March 19, 1946. B. A. WIENER 2,396,731

CABLE CUTTER

Filed Oct. 1, 1942

FIG. 2

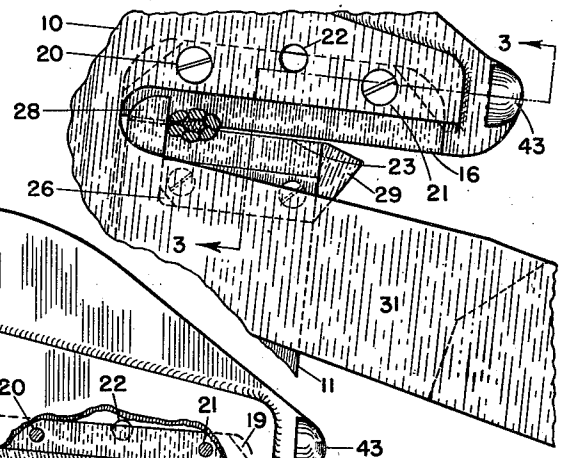


FIG. 1

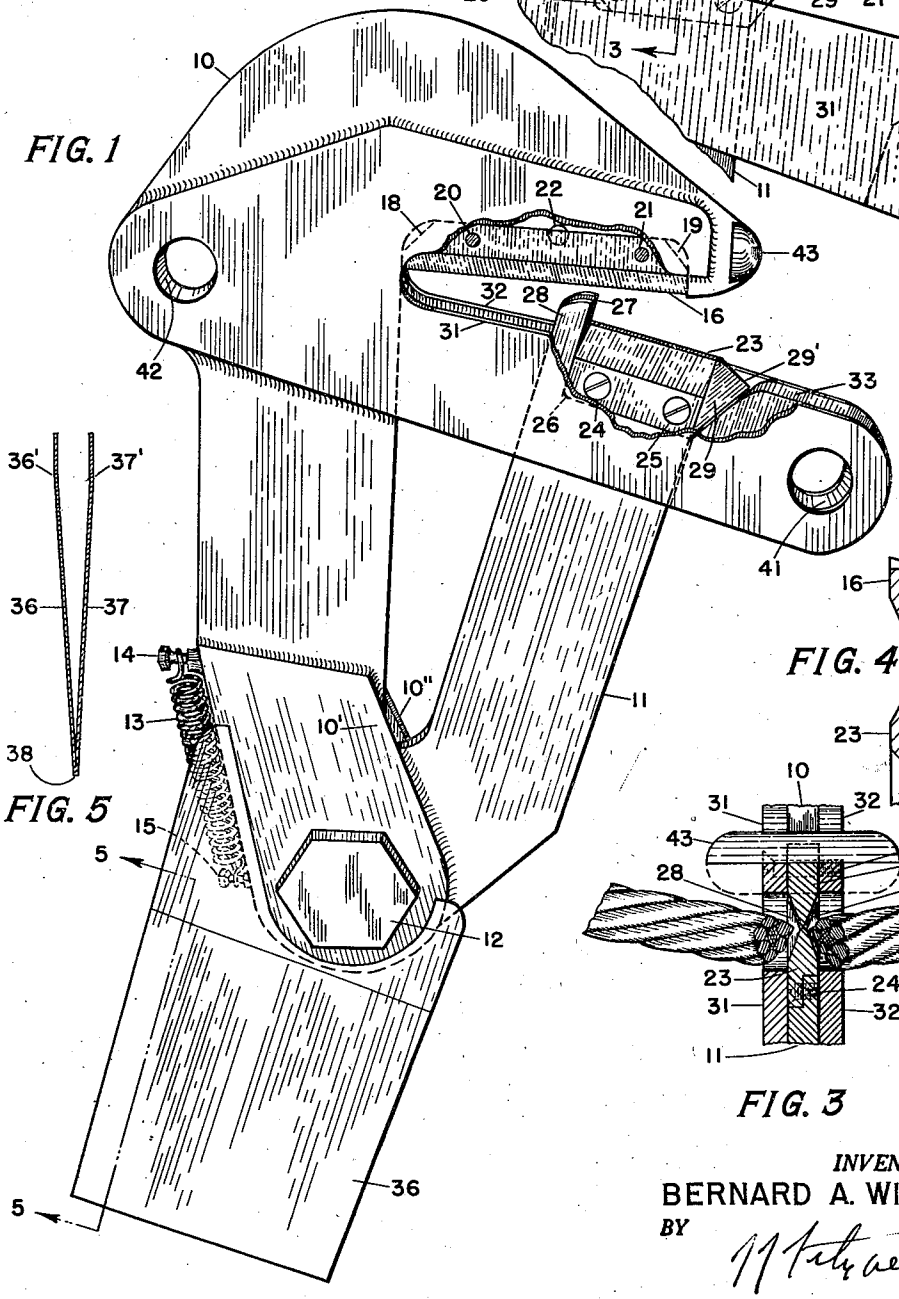


FIG. 5

FIG. 4

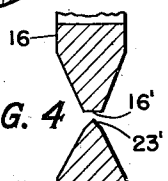


FIG. 3

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CABLE CUTTER

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9 Claims. (Cl. 114—221)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention is in cable cutters, particularly such cutters as are carried by mine sweepers.

The usual procedure in sweeping mines is to drag or tow a cable equipped with cutting devices through the water, more or less horizontally, at such depth that the towed cable will intercept the cables by which explosive mines are commonly anchored below the water surface. The towed cable may be stretched between two towing craft, or one end thereof may be carried by a paravane or water kite. When the towed cable and a mine mooring cable engage, the latter slides along the sweep cable until a cutting device is reached. There the mooring cable is cut, and the freed mine bobs to the surface of the water, where it is destroyed or otherwise disposed of.

Cable cutters most frequently used are mere V-shaped elements, the inside surfaces of which are sharpened. The mooring cable enters the V, which is relatively narrow, and is carried back to the point, where it is engaged by the aforementioned sharpened surfaces, and severed.

Attempts have been made to improve mine cable cutters. In general, the improvements take one of four forms. (1) The device includes explosive means for driving the cutters closed on a cable to cut the same. (2) The knives are driven closed by sweep wire tension. (3) The cutter includes a power driven rotating saw or knife for severing the cable. (4) The cutter contains jaws with knives which are mechanically closed on the mine mooring cable because of contact between the cutter and the cable and the drag of the latter.

