July 30, 1957 R. TEMPLE 2,800,868

MINE CHAIN BREAKER

Filed Oct. 30, 1942 3 Sheets-Sheet 1

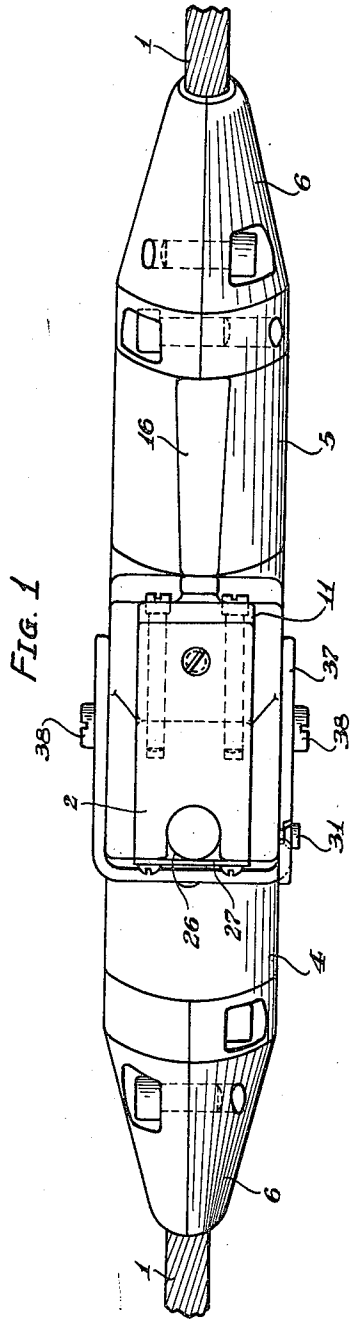


FIG. 1

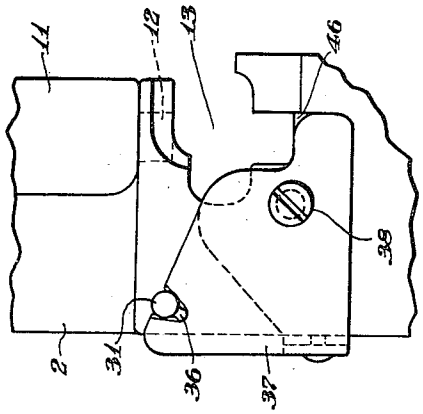


FIG. 5

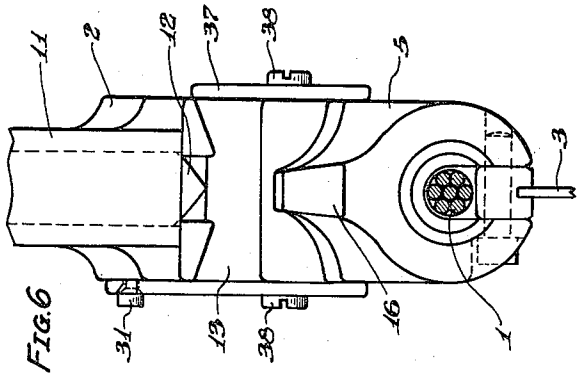


FIG. 6

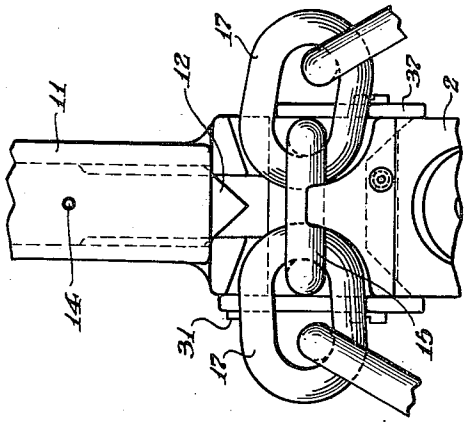


FIG. 7

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MINE CHAIN BREAKER

Filed Oct. 30, 1942 3 Sheets-Sheet 2

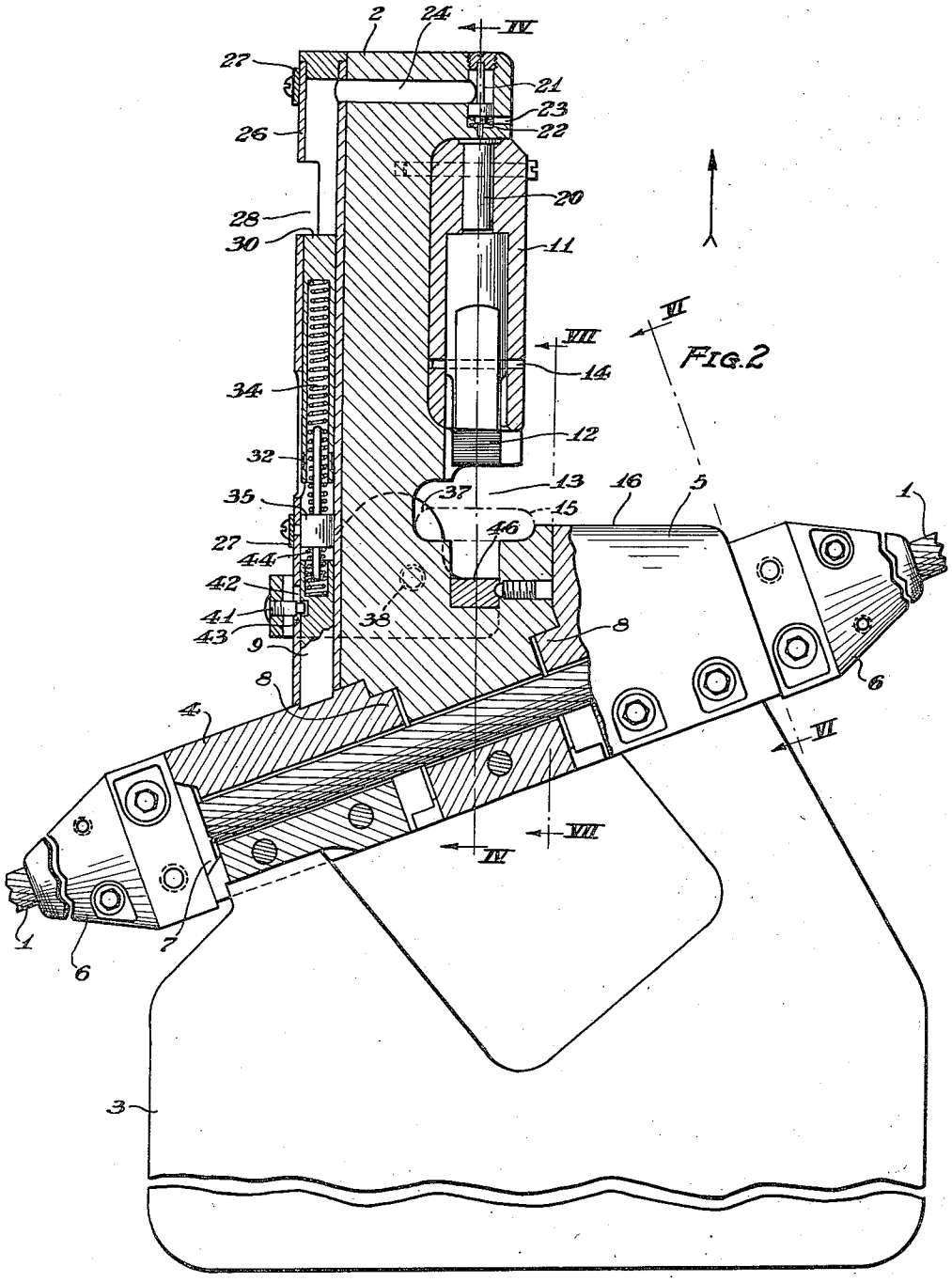


FIG. 2

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MINE CHAIN BREAKER

Filed Oct. 30, 1942 3 Sheets-Sheet 3

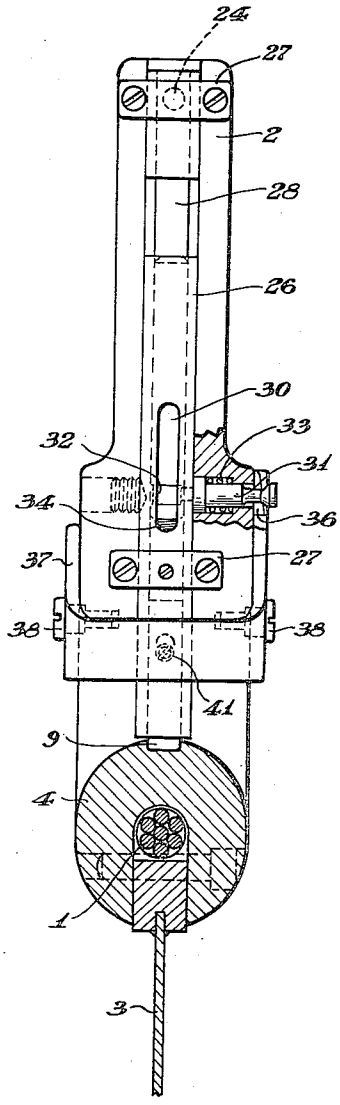


FIG. 3

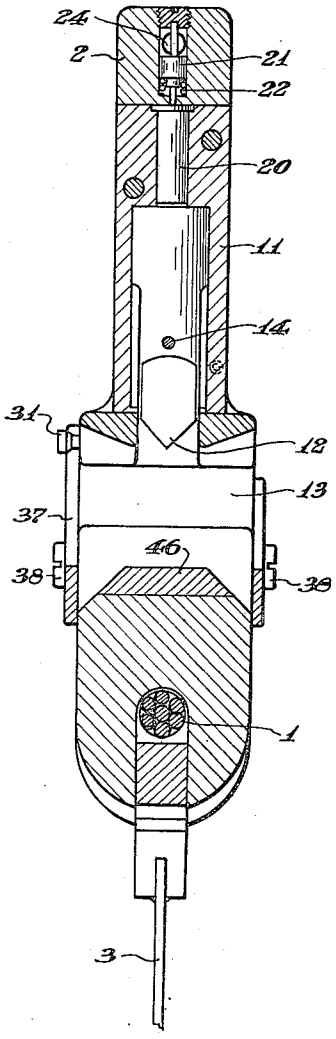


FIG. 4

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MINE CHAIN BREAKER

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Application October 30, 1942, Serial No. 463,907

17 Claims. (Cl. 114—221)

This invention relates to underwater devices for severing the lines by which explosive mines are anchored in oceans and other bodies of water.

In my copending application Serial No. 425,027, filed December 31, 1941, and now Patent No. 2,420,987, I have disclosed such a device for cutting mine-anchoring cables. A great many of those cutters are now in use and are operating very satisfactorily. However, they are not satisfactory for cutting case-hardened chains, especially if the links are large, in case lengths of such chains are used for anchoring mines. Instead, the cutting knife would merely clamp onto the chain and pull the mine along behind the mine sweeper. About the only thing that could be done in such a case would be to release the sweep line from the ship because it would be too dangeous to try to disconnect the cutter from the chain. As a result, the sweep line and all of the cutters attached to it would be lost, and the mine would not be brought to the surface. Also, such cable cutters must be handled carefully when cocked and out of the water, lest they be discharged accidentally.

