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Reed et al.

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[54] **SUBSEA CABLE CUTTER AND THE METHOD OF ITS USE**

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[52] **U.S. Cl.** ..... **102/24 HC,** 114/221 A

[51] **Int. Cl.** **F42b 3/08**

[58] **Field of Search** ..... 102/7, 20, 24 HC; 114/221 A

[56] **References Cited**

UNITED STATES PATENTS

1,311,785	7/1919	Wildrick	102/7
2,920,532	1/1960	McBride	102/24 HC
3,036,522	5/1962	Lindsey	102/20
3,070,011	12/1962	Robinson, Jr. et al,	102/24 HC
3,089,417	5/1963	Beyer et al.	102/24 HC
3,662,634	5/1972	Burke	114/221 A

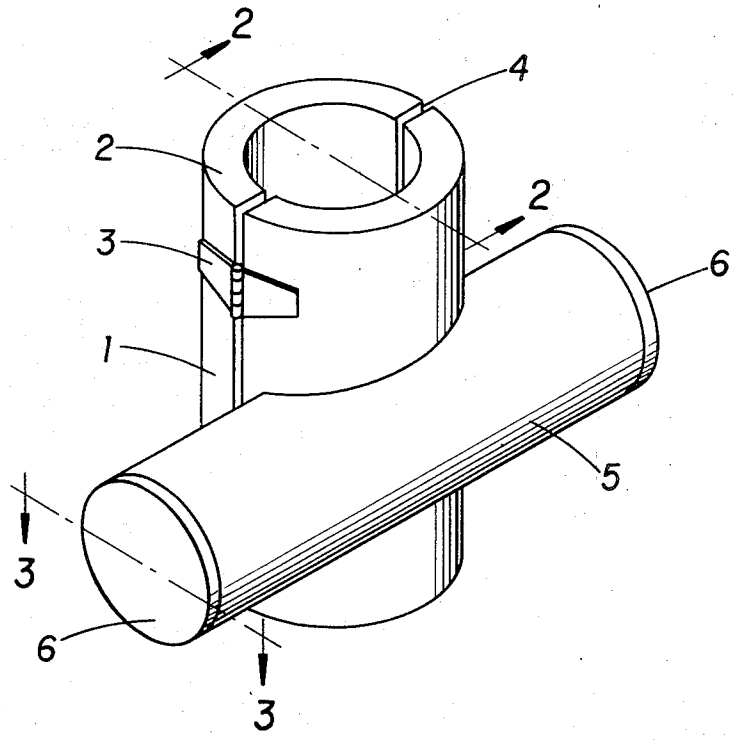
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[57] **ABSTRACT**

The present invention relates to an apparatus for severing cable or line at a preselected time and more particularly to a cutter employing a shaped charge for severing mooring cable or line beneath the surface of the water.

17 Claims, 3 Drawing Figures



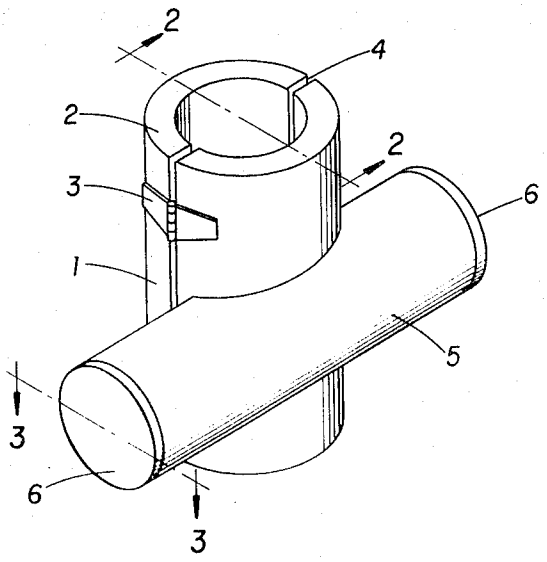


FIG. 1.

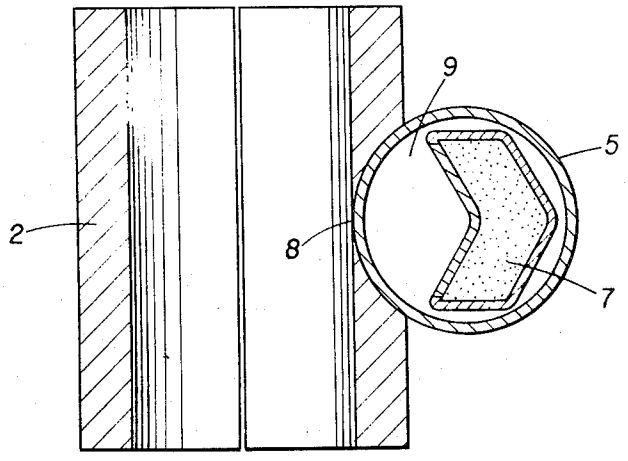


FIG. 2.

