Jan. 15, 1963 L. W. CHENAULT 3,073,388

WIRE LINE CUTTER

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Fig. 1

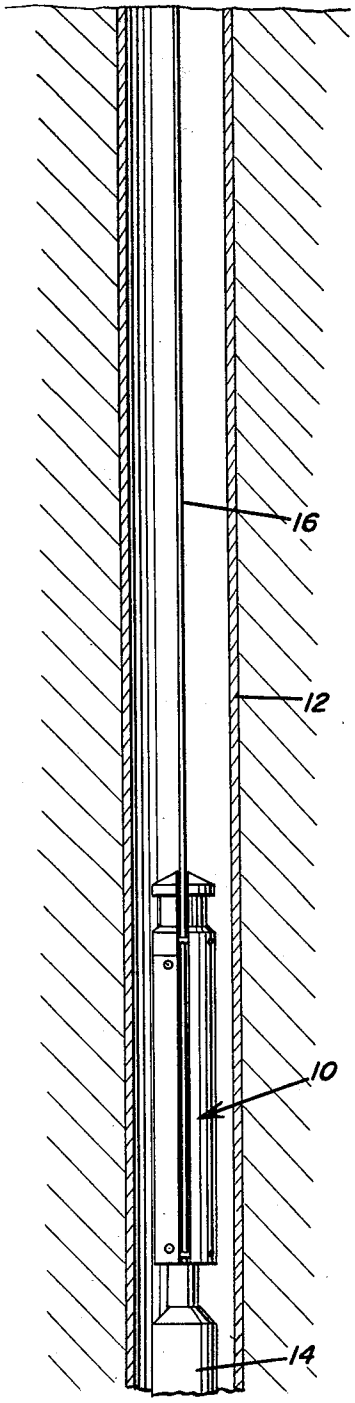



Fig. 2

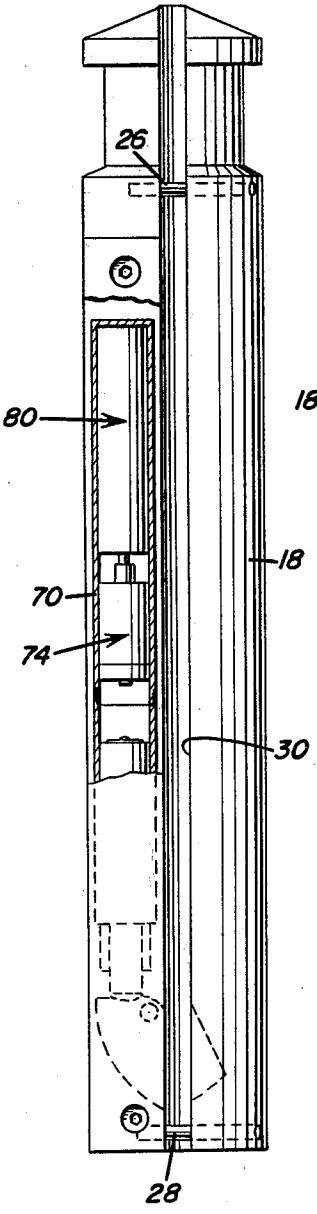
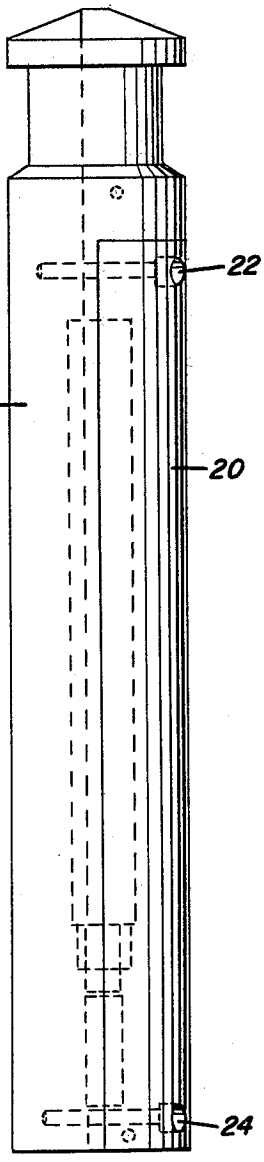



