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CABLE KNIFE

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This invention relates to devices for cutting wire ropes or cables such as those used in drilling oil and other wells.

One of the objects of the invention is to provide an improved device for cutting wire ropes or cables such as are generally used in oil and gas well operations when the drilling tools supported by the cables become lodged in the well in such a manner that they cannot be withdrawn by a pull upon the cable to which they are attached.

Another object of the invention is to provide a device of this character in which a keen edged cutting element is actuated into cutting engagement with the cable by the force exerted by the firing of a confined explosive.

Still another object of the invention is to provide a cable cutting device wherein the cutting element is normally maintained out of contact with the cable so as to permit free movement of the device up and down the cable.

Other objects, features and advantages of the invention will appear from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a vertical sectional view of the device taken generally on line 1—1 of Figure 3.

Figure 2 is a vertical sectional view in general similar to that of Figure 1, but showing the cutting element after having severed the cable.

Figure 3 is a sectional plan view taken on line 3—3 of Figure 1, and

Figure 4 is a sectional plan view taken on line 4—4 of Figure 1.

Referring to the drawings, there is illustrated a section of a well casing 10 through which a wire cable 11 extends. The cable 11 is attached to a socket 12 carrying the usual string of drilling tools (not shown). It is when these drilling tools become lodged in the well that it is necessary to use my cutting tool to sever the cable 11 at a point adjacent the socket 12 in order to clear the way for the use of suitable fishing tools with which to dislodge and remove the drilling tools.

The cutting device comprises an elongated cylindrical body 13 formed with a central longitudinal bore or passage 14 of sufficient diameter to provide a sliding fit with the cable 11. An eye 15 is secured on the upper end of body 13 to receive a cable or line 16 by means of which the device is lowered into the well and withdrawn from the same after the cutting operation has been completed.

The body 13 is formed with a second longitudinal bore or passage 17 which extends substantially the length of the body but curves inwardly near the lower end to intersect cable bore 14. The bore 17 is formed with two diameters, the upper portion being of smaller diameter than the lower portion.

The cable cutting element is disposed within bore 17 and consists of a curved and keen edged cutting member 18 which is pivotally connected to the lower end of a connecting rod 19. The upper end of connecting rod 19 is likewise pivotally connected to the lower end of a piston or plunger 20, the diameter of which is such as to form a working fit within the upper restricted portion of bore 17.

An annular flange 21 is formed intermediate the ends of the lower section of bore 17 and the upper surface of the flange constitutes a seat 22 for a coil spring 23 which surrounds a portion of connecting rod 19 and plunger 20. A ring 24 is secured on plunger 20 and is so positioned as to rest on the upper end of the coil 23. The weight of the cutter assembly thus resting on the spring is sufficient to maintain the latter under compression.

The compression under which the string is maintained normally forces the assembly of cutter, connecting rod and plunger upwardly within bore 17, as is clearly shown in Figure 1. In this position the cutter 18 is entirely within bore 17 and out of contact with cable 11.

A hollow plug 25 is screwed into the upper end of bore 17. The plug is adapted to hold or contain a percussion cap 26 and the wall of the bore together with the space between the upper end of plunger 20 and the lower end of plug 25 form a chamber 27 which is adapted to be completely filled with an explosive mixture such, for example, as gun pow-

der. A hole or opening 28 is provided in the wall of body 13 and is adapted to connect the chamber 27 with the atmosphere.

Body 13 is formed with still another longitudinal bore or passage 29 in which a firing rod 30 is slidably mounted. The firing rod extends beyond the two ends of the body and is prevented from dropping through the bore by means of a collar 31 secured near its upper end. The collar is of greater diameter than bore 29 and may either rest upon the upper face of the body or, as shown, be seated within a recess 32 formed by slightly enlarging the bore at its upper end.

The upper end of firing rod 30 is adapted to make contact with the long arm 33^a of a fulcrumed rocker arm 33 which is pivotally mounted in a bracket 34 secured on the upper face of body 13. The short arm 33^b is provided with a firing pin 35 which is adapted to make contact with cap 26, when actuated by firing rod 30, to fire the cap and, in turn, cause the combustion of the powder within chamber 27.

Assuming that a well is being drilled with the usual drilling tools and that the tools become so lodged that they cannot be removed by pulling the cable 11, it then becomes necessary to resort to the use of fishing tools to dislodge and remove the drilling tools. This necessitates cutting the drilling cable 11 at a point near the tool socket 12, and the removal of the cable from the well in order to make way for free use of the fishing tools.