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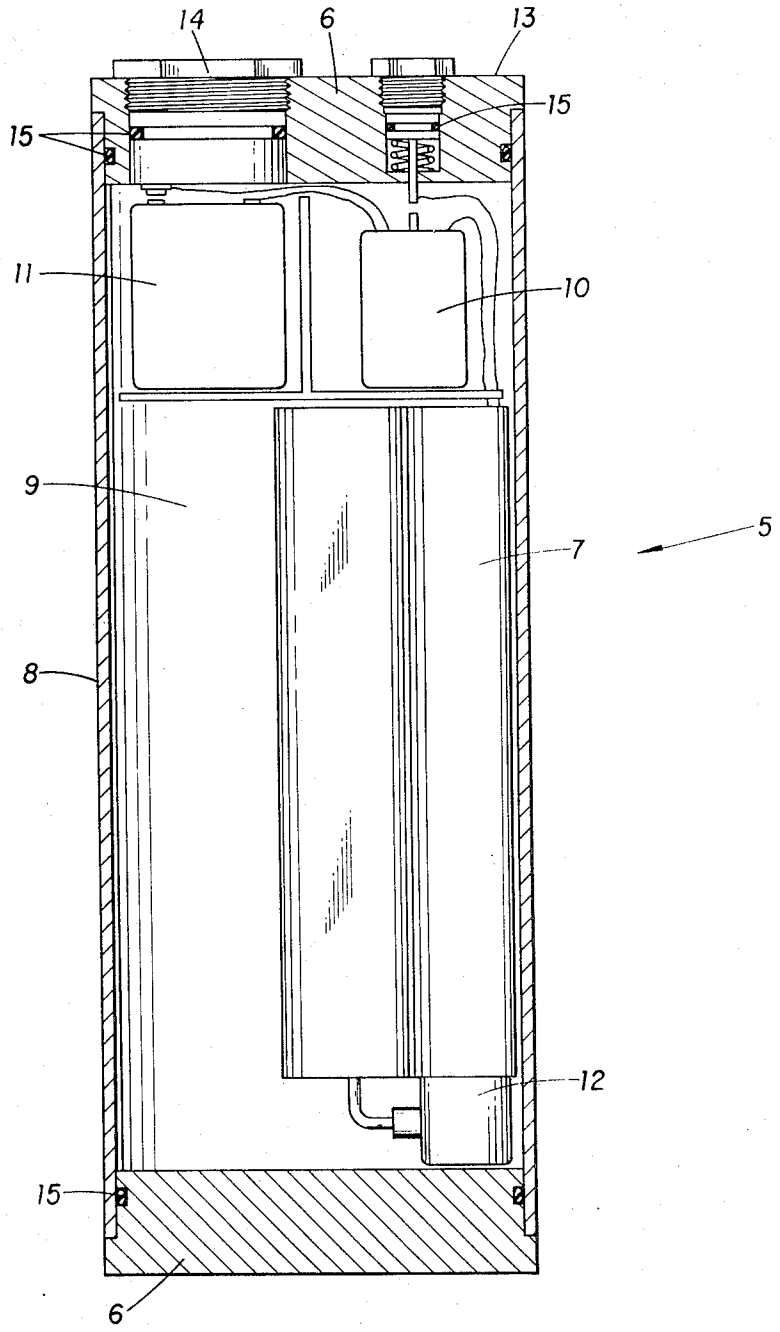


FIG. 3.

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SUBSEA CABLE CUTTER AND THE METHOD OF ITS USE

BACKGROUND OF THE INVENTION

The present invention relates to the severing of cable or line, particularly when disposed beneath the surface of water, at a preselected time or distance from the surface of the water.

It is often desirable to temporarily anchor floating vessels such as buoys or the like in great depths of water. Such vessels are held stationary on the surface of the water by a length of line or cable attached to an anchoring means. When removing the temporary floating vessels it is a common practice to cut the mooring line near the surface of the water, thus losing the length of line between the temporary floating vessel and the anchor. In great depths of water and in cases where heavy cable is used, the loss of cable may be very expensive and highly undesirable.