Fig. 3




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Fig. 5

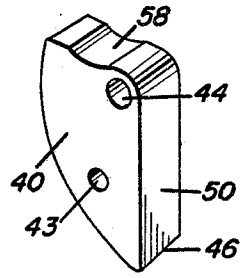



Fig. 6

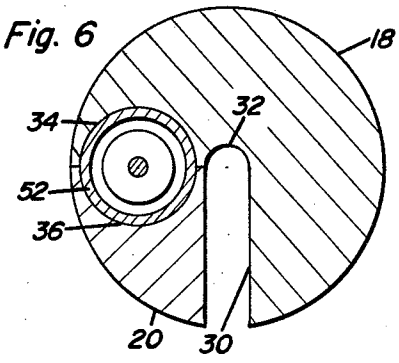



Fig. 7

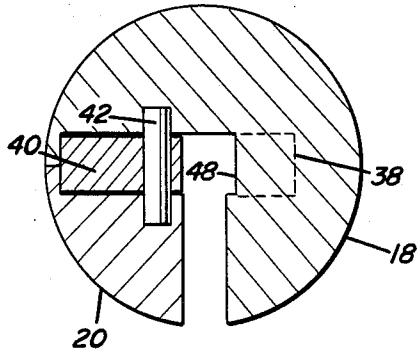
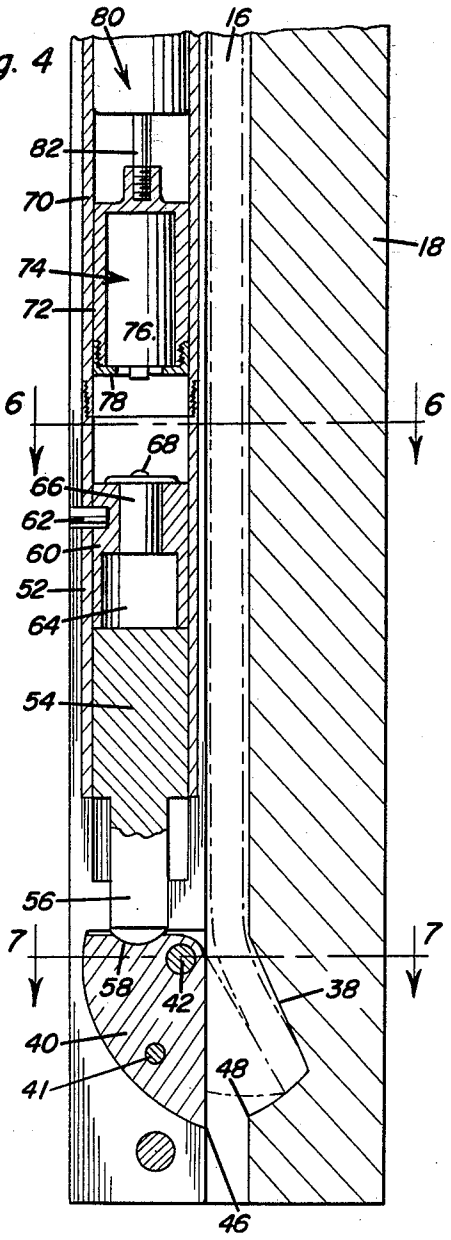



Fig. 4




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# 3,073,388
# WIRE LINE CUTTER

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5 Claims. (Cl. 166—54.5)

This invention relates to a cutting tool especially adapted for the cutting of cable lines at inaccessible locations, such as within the bore of an oil well casing.

In well drilling and other similar operations it frequently becomes necessary to insert tools or equipment for various purposes such as cleaning the bottom of the well which tools or equipment are operated or actuated by cables from which they are suspended. It frequently occurs, however, that such cable actuated equipment becomes lodged within the well bore and cannot be withdrawn by the actuating cable. It accordingly becomes necessary to cut the cable and then insert into the well bore some form of retrieving or "fishing" tool so as to remove the equipment lodged within the well bore. Many forms of wire cable line cutting devices have therefore been employed in the past in order to cut the cable to which the lodged equipment is attached prior to the retrieval operation. A common expedient formerly used for actuating such cable line cutters has included the use of an explosive charge which when fired actuates the cutter blade of the cutting tool to sever the cable. However, the cutting tools heretofore used either required the insertion thereof alongside of the cable within the well bore requiring therefore the use of cutting tools of a necessarily smaller dimension or the use of cutting tools wherein the firing of the explosive charge relied either on the use of externally actuated mechanism and hence additional equipment or relied upon inertia or impact force applied to the cutting tool device on dropping thereof into the well bore which latter method of firing was of course unreliable.

It is therefore a primary object of this invention to provide an explosive type of cable line cutting tool device which is more reliable than those heretofore used and which is of simpler construction and more efficiently operative than the cutting devices heretofore known.

Another object of this invention in accordance with the foregoing objects, is to provide a cable line cutting device which is particularly adaptable for cutting cables within a well bore at a remotely inaccessible location and includes an explosive charge for actuating the cutter blade of the cutting tool, said explosive charge being fired by a timing mechanism thereby eliminating the need for any external source to fire the explosive charge.