The explosive-type cutter is not entirely satisfactory for at least two reasons: it is difficult to waterproof the charges sufficiently to make operation certain; and, unless the parts are made very nicely (which results in an expensive structure), they themselves are apt to be damaged by the explosion of a charge.

Those cutters so far developed to utilize increase in sweep wire tension in the cutting operation have been very heavy and cumbersome.

The rotating-type cutter must contain a motor, and electric leads or some other power-supplying means. Not only are there insulation problems, but devices of this nature are apt to be large and unwieldy.

Cutters of the fourth type mentioned above (of which my invention is an example) can be relatively light and relatively simple. They do not ordinarily develop the power of the devices of the first mentioned three types, but they embody the great advantage of simplicity. The difficulties with the prior art cutters of this general nature have not been fundamental, but are such as too low mechanical advantage, jamming, etc.

One object of the present invention is to provide a simple cable cutter wherein the inertia and drag forces of the mine case and mine anchor need not be large for the cutter to sever successfully the mine mooring cable.

An additional object of the invention is to provide a cable cutter with a movable cutting element, wherein a greater mechanical advantage is achieved as the cutting operation progresses and becomes more difficult.

Other objects will appear from the following specification and claims.

In the drawing:

Figure 1 is a perspective view of the cable cutter, with portions of the structure broken away;

Figure 2 is a detail of a portion of the cutter of Figure 1, but with the knives closed on a cable;

Figure 3 is a section taken on the line 3—3 of Figure 2;

Figure 4 is a section through the cutting knives of the invention, showing particularly the formation of their edges; and

Figure 5 is a section taken on the line 5—5 of Figure 1.