Previous attempts have been made to sever the cable at depths beneath the surface of the water. Typical of such attempts is a guillotine-type cutter which is slipped down the cable to a predetermined depth at which time the knives of the cutter are closed to sever the cable. An explosive charge has sometimes been used to close the knives of the cutter. Although such an apparatus has met with some success, it is expensive to manufacture, relatively large and is lost upon each use. Also, such devices have been found to be useful only at limited depths and, in fact, are most often used above the water's surface.

The present invention provides a cable cutter for severing line and cable at a predetermined time, which comprises:

- a collar guide adapted to fit slidably around the line sought to be severed;
- a waterproof pressure housing attached to the outside of the collar;
- a shaped charge contained within said housing and positioned so as to extend a cutting jet blast through the collar and the line upon detonation; and
- a timed detonating means contained in said housing and operatively connected to the shaped charge.

The cable cutter provides an economical and effective means for cutting line at a predetermined time and is particularly useful for cutting an underwater line in depths as great as 20,000 feet at or near the anchor to which the line is attached.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the preferred embodiment of the cable cutter.

FIG. 2 shows a cross section of the cable cutter and the preferred placement of the shaped charge.

FIG. 3 shows a cross section of the preferred embodiment of the pressure housing containing the shaped charge and timed detonating means.

DETAILED DESCRIPTION

Referring now to FIG. 1, the casing cutter 1 in its preferred form is shown. The collar guide 2 is an elongated tube opened at both ends. In its preferred form it is hinged with door-type hinges 3 to allow the collar guide 2 to be opened at opening 4 so that it can be placed loosely around the line sought to be cut. When placed loosely and slidably around the line sought to be cut,

the collar guide may be securely closed. The collar guide 2 may be made of any firm material which is nonreactant with water, such as plastic or steel, the preferred material being steel. The collar guide 2 must have a density sufficient to cause the cable cutter to sink to desired depths in water. The collar guide 2 may be varied in diameter to accommodate various diameters of line. The collar guide 2 fits loosely over the line so as to allow said guide 2 to slip easily past splices in the line and the like.

The pressure housing 5 is tangentially attached to the collar guide 2, and in the preferred embodiment of the casing cutter 1 said housing 5 is tangentially attached perpendicular to the axis of the collar guide 2 and is set into the outer wall of the collar guide 2. In its preferred form the pressure housing 5 is an elongated tube closed at both ends with watertight seals 6 and is able to withstand pressures at depths of at least 20,000 feet beneath the surface of the water. Although the preferred composition for the pressure housing 5 is steel, it may be made of any material which is not reactant with water, such as plastic.

Referring now to FIG. 2, a cross section of the collar guide 2 and the pressure housing 5 is shown along reference line 2 in FIG. 1. Contained within the pressure housing 5 is shaped charge 7 positioned so that a jet blast emanating therefrom will cut wall portion 8 of said housing 5 which is in contact with the collar guide 2 and the line passing through said collar guide 2.

Shaped charges are well known in the art as a device for creating a directed jet blast. In its preferred form, the shaped charge 7 is a linear shaped charge extending the width of wall portion 8 where said housing 5 is in contact with the collar guide 2 and is positioned at a 90° angle with the axis of the collar guide 2.

To be operative, the shaped charge 7 must be positioned so as to provide a standoff space 9 between the operative face of said charge 7 and the portion 8 where said housing 5 is in contact with the collar guide 2. The standoff space 9 allows the focusing of the jet blast along an area of concentration where cutting is desired.

The shaped charge 7 may be formed from any explosive capable of blasting through wall portion 8 of the housing 5 wall and through the line sought to be cut. The preferred explosive is cyclotrimethylenetrinitramine. Various size charges of the preferred explosive may be used for lines of various sizes and materials. For example, a 1,000 grain charge cyclotrimethylenetrinitramine is needed to cut a 1 inch diameter steel cable while a 1,600 grain cyclotrimethylenetrinitramine charge will cut a 3-½ inch nylon cable.

Referring now to FIG. 3, a cross section of the preferred form of the pressuring housing 5 is shown along the lines of reference number 3 in FIG. 2. Watertight seals 6 are shown in either end of the elongated tubular pressure housing 5. Shaped charge 7 is shown contained in said housing 5 so as to direct a jet blast across standoff space 9 against wall portion 8 which is in tangential contact with the collar. In the preferred embodiment, shaped charge 7 is detonated by means of a timer 10 powered by battery 11 which operates detonator-booster 12. The watertight seal 6 closest to the timer 10 contains a pressure switch 13 which activates the timer at a predetermined water pressure in the preferred embodiment. The time 10 may alternatively be a mechanical, hand-actuated timer which triggers a me-

chanical detonator; for example, a spring-loaded firing pin. In the preferred embodiment a battery port plug **14** is contained in the seal **6** nearest the battery **11**. O-rings **15** may be used to insure the watertight qualities of the seals **6**, the pressure switch **13** and the battery port plug **14**.

