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UNDERWATER CABLE CUTTER

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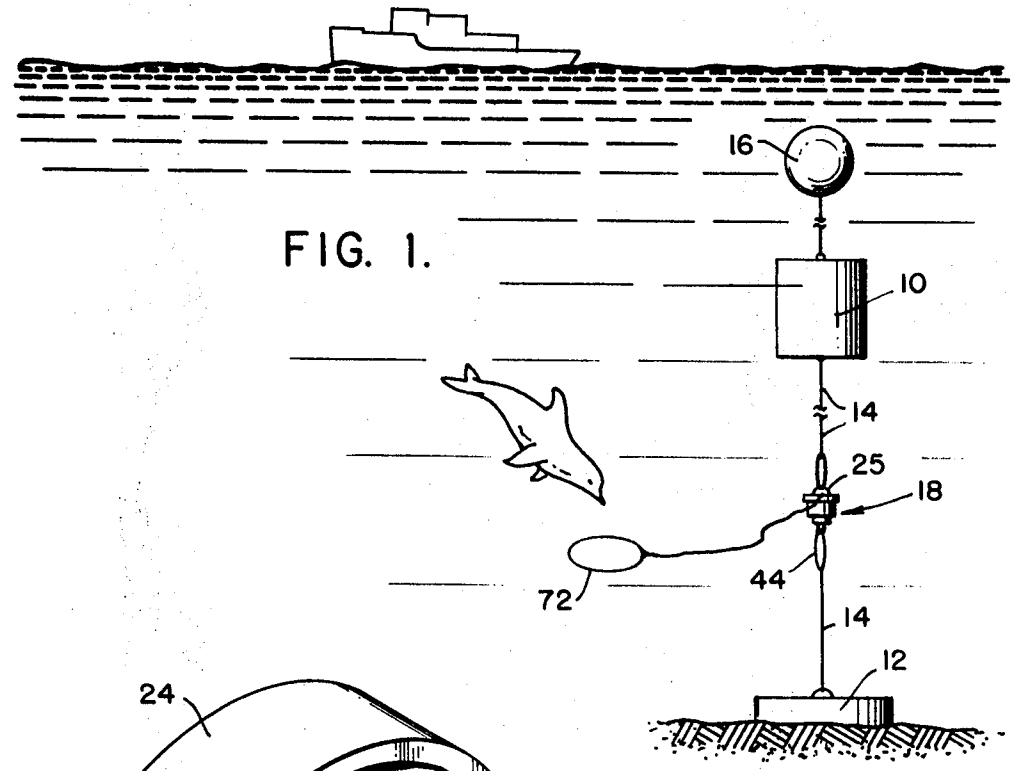


FIG. 1.