The cutting device of this invention, as illustrated, comprises essentially a body member 10, an arm 11 mounted on the body member 10 between ear-like appendages 10′ and 10″ by means of a pintle bolt 12 for movement relative to the body member, and a spring 13, one end of which is secured to the body member 10 by means of the screw 14 and the other end of which is attached to the arm 11 by means of the screw 15, the spring 13 thereby serving to maintain the arm 11 normally in the position shown in Figure 1, and to return it to such position after a cutting operation.

The body member is provided in its upper portion with a knife 16. The cutting surface may be integral with the body member, but preferably is a separate element (as shown), which fits into a slot provided for it. In the latter case, it has been found desirable not to have the cutting element fit the slot completely at all points, but instead to have the corners cut off somewhat, as at 18 and 19. This kind of construction makes somewhat simpler the removal of a cutting element, when such removal is desirable or necessary. The hole 22, which passes entirely through the body member, also aids in the removal of the knife. Should the cutting element become stuck in the body member because of rust or corrosion, or for any other reason, it can be forced out by inserting in the hole 22 a suitable tool, as an ordinary rod, and exerting downward pressure on the element. The knife 16 is normally secured in place in the body member by means of the screws 20 and 21.

It may be said here that in this description, the expressions "upper," "lower," etc., unless otherwise noted, have reference to the drawing only,

and do not define the locations of parts while the cutter is in operation.

The movable arm 11 is provided in its upper portion with a cutting element 23. This knife may be formed integral with the arm 11 if desired, but is shown as detachable. It is notched to fit a notched section at the top of the arm 11 (see Figures 3 and 4), and screwed in place by means of the screws 24 and 25. The front portion of knife 23 coincides with the front of the arm 11; the rear portion, as at 26, is cut off to provide a means—analogous to the hole 22—for removing the knife from place in case it should become jammed for any reason.

The rear portion of the arm 11, which extends above the rest of the arm and above the knife 23, is bifurcated to provide lug-like members 27 and 28 so spaced that they can straddle the knife 16. The function of these members will be later described.

Secured to or formed integral with the body member 10 are the parallel arm members 31 and 32. At their outer ends, a filler block 33 is provided which serves not only to space the arms 31 and 32 properly but to give needed strength to this portion of the cutter.

The knife 23 has formed thereon an extension 29. The front portion thereof should conform to the shape of the filler block 33. The upper portion 29' forms an incline leading to the edge of knife 23. The function of the portion 29' will be described hereinafter.

A fin is provided at the lower end of the cutter. This may be of any desired construction, but as shown consists of two plates 36 and 37 (see Figures 1 and 5). Plate 36 is welded or otherwise secured to the appendage 10', and plate 37, to appendage 10''. The plates are substantially parallel at their upper portions, and then are bent toward each other, at 36' and 37', so that their lower portions may be joined, as at 38. The parallel arrangement above the points 36', 37', leaves space between the plates for the operation of the movable arm 11 and the spring 13.

If the cable cutter is to be towed at high speeds, no fin is necessary, since the area of the cutter proper is sufficient to cause it to assume its proper position in the water. When the operation is to be carried out at low speeds, however, the described fin, or its equivalent, should be used.

The body member is provided with means for attaching the cables by which the cutter is towed, as the holes 41 and 42. One end of a cable is attached directly or indirectly to the towing ship. The other end is secured, usually by means of a swivel, through the hole 41. A second cable is secured, also with a swivel, in the hole 42, and its other end is carried by a paravane or the like.

Just above the opening between the cutting surfaces is provided a member 43 which may be termed a bumper bar. This bar is not essential to the successful operation of the cutter so long as cables only are encountered. It has an important function, however, when, as frequently happens, a mine is moored with a chain instead of a cable. For the cutter to operate successfully on chain, it is essential that the chain link to be cut enter flat between the knives; if it should enter upright, it might jam the cutter, and completely prevent operation. The bumper bar 43 acts to turn over any upstanding link of chain, and insure that it lie flat between the knives.