It is among the objects of this invention to provide a device which will sever mine-anchoring lines regardless of whether they are cables or chains, which can not be set off accidentally outside of the water, which does not obstruct the sweep line after it has severed a mine line, which is relatively simple in construction, and which can be used over and over again without returning it to the manufacturer for reloading.

In accordance with this invention, a movable wedge is carried by a frame attached to the usual sweep line by which mine cable cutters are towed through the water. Near the operative end of the wedge the frame is provided with a recess for receiving a link of a chain by which a mine is anchored and which the sweep line has engaged and guided along to the frame. The recess is shaped to hold the link in a plane substantially perpendicular to the direction of movement of the wedge and centered relative thereto. When a chain enters the recess it actuates means by which the wedge is driven between and against the ends of the two links connected to the opposite ends of the link caught in the recess. The force of the impact and the wedging action forces the two end links away from each other in opposite directions so that the center link is pulled apart or broken. It is not necessary that the wedge touch the center link. In case a cable instead of a chain is encountered by this device, the sharp end of the wedge cuts the cable against a support or anvil at the opposite side of the recess. The device is thus effective with either cable or chains.

The wedge preferably is driven by the force of an explosion created when a firing pin sets off an exposive charge behind the wedge. To prevent the pin from being actuated accidentally it is operated by hydraulic pressure. Thus, a passage in the frame communicates at one end with the pin and is open at the other end so that when the frame is submerged in the ocean the passage becomes

filled with water. Near the open end of the passage there is a normally retracted spring-pressed plunger which is released when a mine line enters the severing recess. The released plunger exerts enough pressure on the water in the passage to cause it to move the firing pin and explode the charge. At about the same moment the trigger that releases the plunger also preferably releases a locking pin by which the frame is rigidly connected to a positioning member that compels the frame to project ahead of the sweep line as it travels through the water. When the charge has been exploded the device is of no further use until reloaded, so it is desirable to get it out of the way of any other mine line that might engage the sweep line and be obstructed by the frame. Therefore, when the locking pin is released, the frame rotates on the sweep line independently of its positioning member and thus swings out of operative position to enable the next mine line to pass the device and be severed by a similar device further along the sweep line.

The preferred embodiment of this invention is illustrated in the accompanying drawings in which Fig. 1 is a front end view; Fig. 2 is a plan view partly in horizontal section; Fig. 3 is a side view partly broken away; Fig. 4 is a longitudinal section taken on the line IV—IV of Fig. 2; Fig. 5 is a fragmentary plan view of the frame showing the trigger; Fig. 6 is a fragmentary side view taken on the line VI—VI of Fig. 2; and Fig. 7 is a fragmentary side view taken on the line VII—VII of Fig. 2 and showing a mine-anchoring chain in position for breaking.

Referring to Fig. 2 of the drawings, several of my line-severing devices are towed by a ship through the water in the direction of the arrow by means of a sweep line 1 that extends laterally at an angle from the stern of the ship. The sweep line is held at the desired angle and depth by means that form no part of this invention. Each severing device has two major parts; a frame 2 and a vane or fin 3 that keeps the frame more or less horizontal and projecting ahead of the sweep line. The end of the fin adjacent the line is bifurcated and detachably connected to yokes 4 and 5 that straddle the line. The passages through the yokes are large enough to permit the fin to rotate relative to the line so that it can stay horizontal regardless of the twisting of the line. The fin is held in place by means of the usual positioning collars 6 clamped on the sweep line and provided at their inner ends with tapered bosses 7 that project into sockets in the adjoining ends of the yokes. These bosses and sockets serve as bearings that facilitate rotation of the fin on the sweep line.

The rear end of frame 2 projects between yokes 4 and 5 and likewise is detachably mounted on the sweep line and rotatable relative to it. The sides of this end of the frame are provided with sockets that receive circular bosses 8 on the adjoining ends of the yokes to provide bearings for rotation of the frame relative to the fin. Normally, however, the frame and fin are locked together as a unit by means of a locking pin 9 carried by the frame and projecting into an opening in yoke 4. Although the frame may be disposed at right angles to the sweep line, it is preferred to have it project straight ahead in the direction it is towed through the water.