An additional object of this invention in accordance with the foregoing objects is to provide a time explosive actuated cutting tool which is slidably disposed about the cable and which cutting device is operative to cut the cable adjacent to the equipment lodged within the well bore so as to prevent damage to the well bore by the cut cable and further ensuring no damage to the well bore by clamping the cut end of the cable to the cutting tool device so that the cut cable may also be withdrawn with the cutting tool device from the well bore.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a sectional view taken through a typical well bore casing showing the cable line cutter device on a cable which is to be cut.

FIGURE 2 is a side elevational view with parts shown in section of the cutter tool made in accordance with this invention.



FIGURE 3 is an elevational view of the cutter tool from another side thereof.

FIGURE 4 is a partial enlarged sectional view of the cutter tool device.

FIGURE 5 is a perspective view of the cutter blade.

FIGURE 6 is a transverse sectional view taken through a plane indicated by section line 6—6 in FIGURE 4.

FIGURE 7 is a transverse sectional view taken through a plane indicated by section line 7—7 in FIGURE 4.

Referring to the drawings in detail, FIGURE 1 illustrates a well casing 12 within which a piece of equipment generally indicated by the reference numeral 14 has been suspended by an actuating cable 16, said equipment having become lodged within the well bore of casing 12 so that the cutting tool device generally indicated by the reference numeral 10 has been slidably inserted over the cable 16 and dropped down to the position shown in FIGURE 1 abutting against the lodged equipment 14. As will hereafter be explained, the cutting tool 10 will fire after the lapse of a predetermined length of time and sever the cable adjacent to its connection to the equipment 14, said cable being subsequently clamped to the cutter tool 10 so that the tool 10 with the cable 16 may be withdrawn from the bore of the well casing 12. Retrieval of the lodged equipment may thereafter be attempted.

Referring now to FIGURES 2, 3 and 6 it will be observed that the cutter tool 10 is disposed within a cylindrical casing structure which is constituted by sections 18 and 20. The sections are held assembled to each other by means of bolts the heads of which are recessed within apertures 22 and 24 as will be seen in FIGURE 3, the sections 18 and 20 also being held in assembled position by means of alignment pins 26 and 28 as more clearly seen in FIGURE 2. The sections 18 and 20 also form a longitudinal slot 30 therealong which terminates in a centrally disposed bore 32 through which the cable 16 may extend. Also, as will be more clearly seen in FIGURE 6, semi-circular recesses 34 and 36 are formed respectively within the casing sections 18 and 20 so as to confront each other and form a mounting bore within the tool casing.

As will be observed in FIGURES 4 and 7, a recess 38 is formed within the casing section 18 adjacent its lower end and as will be apparent from FIGURE 4 said recess 38 will accommodate movement thereinto of a pivotally mounted cutter blade 40 which is also illustrated in FIGURE 5. The cutter blade 40 is pivotally mounted within the casing by means of a pivot pin 42 which extends through aperture 44, said pin being assembled within the casing sections 18 and 20 as will more clearly be seen in FIGURE 7. The blade 40 is retained as illustrated on one side of the cable receiving bore 32 by any suitable means such as a shear pin 41 cross-sectionally illustrated in FIGURE 4, said shear pin extending through the lower aperture 43 formed in the blade 40 as more clearly seen in FIGURE 5. The lower edge 46 of the cutter blade 40 constitutes a cutting edge which cooperates with the edge 48 on the recess 38 to thereby sever the cable 16, the cable subsequently being clamped within the recess 38 by the side surface 50 of the cutter blade 40 as will be apparent in FIGURE 4.

In order to actuate the cutter blade 40, an actuating mechanism is provided therefor and is mounted within a tubular cylindrical member 52 which is inserted within the cylindrical bore formed by recesses 34 and 36 as hereinbefore described. Slidably mounted at the lower end of the tubular member 52 is a piston ram member 54 which has a portion 56 which abuts against a depression 58 formed on the cutter blade 40 so that the pivotal movement of the cutter blade 40 relative to the slidable piston member portion 56 may be accommodated. A cylindrical member 60 is fastened to the tubular member 52 and to the casing by means of pin 62 said member 60

forming the head end of a cylinder for the piston member 54 and also defining an expansion chamber 64. A powder charge containing shell 66 is disposed within a bore of the cylinder head member 60 and has a firing pin 68 disposed at the upper end thereof. It will therefore be apparent that the explosive shell 66 when fired by contact of a firing mechanism with the firing pin 68, the powder charge will explode into chamber 64 so that expanding gases in chamber 64 force the piston member downwardly and thereby actuate the cutter blade 40 with an impact sufficient to sever the cable. It will be obvious that when the actuating impact is applied to the blade 40, the shear pin 41 is sheared and the blade thereafter will project into the internal cavity of recess 38 to hold the severed cable clamped therein. Thus, the blade is effective to maintain the cable clamped in the recess 38 after its severing action so that a pull applied to the cable thereabove may withdraw the cutting tool from the oil well bore within the casing 12.