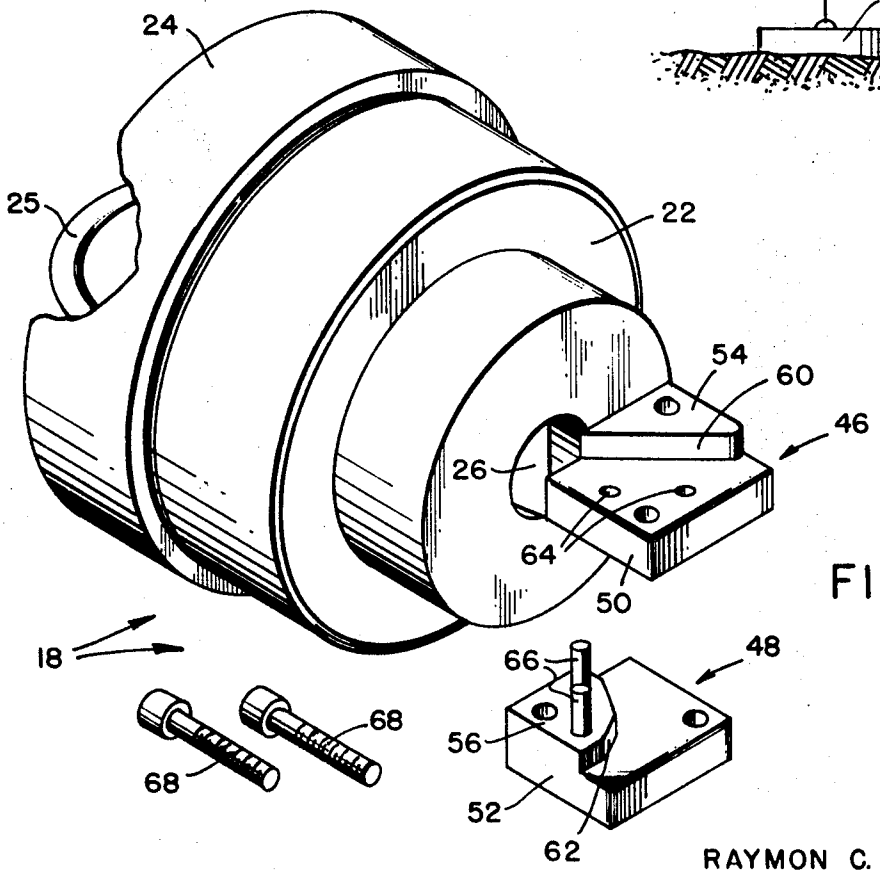
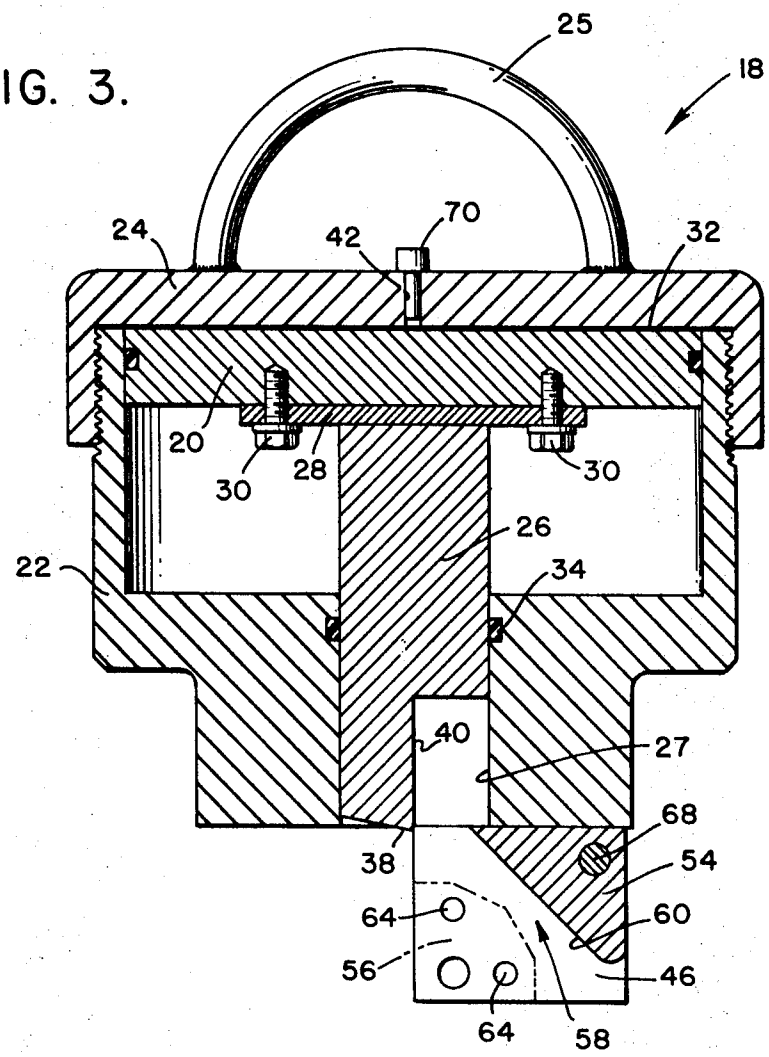


FIG. 2.

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FIG. 3.


25
18
24
42
70
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22
34
40
27
68
38
54
64
60
56
46
64
58

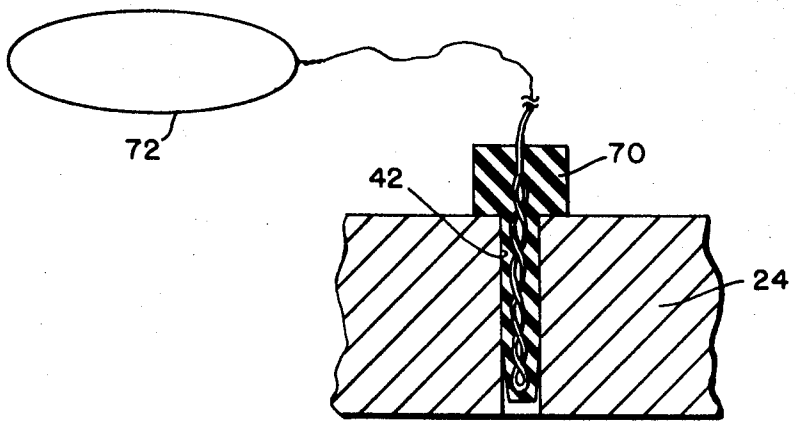

72
70
42
24

FIG. 4.