Removably mounted in a space provided in the side of the frame facing the ship is a barrel 11 in which a punch or wedge 12 is slidably mounted. The inner end of the wedge is in the form of a piston while the opposite end is tapered and is located at one side of a line-receiving recess 13 in the frame. The wedge is normally held in inoperative position by means of a shear pin 14 extending through it and the barrel. The severing recess is shaped to receive a link 15 (Fig. 7) of a mine chain and to hold it in a plane substantially perpendicular to the

axis of the wedge and centered relative to it. The entrance to the recess is too narrow to receive the link in any position except edgewise, and the front of yoke **5** is provided with a ridge having a narow flat surface **16** (Fig. 6) for engaging the central portion of the link and guiding it edgewise into the recess. The sides of the ridge are of such contour as to permit the two links **17** at the opposite ends of link **15** to lie at right angles to the center link while the latter is sliding into the recess.

To drive the wedge into engagement with the chain the wedge preferably is explosively actuated, and therefore the inner end of the barrel is provided with an opening in which an explosive cartridge **20** is inserted with one end a short distance from the inner end of the wedge. The cartridge is exploded by a firing pin **21** slidably mounted in the front end of the frame. In accordance with this invention the central portion of this pin is enlarged to form a collar between which and the frame a coil spring **22** is compressed to normally hold the pin retracted. The small area in which this spring is located is connected to the outside of the frame by a vent **23**. The opposite side of the firing pin collar is connected by a passage **24** through the frame with the inside of a tube **26** rigidly mounted in a longitudinal recess in the side of the frame by means of cross pieces **27** screwed to the frame, as shown in Figs. 2 and 3. A short distance from the closed front end of the tube the side of the tube is provided with an opening **28** that admits sea water to the tube and passage when the device is submerged. The water pressure will force any air trapped in the passage past the firing pin and out of vent **23**. When it is time to fire the cartridge the water in passage **24** is suddenly put under sufficient pressure to drive the pin against the cartridge cap. This is done by means of a plunger **30** slidably mounted in the tube and normally held in retracted position, with its front end behind the side wall opening **28** of the tube, by a trigger pin **31** slidably mounted in the frame with its inner end extending through a hole in the tube and into a peripheral groove **32** in the rear end of the plunger. This pin is pressed inwardly by a coil spring **33** encircling it inside the frame. When the trigger pin is withdrawn from engagement with the plunger, the latter is shot forward in the tube by a long coil spring **34** disposed in the hollow plunger and compressed between it and a fixed plug **35** in the tube. The shear pin **14** in the wedge compels the explosion to build up considerable pressure before the pin is sheared off and the wedge shot out of the barrel with great force.

The trigger pin **31** is pulled out of contact with the plunger by means of a U-shape trigger **37** that straddles the frame to which it is pivotally connected by screws **38**. The projecting end of the trigger pin is reduced in size and extends through an inwardly tapered slot **36** in one side of the trigger, while the extreme end portion of the trigger pin is tapered toward the trigger and engages the chamfered sides of the slot as shown in Fig. 5. When the center link **15** (Fig. 7) enters severing recess **13** the two end links **17** engage the ends of the trigger projecting to the right of pivot screws **38** at the opposite ends of the recess as shown in Figs. 2 and 5, and the forward pull of the device on the chain causes the chain to bend and links **17** to swing back the trigger on its pivots **38**, thereby rotating the trigger in a clockwise direction as viewed in Figs. 2 and 5. This causes the tapered slot **36** to exert on the trigger pin a wedging action which moves it outwardly of the frame and thereby releases plunger **30**. It will be seen that before this device is placed in the water the accidental release of the plunger will not cause the firing pin to discharge the cartridge because there will be no water behind the firing pin to move it.