OPERATION

To cut an underwater line at or near the anchor, the collar guide **2** is placed around the line sought to be cut and secured. The cable cutter **1** then is allowed to slide down the line until the shaped charge **7** detonates at a predetermined time and cuts through the collar portion **8** and through the line. In the preferred embodiment the pressure switch **13** activates the timer **10** at a predetermined depth. After a predetermined delay, the timer ignites the detonator-booster **12** which in turn detonates the shaped charge **7**.

It will be apparent to those skilled in the art that many various embodiments of the present invention may be envisioned and the scope of the invention is not intended to be limited except by the appended claims.

What is claimed is:

1. A cable cutter comprising:

a. An elongated tubular sleeve having each end thereof open and being adapted for loose and slidable placement around a cable;

b. an elongated tubular housing having each end thereof closed and being tangentially and fixedly attached to said sleeve;

c. a shaped charge positioned within said housing so as to direct, upon detonation, a jet blast toward said sleeve wherein said shaped charge is of sufficient size to generate a blast capable of severing said cable and at least said tangentially attached portions of said housing and said sleeve; and

d. a self-contained timed detonating means disposed within said housing and operatively connected to said shaped charge.

2. The cable cutter of claim **1** wherein said shaped charge is a linear shaped charge.

3. The cable cutter of claim **1** wherein said shaped charge is formed of cyclotrimethylenetrinitramine.

4. The cable cutter of claim **1** wherein said timed detonating means comprises:

a. a timer;

b. a pressure-operated switch to initiate said timer at a predetermined pressure;

c. a battery operatively connected to said timer; and

d. a detonator operatively connected to said timer.

5. The cable cutter of claim **1** wherein said sleeve comprises two symmetrical, elongated, curved members connected along one elongated side by hinges.

6. The cable cutter of claim **1** wherein each of said closed ends of said housing is a watertight seal, said housing having sufficient compressive strength to withstand up to about 20,000 feet of hydraulic head.

7. The cable cutter of claim **1** wherein said housing is attached to said sleeve such that a plane containing the longitudinal axis of said housing is perpendicular to the longitudinal axis of said sleeve.

8. The cable cutter of claim **7** wherein said housing is set into the outer wall of said sleeve.

9. A method of cutting cable suspended in a body of water, said cutting occurring at predetermined point below the surface of said water, comprising the steps of:

a. placing a cable cutter on the cable sought to be cut, wherein said cable cutter comprises

1. an elongated tubular sleeve having each end thereof open and being adapted for loose and slidable placement around a cable,

2. an elongated tubular housing having each end thereof closed and being tangentially and fixedly attached to said sleeve,

3. a shaped charge positioned within said housing so as to direct, upon detonation, a jet blast toward said sleeve wherein said shaped charge is of sufficient size to generate a blast capable of severing said cable and at least said tangentially attached portions of said housing and said sleeve; and

4. a self-contained timed detonating means disposed within said housing and operatively connected to said shaped charge;

b. sliding said cable cutter down said suspended cable until said shaped charge is detonated by said timed detonating means, whereby said cable is cut.

10. The method of claim **9** wherein said shaped charge is a linear shaped charge.

11. The method of claim **9** wherein said shaped charge is formed of cyclomethylenetrinitramine.

12. The method of claim **9** wherein said timed detonating means comprises:

a. a timer

b. a pressure-operated switch to initiate said timer at a predetermined pressure;

c. a battery operatively connected to said timer; and

d. a detonator operatively connected to said timer.

13. The method of claim **9** wherein said sleeve comprises two symmetrical, elongated, curved members connected along one elongated side by hinges.

14. The method of claim **9** wherein each of said closed ends of said housing is a watertight seal, said housing having sufficient compressive strength to withstand up to about 20,000 feet of hydraulic head.

15. The method of claim **9** wherein said housing is attached to said sleeve such that a plane containing the longitudinal axis of said housing is perpendicular to the longitudinal axis of said sleeve.

16. The method of claim **9** wherein said housing is set into the outer wall of said sleeve.

17. The method of claim **9** wherein said timed detonating means is activated by predetermined hydrostatic head.

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