The operation of the cutter is as follows: with the sweep cable attached as described, the cutter assumes a position in the water such that the trailing fin is substantially horizontal. When that portion of the sweep cable between the ship and the attachment orifice 41 intercepts a mine mooring cable, the latter slides along the former until the mooring cable enters the opening in the cable cutter between the fixed knife 16 in the head portion of the body 10 and the knife 23 on the movable member 11. After entering the opening, the mooring cable strikes the lugs 27 and 28 of the movable member 11, and forces the lugs and the movable member with its sharpened surface rearwardly relative to the fixed portion, i. e., against the action of the spring 13.

As has been mentioned, the lug-like portions 27 and 28 are spaced apart. This of course prevents the lugs, as they move rearwardly, from striking or otherwise interfering with the fixed cutting surface 16.

The inclined portion 29' of the member 29 eliminates the possibility that the mooring cable will catch against the forward portion of knife 23, and close the knives ahead of the cable; it assures, in other words, that the cable will ride up over the knife 23, and back against the lugs 27 and 28.

As the cable moves rearwardly against the lugs 27 and 28, causing the member 11 to move rearwardly, the knife 23 closes with respect to the fixed knife 16 upon the cable. The action continues if necessary until the lugs and the movable member strike the body member, at which point the cutting surfaces are approximately parallel and in contact with each other. The parts of the cable cutter should be so proportioned that the movable arm can not move much beyond a position perpendicular to the fixed knife. Not only is there little effective cutting action after such point has been reached, but it may be impossible for spring 13 to return arm 11 to its normal position. Figures 2 and 3 show the relationship of the knives and cable just as the cutting operation is complete. It will be understood that in both figures the cable is shown more or less diagrammatically. For in actual operation, a cable is seldom severed as cleanly as indicated in Figure 3, but is somewhat mashed and frayed. Ordinarily it will not be necessary for the movable knife to close completely on the fixed knife, since as soon as the cable is substantially weakened, the inertia and drag of the mine anchor on the one hand, and the buoyancy, inertia and drag of the mine on the other, will break the mooring cable.

It will be seen that the rearward movement of the movable knife 23 is substantially greater than the closing movement thereof; and, further, that the difference between these two rates of movement is not fixed, but that it increases as the movement of the movable arm continues. In other words, at the beginning of its travel, a unit movement of the lugs rearwardly, for example, will result in a closing of the blades with respect to each other of perhaps a half unit; the next unit of travel will produce a closing effect of perhaps three-sixteenths of a unit, etc. The difference between the rates of rearward and closing motions of the knife results in a multiplication of the power of the moving cable in the actual cutting operation, and the effect increases as the cutting progresses. The mechanical advantage at any point in the operation will depend upon the proportions of the various parts.

After the cable is severed, the spring 13, relieved of its load, is enabled to return the movable member 11 to its forward position, and the device is in condition to engage and cut another cable.

Various types of cutting edges may be used. Two which are especially effective are shown in the drawing, and especially in Figure 4. These may be used in different combinations to advantage, depending upon circumstances. The most consistent arrangement of these cutting edges has been found to be that in which the flattened edge 16' forms the fixed cutting surface, and the sharpened edge 23' of knife 23 forms the movable cutting surface. This is the arrangement of the drawing. Under certain conditions, however, it has been found that the parts function more efficiently when reversed. Under still other circumstances it is desirable to sharpen the edges of both cutting members.

One specific embodiment of the invention has been described and illustrated. It is obvious that many changes within the spirit of the invention can be made in the shapes and proportions of the various elements and the means for securing them together. A shearing action may, for example, be provided in place of the nipping action resulting from the described structure. It is therefore to be understood that the invention is not limited to the device described and shown, but instead includes everything that properly comes within the scope of the appended claims.