Except in the case of small chains the wedge does not sever the chain by cutting link **15**, but rather by breaking it. Thus, the tapered or operative end of the wedge is narrow enough in one direction to enter the space between the sides of the link, but wide enough in the other direction to strike the adjacent ends of links **17** and wedge them apart as it moves between them. This action, combined with the tension on the chain, pulls the center link **15** apart, usually at points about midway between its ends. The shock of the impact of the wedge also helps break the chain because it often is found that the two links **17** are broken apart. To prevent only one side of link **15** from being pulled apart and the other side merely stretched and bent, the recess has side walls shaped to engage both sides of the link and thus compel the end links **17** to exert substantially uniform tension on both sides of the center link.

At substantially the same moment that the trigger releases plunger **30** it also pulls locking pin **9** out of yoke **4** so that the frame can rotate on the sweep line independently of the fin. This is done, as shown in Fig. 2, by means of a screw **41** projecting from the back part of the trigger through a slot **42** in tube **26** and into a hole **43** in the locking pin. Movement of the trigger by the chain causes this screw to be moved forward and thereby to pull the locking pin out of the yoke **4** against the resistance of a coil spring **44** compressed between the pin and plug **35**. Gravity, or the force of the water, will immediately swing the frame back around the sweep line so that it will not catch onto the next mine line that is encountered by the sweep line and prevent it from reaching and being severed by a similar undischarged device further along the sweep line.

In case a cable instead of a chain enters severing recess **13** it will move the trigger and discharge the cartridge in the same way as a chain. However, the wedge will act as a knife and cut the cable in two against an anvil **46** (Figs. 2 and 4) that is mounted opposite to the wedge in a central recess in the back wall of the severing recess **13**. To prevent the cable from passing across the anvil and becoming caught in the back of the severing recess where it would not actuate the trigger, the sides of the trigger project part way across the opposite ends of the recess as shown in Figs. 2 and 5. These projections do not interfere with a mine chain because link **15** is disposed between them while links **17** do not extend into the back part of the severing recess.

After the cartridge has been discharged it can be replaced by a new one merely by removing barrel **11** from the frame. The plunger **30** can be cocked by inserting a screw driver or the like in the tube opening **28** and pushing the plunger back in the tube until the trigger pin **31** snaps into plunger recess **32**.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, and means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart.

2. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, means adapted to receive an explosive charge adjacent the opposite end of the wedge, and means for exploding the charge to drive the wedge between and against the ends of the two chain links connected to said caught link to force them

in opposite directions and thereby pull the center link apart.

3. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, and means set in operation by said chain for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart.

4. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, means adapted to receive an explosive charge adjacent the opposite end of the wedge, a firing pin for said charge, and means operable by said chain for actuating the firing pin to explode the charge in order to drive the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart.

5. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, means adapted to receive an explosive charge adjacent the opposite end of the wedge, a firing pin for said charge, and means operable by said chain for exerting hydraulic pressure on the firing pin to explode the charge in order to drive the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart.

6. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, and means operable when the chain is broken to release said chain-catching means from operative position whereby the breaker offers no obstruction to the next mine chain engaged by the sweep line.

7. A combination mine chain breaker and mine cable cutter for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge adapted to catch a mine chain link and hold it in a plane substantially perpendicular to the direction of movement of the wedge, means adapted to drive the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, and an anvil against which the wedge cuts a mine cable in case such a cable is caught instead of a chain.

8. A mine chain breaker for attachment to a sweep line, comprising a movable wedge, means adjacent the operative end of the wedge for catching a mine chain link and holding it in a plane substantially perpendicular to the direction of movement of the wedge, means for engaging the central portion of said link and guiding it edgewise to said catching means, and means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, said holding means substantially engaging the outer surfaces of the opposite sides of the center link as it is pulled apart.