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UNDERWATER CABLE CUTTER

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U.S. Cl. 83—453 11 Claims

ABSTRACT OF THE DISCLOSURE

An underwater cable cutter including: a piston and a cylinder, the cylinder being closed at a top end; the piston having a rod which slidably extends through the bottom end of the cylinder; the bottom end of the rod having a cutting edge which is capable of cutting a cable; means mounted on the cylinder for retaining a cable for cutting by said cutting edge; and an aperture in the cylinder for introducing sea pressure for actuating said piston.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

In oceanographic exploration it is frequently necessary to submerge instruments such as hydrophones, transducers, or other sensing devices, to depths of several thousands of feet below the surface. This is commonly accomplished by fastening a float to a bottom anchor by means of a support cable and suspending the oceanographic instrument on the cable at a predetermined depth or fixed distance from the bottom. A preferred method of retrieving the oceanographic instrument is to break the connection between thet cable and the anchor so as to allow the float to ascent the instrument to the surface of the water. When this method is employed the anchor is a type which is expendable.

Several devices already exist for releasing the float and instrumentation from the expendable anchor. Most of these devices are located along the cable between the anchor and the instrumentation and are actuated by a timed release means or by an acoustic command from a surface vessel. The timed release approach has the serious limitation of releasing the instrumentation at a future time which may not be favorable from the standpoint of weather and other recovery conditions. The acoustic command release approach has resulted in an undesirably large and expensive mechanism as well as having the problem of accidental actuation by stray noises.

SUMMARY OF THE INVENTION

The present invention overcomes the disadvantages associated with the prior art release devices by providing an underwater cable cutter which utilizes hydrostatic pressure to cut the cable between the expendable anchor and the instrumentation to be recovered. The present cable cutter is inexpensive to construct and yet performs in a highly efficient manner. The cutter can be remotely actuated at a time which is favorable for recovery and there is no danger that stray acoustic electromagnetic signals will prematurely actuate the device. These unusual combination of advantages have been accomplished by providing a piston and cylinder wherein the cylinder is closed at a top end, the piston having a rod which slidably extends through the bottom end of the cylinder; the

bottom end of the rod having a cutting edge which is capable of cutting the cable; means mounted on the cylinder for retaining the cable for cutting by the cutting edge; and an aperture in the cylinder for introducing sea pressure for actuating the piston. When it is desired to recover the oceanographic instrumentation a plug is simply pulled from the aperture in the cylinder and the hydrostatic pressure acting on the piston forces the piston rod through its cutting evolution. The plug may be withdrawn manually or by a trained porpoise.

STATEMENT OF THE OBJECTS OF THE INVENTION

An object of the present invention is to overcome the aforementioned problems associated with the prior art underwater release devices.

Another object is to provide an underwater cable cutter which is inexpensive to make and highly efficient in operation.

A further object is to provide an underwater cable cutter which can be actuated at a time which is favorable for recovery and yet is immune from stray acoustic and electromagnetic signals.

Yet another object of the present invention is to provide an underwater cable cutter which can be actuated by a trained porpoise.

Other objects and many of the attendant advantages of this invention will be readily appreciated as it becomes better understood by reference to the description and accompanying drawings which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an undrwater elevational view illustrating an oceanographic instrument suspended by a float above an expendable anchor, and the underwater cable cutter located therebetween.

FIG. 2 is an exploded isometric view of the underwater cable cutter.

FIG. 3 is a longitudinal cross sectional view of the cable cutter.

FIG. 4 is a longitudinal cross sectional view of a plug which may be used in combinataion with the cable cutter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals designate like or similar parts throughout the several views, there is shown in FIG. 1 an oceanographic instrument **10** which is connected to an expendable anchor **12** by a cable **14**, and which is suspended at a predetermined depth in the water by a float **16**. Located within the cable **14**, and between the oceanographic instrument **10** and the expendable anchor **12** is an underwater cable cutter **18**. The cutter **18** has the capability of cutting the cable **14** at the bottom end of the cutter so that the float **16** will float the oceanographic instrument **10** to the surface of the water at a desired time for recovery.