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

I claim:

1. A cable cutter comprising a fixed knife and a knife adapted to move in substantial alinement with the fixed knife and having a normal position such that the substantially alined knives form an acute angle with respect to each other and a closed position such that they are substantially parallel and substantially in contact at their edges throughout their lengths, and means cooperating with a cable to be cut for moving the second mentioned knife from its normal position toward its closed position to cut the cable.

2. A cable cutter comprising a body member with an upper portion and a lower portion, an elongated knife member in the upper portion, an arm with an upper end and a lower end the lower end being pivoted in the lower portion of the body member the upper end being provided with an elongated knife member adapted to move from one position into substantial edge-to-edge engagement throughout its length with the elongated knife in the upper portion to cut a cable, means actuated by the cable to be cut for moving the arm from its first mentioned position to its cable cutting position, and means for returning the arm to its first mentioned position.

3. A cable cutter adapted to operate in a condition of relative movement with a cable to cut comprising a body member with an upper portion and a lower portion, an elongated knife member in the upper portion, a bifurcated member below the elongated knife and substantially parallel thereto, an arm with an upper end and a lower end the lower end being pivoted in the lower portion of the body member the upper end being provided with an elongated knife member adapted to move in the bifurcated member from one position into substantial edge-to-edge engagement throughout its length with the elongated knife in the upper portion to cut a cable, and means on the knife member of the pivoted arm adapted to be contacted by the cable to be cut and to be urged by the drag of the cable thereagainst in a direction to move the arm from its first mentioned position to its cable cutting position.

4. A cable cutter comprising a body member, a member pivoted to the body member for rotation in a substantially fixed plane and having a knife thereon, a knife fixed in the body member substantially in the plane of rotation of the pivoted member substantially at the circumferential limit thereof, means for normally maintaining the pivoted member and its knife in spaced relation to the fixed knife, means on the movable member substantially closing one end of the space and adapted to engage a cable to be cut to be moved thereby and to move the pivoted member, whereby the knife on the pivoted member is caused to close on the cable and substantially on the fixed knife surface to cut the cable.

5. A cable cutter comprising a body member, an arm pivoted near one of its ends to the body member and adapted to describe at a point in its other end an arc of a circle, a knife on the said other end substantially tangent to said arc, a knife fixed in the body member substantially tangent to the said arc, means for maintaining the pivoted arm normally spaced from the fixed knife, and means on the pivoted arm adapted to engage a cable to be cut for moving the pivoted arm and the cable toward the fixed knife, thereby to cut the cable as the knives with the cable therebetween approach their tangential relation.

6. A cable cutter comprising a fixed knife and a knife adapted to move in substantial alinement with the fixed knife and having a normal position such that the substantially alined knives form an acute angle with respect to each other and a closed position such that they are substantially parallel and substantially in contact throughout their lengths, means for moving the movable knife toward the fixed knife at a decreasing rate with respect to the rate of angular change as between the knives, and means for restoring the movable knife to its normal position.

7. A cable cutter comprising a body member, a knife fixed in the body member, a movable member mounted on the body member with a knife thereon in substantial alinement with the knife in the body member for movement relative thereto in the direction of the length of the edge thereof and also toward the edge thereof, and an actuating member on the movable knife adapted to engage a cable to be cut and to be moved thereby in both directions mentioned but progressively less toward the edge of the fixed knife.

8. A cable cutter adapted to cut in a condition of relative movement with a cable comprising a fixed knife and a movable knife the movable knife being normally substantially spaced from the fixed knife, and an actuating member in the space between the knives secured to the movable knife, whereby a cable entering the normal space between the knives strikes the actuating member and thereby forces the movable knife into sliding edge-to-edge cooperating relation with the fixed knife to cut the cable.

9. A cable cuter adapted to operate in a condition of relative movement with a cable to be cut which comprises a fixed knife and a movable knife normally spaced from the fixed knife but adapted upon encountering a cable to be cut to be moved thereby into sliding. edge-to-edge cooperating relation with the fixed knife to cut the cable.

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