series of inwardly extending cutters pivotally mounted on said pivot members; compression springs mounted in said tubular body; and plate members resiliently forced against opposite faces of said cutters by said springs to normally position said cutters with their cutting axes in a plane substantially perpendicular to the axis of said tubular body.

3. In a cutting-off tool: the combination of a rotatable tubular body adapted to act upon the outside surface of a pipe; pivot members mounted in said tubular body in a plane perpendicular to the axis of said body; cutters pivoted on said pivot members

in inwardly projecting positions and arranged to swing in planes substantially parallel to said axis of said body; and plate members resiliently held against the upper and lower faces of said cutters, in a manner causing said cutters to be normally maintained in laterally projecting positions and resiliently displaceable to either an upwardly or downwardly projecting position.

4. In a cutting-off tool adapted to operate at any point upon the outside surface of a pipe; a rotatable cutting tool body; inwardly extending substantially symmetrical cutters pivotally mounted in said body and inwardly swingable in planes substantially parallel with the axis of said body; and spring means for normally forcing said cutters into resiliently projecting positions in which positions said cutters are continuously in pressure contact with the surface of the pipe upon which the cutting operation is to be performed.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 19th day of September, 1922.

AUGUST L. SEGELHORST.