The firing mechanism for contacting the firing pin 68 of the powder charge shell 66 is mounted within a tubular member 70 which is threadedly engaged with the tubular member 52 of the actuating mechanism as will more clearly be seen in FIGURES 2 and 4. Slidably disposed within the lower end of the tubular member 70 is a holder member 72 of a firing mechanism generally indicated by reference numeral 74. Disposed within the holder member 72 is a battery 76 which is retained within member 72 by a cap member 78 threadedly engaged with the lower end of the member 72 as will more clearly be seen in FIGURE 4. It will therefore be apparent that upon contact of the battery 76 with the firing pin 68 of the explosive shell 66, the charge therein will fire to thereby cause the actuating explosion.

The firing mechanism 74 is actuated by means of a timing mechanism generally indicated by the reference numeral 80. The timing mechanism 80 is operatively connected to the firing mechanism 74 by means of rod member 82 which is threadedly engaged with the member 72 of the firing mechanism. The timing mechanism 80 may be of any type well known to those skilled in the art such as spring actuated gear type of timing mechanism or clock work type of mechanism, it being understood, of course, that the specific details of the timing mechanism per se form no part of this invention. The only requirement of the timing mechanism to be used is that it is enclosed within a tubular casing such as illustrated in FIGURE 2 so as to extend the rod 82 with respect thereto after a preset amount of time for displacing member 72 of firing mechanism 74 into contact with the firing pin of shell 66.

From the foregoing description the operation and the purposes for which the cutter device made in accordance with this invention may be used, is apparent. It will therefore be recognized as previously noted that the cutting device is extremely simple and efficient in operation and embodies a method of cutting cable which differs from the methods heretofore used. As a result of the novel method and apparatus, externally initiated actuation of the explosive charge and the additional equipment incident thereto is avoided. Also, the cutter actuation is accomplished with much more reliability than would heretofore be possible with explosive actuated cutting devices which relied upon inertia or impact forces for firing thereof. The cutting device is also more efficient because of the clamping action involved between the cutter blade and the cut end of the cable whereby the cut end of the cable is prevented from damaging the well bore and enables immediate withdrawal of the cutting tool.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. Apparatus for cutting cable at a remotely inaccessible location in a well bore comprising, tool casing means through which said cable extends, cutter means operatively mounted in said casing means for displacement therewithin, cable clamping recess means disposed within said casing means for receiving said cable and said cutter means to cut and then clamp the cable to said casing means in response to displacing impact applied to the cutter means, explosive means disposed within said casing means, explosive force transmitting means operatively interconnecting said explosive means and cutter means for imparting displacing impact to the cutter means, firing means operatively mounted within said casing means and actuatable to fire said explosive means and timing mechanism mounted within said casing means and operatively connected to said firing means for actuation thereof after a predetermined time following positioning of the casing means at said remotely inaccessible location in the well bore.

2. The apparatus as defined in claim 1, wherein said casing means is cylindrical and has a central bore within which the cable is loosely disposed, said timing mechanism, firing means and force transmitting means being slidably mounted within said casing means on one side of the cable while the cutter means is pivotally mounted in said casing means for pivotal movement from said one side into said recess means on the other side of the cable displacing a cut end portion of the cable into clamping relation within the recess means after cutting of the cable.

3. Apparatus for cutting cable at a remotely inaccessible location in a well comprising, a casing having a centrally disposed bore through which the cable extends, cutter means pivotally mounted in the casing and retained on one side of the bore, clamping recess means mounted on the other side of the bore for receiving a severed end portion of said cable and the cutter means in response to pivotal displacement of the cutter means across said bore to cut the cable and self-contained actuating means mounted in the casing and operatively connected to said cutter means.

4. The combination of claim 3, wherein said actuating means includes, time-controlled explosive means mounted on said one side of the casing and operatively connected to the cutter means for actuation thereof a predetermined period of time after insert of the apparatus within the well.

5. The combination of claim 3 wherein said clamping recess means comprises, an internal side wall downwardly inclined away from said centrally disposed bore a distance substantially in excess of the diameter of said cable, and a lower arcuate wall interconnecting said side wall and said bore to form an internal cavity in communication with said bore, said lower arcuate wall being dimensioned for contact with said cutter means in clamping relation to said severed end portion of the cable.

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