9. A mine chain breaker for attachment to a sweep line, comprising a frame, a longitudinally movable wedge carried by the frame, said frame being provided with a restricted recess adjacent the operative end of the wedge for receiving a mine chain link flatwise, the walls of the recess being shaped to hold the link in a plane substantially perpendicular to the direction of movement of the wedge, and means for driving the wedge between and agains tthe ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart.

10. A mine chain breaker for attachment to a sweep line, comprising a frame, a longitudinally movable wedge carried by the frame, said frame being provided with a restricted recess adjacent the operative end of the wedge for receiving a mine chain link flatwise, the walls of the recess being shaped to hold the link in a plane substantially perpendicular to the direction of movement of the wedge, and means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, said recess having front and back walls that engage the opposite sides of the center link.

11. A mine chain breaker for attachment to a sweep line, comprising a frame, a longitudinally movable wedge carried by the frame, said frame being provided with a recess adjacent the operative end of the wedge for receiving a mine chain link, the walls of the recess being shaped to hold the link in a plane substantially perpendicular to the direction of movement of the wedge, and means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, the wall of the recess opposite the wedge being recessed for receiving and holding a mine cable for cutting by the wedge.

12. A mine chain breaker for attachment to a sweep line, comprising a frame, a longitudinally movable wedge carried by the frame, said frame being provided with a recess adjacent the operative end of the wedge for receiving a mine chain link, the walls of the recess being shaped to hold the link in a plane substantially perpendicular to the direction of movement of the wedge, means for driving the wedge between and against the ends of the two chain links connected to said caught link to force them in opposite directions and thereby pull the center link apart, the wall of the recess opposite the wedge being recessed for receiving and holding a mine cable for cutting by the wedge, and means at the side of the frame for guiding the cable into position.

13. A device for attachment to a sweep line for severing a mine-anchoring line, comprising a movable severing member, means adjacent the operative end of said member for catching a mine line and holding it in position for severing, means adapted to receive an explosive charge adjacent the opposite end of the severing member, a firing pin for exploding the charge to actuate the severing member, spring actuated means for forcing water under pressure against the firing pin to actuate it, and means operable by said mine line for releasing said spring actuated means.

14. A device for attachment to a sweep line for severing a mine-anchoring line, comprising a movable severing member, means adjacent the operative end of said member for catching a mine line and holding it in position for severing, means adapted to receive an explosive charge adjacent the opposite end of the severing member, a firing pin for exploding the charge to actuate the severing member, a passage communicating at one end with the firing pin and open at the other end, normally retracted spring pressed means adjacent the open end of said passage, and means for releasing said spring pressed means whereby sea water in said passage is forced against the firing pin to actuate it.

15. A device for severing mine-anchoring lines, comprising a frame adapted to engage and to be rotatably mounted at one end on a sweep line, means for holding the frame projecting forward as it is carried through a body of water by the sweep line, means for locking the

frame to said first-mentioned means, mine line severing means carried by the frame, and means actuated when a mine line is severed for unlocking said locking means to release the frame from said first-mentioned means whereby the frame is allowed to rotate around the sweep line independently of said first-mentioned means and swing back out of mine line obstructing position.

16. A device for severing mine-anchoring lines, comprising a frame adapted to engage and to be rotatably mounted at one end on a sweep line, frame-positioning means adapted to be rotatably mounted at its front end on the sweep line, means for locking the frame to said positioning means, mine line severing means carried by the frame, and means for unlocking the frame from said positioning means when a mine line is severed whereby the frame is allowed to rotate around the sweep line relative to and independent of said positioning means.

17. A device for severing mine-anchoring lines, comprising a frame adapted to be rotatably mounted at one end on a sweep line, frame-positioning means adapted

to be rotatably mounted at its front end on the sweep line and provided with a recess, a locking member carried by the frame and normally projecting into said recess for locking the frame to said positioning means, mine line severing means carried by the frame, and means for withdrawing said locking member from said recess when a mine line is severed whereby the frame is allowed to rotate on the sweep line relative to said positioning means.

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