As shown in FIGS. 2 and 3 the underwater cable cutter **18** includes a piston **20** and a cylinder **22**, which may be closed at its top end by a threaded cap **24**. A lift ring **25** may be welded to the top of the cap **24**. The piston **20** has a rod **26** which slidably extends through a passageway **28** in the bottom end of the cylinder **22**. The piston rod **26** may be mounted to the piston **20** by any suitable means such as a flange **28** and bolts **30**. In order to seal the interior of the cylinder **22** from the outside pressure environment a gasket **32** may be provided between the cap **24** and the remainder of the cylinder, and an O-ring **34** may be provided in the cylinder passageway **27**. The cylinder passageway **27** may be appropriately grooved for receiving the O-ring.

The cable **14** is connected at the bottom end of the cylinder **22**. In order to cut this cable and release the

oceanographic instrumentation the bottom end of the piston rod **26** is provided with a cutting edge **38**. This cutting edge may be formed by a semi-circular projection of the piston rod which has a cutting face **40** which is substantially coextensive with the longitudinal axis of the piston rod. The cutting edge **38** is forced at a selected time in a downward direction by hydrostatic pressure. The hydrostatic pressure is introduced into the cylinder **22** by an opening in the cylinder such as an aperture **42** which may be located in the cylinder cap **24**.

Mounted on the bottom end of the cylinder **22** is a means for retaining the cable for cutting by the cutting edge **38** of the piston rod. As shown in FIG. 1 the preferred embodiment of the invention receives a loop **44** of the cable from the expandable anchor **12**. It is this loop that is cut and enables recovery of the oceanographic instrument **10**. In this preferred embodiment the cable retainer means has a passageway (to be described in detail hereinafter) which is capable of leading the cable within the loop **44** at an angle to the longitudinal axis of the piston rod. The cable retainer means may include a block which is divided into two portions **46** and **48**. The block portion **46** may be rigidly fixed to the bottom end of the cylinder **22** and the other block portion **48** may be removable from the fixed block portion **46**. Each block portion **46** and **48** has a respective cutting face **50** and **52** which are substantially coextensive with the longitudinal axis of the piston rod and the cutting face **40** of the piston rod. With such an arrangement the cutting edge **38** of the piston rod may slide across the cutting faces **50** and **52** to cut the loop **44** of the cable.

In order to properly position the loop **44** of the cable for cutting by the cutting edge **38** of the piston rod the fixed and removable block portions **46** and **48** may each be provided with a respective projection **54** and **56** which when combined form a passageway **58** for the cable. The projection **54** has a planar face **60** which is perpendicular to the fixed block portion **46**, and the projection **56** has an arcuate face **62** which is curved 90° and which is perpendicular to the removable block portion **48**. When the block portions **46** and **48** are fitted together the passageway **58** curves 90° from a direction parallel to the longitudinal axis of the piston rod **26** to a direction which is perpendicular to the axis. It should be noted that this novel arrangement enables the block portions **46** and **48** to receive the loop **44** of the cable and place the loop in a cutting position with respect to the cutting edge **38** of the piston rod **26** without undue strain on the loop. Further, the planer face **60** of the projection **54** enables the loop **44** to be easily captured in the passageway **58** when a user assembles the two block portions **46** and **48**.

In order to facilitate assembly of the block portions **46** and **48** the fixed block portion **46** may be provided with a pair of alignment holes **64**, and the projection **56** of the removable block portion may be provided with a pair of alignment pins **66**. Upon registering the pins **66** with the alignment holes **64** the block portions **46** and **48** are properly assembled so as to form the passageway **58**. The block portions **46** and **48** may be fastened together by any suitable means such as bolts **68**.

In order to close the aperture **42** from the outside water environment a plug **70** may be employed. As shown in FIG. 4, the plug may be constructed of a resilient material, such as neoprene, and bonded within the plug along its longitudinal axis there may be two twisted ends of a wire loop **72**. The loop **72** may be manually pulled for withdrawing the plug **70** from the aperture **42**. This may be accomplished by a diver, or if the depth is too great by a line (not shown) which is connected to the loop **72** and extends to the surface by a float (not shown). In the preferred embodiment the loop **72** is of a size which is sufficient to form a neck ring for a porpoise. With such an arrangement a trained porpoise may be utilized for capturing the loop **72** and pulling the plug **70** from the aperture **42**. It should be understood that a soluble plug could be utilized in lieu of the resilient plug **70**. Salt or sugar have been utilized as soluble plugs and such materials may fill the aperture **42** and dissolve after a predetermined time to actuate the cable cutter **18**.