In order to sever the cable 11 my improved device is first put in readiness for use by filling the chamber 27 with gun powder or another suitable explosive and screwing the plug 25, with its percussion cap 26, in place. When ready for use the parts are in the position shown in Figure 1, with the coil spring 23 holding the cutting member 18 well within the bore 17.

The next step is to slip the device over the upper end of the cable 11 and then to lower it into the well by means of the cable 16. As will be seen the firing arm 30 extends below the lower end of body 13 and as the device descends into the well the end of the firing arm will eventually make contact with socket 12. If the device is lowered into the well with sufficient speed the impact between the firing arm 30 and the socket 12 will be enough to give an upward thrust to the firing arm, the upper end of which will then actuate the rocker arm 33 so as to force the firing pin 35 into suddent contact with the percussion cap 26. This sudden contact will cause the cap to explode and the fire caused by the explosion will ignite the powder within the chamber 27. The sudden burning of the powder within the limits of the chamber 27 will cause a sudden increase in pressure which will actuate the plunger 20 in a downward direction much as does the explosion of a cartridge in a gun expel a bullet. The entire cutting assembly is thus forced downwardly under great pressure and the cutting member 18 is guided by the curved wall at the lower end of bore 17 into cutting engagement with the cable 11. With a sufficient charge of explosive in the chamber 27 the force exerted upon the cutting member 18 through the connecting rod 20 will be sufficient to completely sever the cable with a single operation. The force of the explosion projects the plunger downwardly and opens the hole or opening 28 to the atmosphere so that the products of the combustion may escape from the chamber 27. The parts will be in the positions shown in Figure 2 at the moment the cable 11 is severed.

As soon as pressure is relieved within the chamber the coil spring 23, the compression of which has been greatly increased, will immediately force the cutting assembly upwardly within the bore 17 until the parts again assume their original position. The device can then be withdrawn from the well by a pull on cable 16 and the fishing tools can then be inserted to effect the removal of the drilling tools.

A device of preferred form and construction has been illustrated and described for the purpose of showing a way in which this invention may be practiced, but the inventive thought upon which this application is based is broader than this illustrative embodiment thereof. It is, therefore, understood that the scope of the invention is not to be limited by the present disclosure, reference being had to the appended claims for that purpose.

What I claim is:

1. A device for severing a drill cable from a tool socket comprising a body formed with a longitudinal bore for the drill cable and a second bore intersecting the cable bore, a cable cutting member in said second bore, an explosive in said second bore, and impact controlled means for controlling the projection of the cutting member by said explosive into cutting engagement with the drill cable.

2. A device for severing a drill cable from a tool socket comprising a body formed with a longitudinal bore and a second bore intersecting the first bore, a keen-edged member normally disposed within said second bore, a member slidable within said body and projecting below the lower end thereof, and explosive means rendered effective upon the contacting of said projecting member with the tool socket for actuating the keen-edged member into cutting engagement with the drill cable.

3. In a device for severing a drill cable, a body member adapted to slide on the drill cable, a keen-edged member movably mounted within said body, a chambered member in said body adapted to contain an explosive mixture, and means slidably mounted in said

body adapted to effect the combustion of said explosive mixture for actuating the keen-edged member into cutting engagement with the drill cable.

4. In a device for severing a drill cable from a tool socket, a body member formed with a bore for the drill cable, a second bore intersecting the cable bore, a keen-edged member normally maintained in said second bore, a plunger in said second bore and operatively connected with the keen-edged member, a plug removably secured in the upper end of said second bore, the space between the lower end of the plug and the upper end of the plunger being adapted to be filled with an explosive, a rod slidably mounted in said body and extending beyond the ends thereof, and means rendered effective upon the contacting of the rod with the tool socket for effecting the combustion of the explosive to actuate the plunger and thereby impel the keen-edged member into cutting engagement with the cable.

5. In a device for severing a cable, a body formed with a longitudinal bore for said cable, a cable cutting member mounted in said body, means including a charge of explosive for actuating said cutting member to sever said cable, and means energized upon striking a predetermined fixed object for igniting said explosive.

6. A cable cutting device comprising a body formed with a longitudinal bore for the cable, a keen-edged cutting member mounted in said body, explosive means for propelling said cutting member to cut said cable, and impact-controlled means for actuating said explosive means.

In witness whereof I have hereunto set my hand this 7th day of December, 1928.

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