In the operation of the present device the oceanographic instrument **10** is connected at a bottom end to the expendable anchor **12**, and at a top end to a float **16**. The cable cutter **18** is interconnected in the cable **14** between the expendable anchor **12** and the oceanographic instrument **10**. The lower portion of the cable **14** has a loop **44** which extends through the cable retainer means at the bottom end of the cutter **18** and the upper portion of the cable **14** is looped around a lift ring at the top end of the cutter. This whole assembly may be simply thrown over the side of a surface vessel and it will go into the position which is illustrated in FIG. 1. When recovery conditions are favorable the surface vessel may release a porpoise which is trained to capture the loop **72** and pull the plug **70** from the aperture **42**. Since the cable cutter originated at atmospheric pressure hydrostatic pressure will enter through the aperture **42** and force the piston **20** in a downward direction. This will cause the cutting edge **38** of the piston rod **26** to slide across the cutting faces **50** and **52** of the block portions **46** and **48** to sever the cable loop **44**. When the cable loop **44** is severed the float **16** will ascend the oceanographic instrument **10** and the cable cutter **18** to the surface of the water where this assembly may be retrieved by the surface vessel.

It should be noted that in the preferred embodiment the cable cutter **18** is arranged to cut a cable which is configured in a loop. In certain instances it may be desirable to cut a cable in its straight form. If this is desired the cable retainer means would simply provide a passageway which is straight and perpendicular to the longitudinal axis of the piston rod **26**, and which is substantially adjacent to the bottom end of the cylinder **22**. To provide such a passageway the fixed block portion **46** may be provided with a projection at its bottom end. This projection may have a top face which is perpendicular to the longitudinal axis of the piston rod **26** and which is spaced in a parallel fashion to the bottom end of the cylinder **22** for receiving the cable. In such an arrangement the block portion **48** would not have a projection, but would simply be a block which fits on top of the fixed block projection and extends thereabove to complete the passageway for the cable. Registering pins may be provided on the removable block for insertion in apertures within the projection of the fixed block and the two blocks may be held together by bolts.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. An underwater cable cutter comprising:
- a piston and cylinder, said cylinder being closed at a top end;
- the piston having a rod which slidably extends through the bottom end of the cylinder;
- the bottom end of the rod having a cutter edge which is capable of cutting a cable;
- means mounted on the cylinder for retaining a cable for cutting by said cutting edge; and
- an aperture in the cylinder for introducing sea pressure for actuating said piston.

2. An underwater cable cutter as claimed in claim **1** wherein:
- the cable retainer means has a passageway which is capable of leading the cable at an angle to the longitudinal axis of the piston rod.

3. An underwater cable cutter as claimed in claim **1** wherein:
- the cable retainer means has a passageway which curves

90° from a direction parallel to the longitudinal axis of the piston rod to a direction which is perpendicular to said axis.

4. An underwater cable cutter as claimed in claim **3** wherein:

the cable retainer means includes a block which has a cutting face which is substantially coextensive with the longitudinal axis of the piston rod; and

the cutting edge at the bottom end of the piston rod is formed by a cutting face on the rod which is substantially coextensive with the longitudinal axis of the piston rod.

5. An underwater cable cutter as claimed in claim **4** wherein:

the block is divided into two portions, one block portion being rigidly fixed to the bottom end of the cylinder and the other block portion being removable from the fixed block portion;

the fixed and removable block portions each have a respective projection which in combination from said passageway; and

the projection of the fixed block portion has a planar face and the projection of the removable block portion has an arcuate face which is curved 90°.

6. An underwater cable cutter as claimed in claim **5** wherein:

the fixed block portion has a pair of alignment holes; and

a pair of alignment pins are mounted on the projection of the removable block portion for registering with the alignment holes and positioning the block portions to form said passageway.

7. An underwater cable cutter as claimed in claim **1** wherein:

the cylinder has a removable top; and

said aperture is located in the removable top of the cylinder.

8. An underwater cable cutter as claimed in claim **7** including:

a plug which is insertable in said aperture for closing the cylinder from outside water pressure; and

a line attached to the plug for pulling the plug from the aperture.

9. An underwater cable cutter as claimed in claim **8** wherein:

said line is formed into a loop.

10. An underwater cable cutter as claimed in claim **1** wherein:

the cylinder has a removable top; and

a lift ring is mounted on said removable top.

11. An underwater cable cutter as claimed in claim **1** wherein:

the bottom end of the cylinder having a passageway which slidably receives the piston rod; and

said passageway has an O-ring for sealing the piston rod.

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FRANK T. YOST, Primary Examiner

U.S. Cl. X.R.

30—277; 83—639, 925; 14—221A