June 28, 1966 R. TEMPLE 3,257,984

MINE ANCHOR LINE CUTTERS

Filed May 21, 1953 2 Sheets-Sheet 1

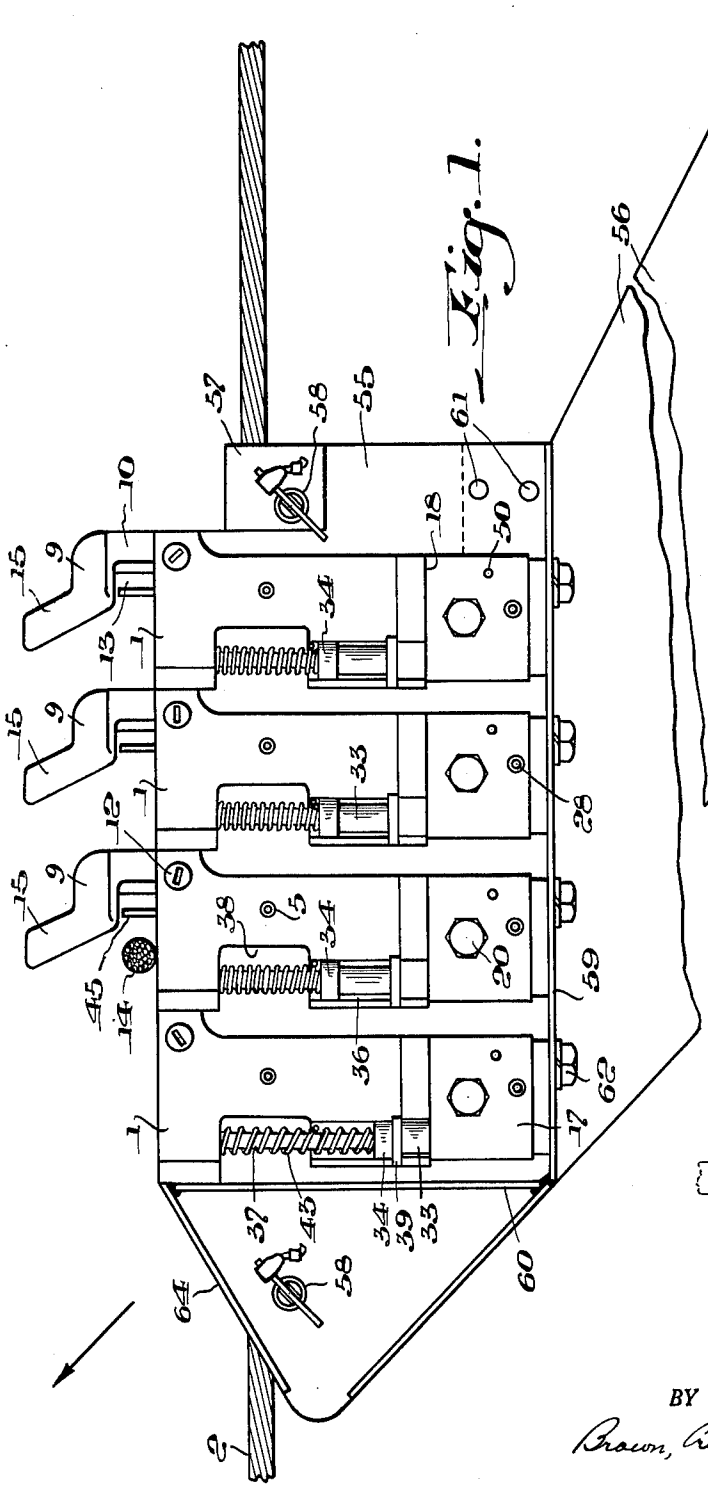

Fig. 1.

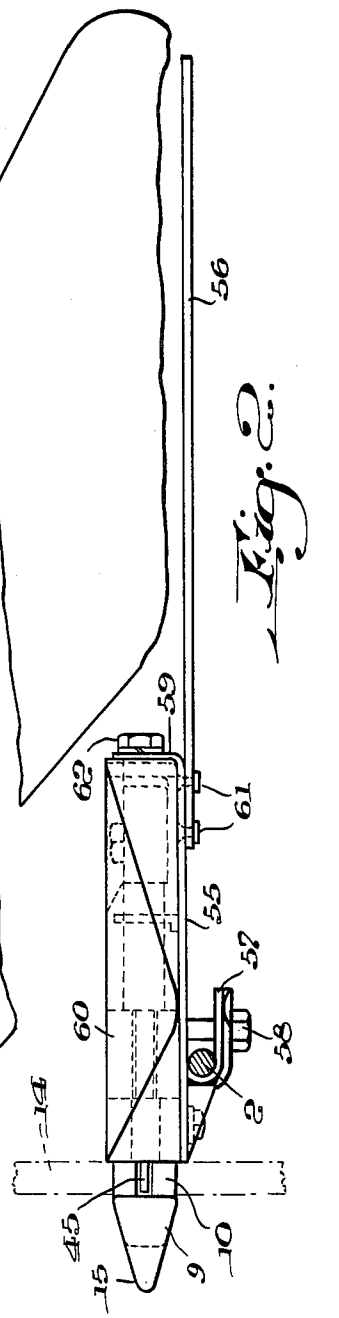

Fig. 2.

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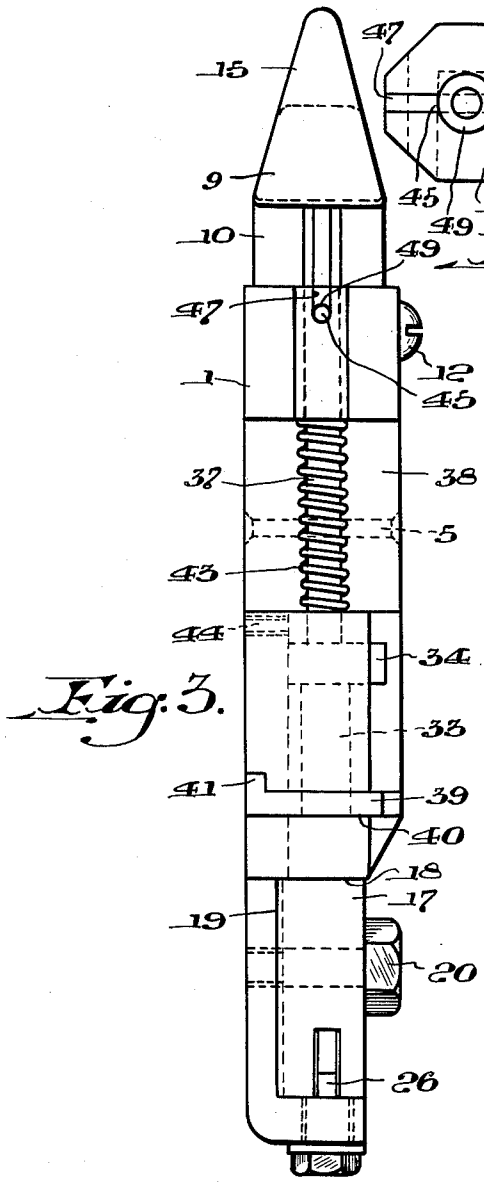

Fig. 3.

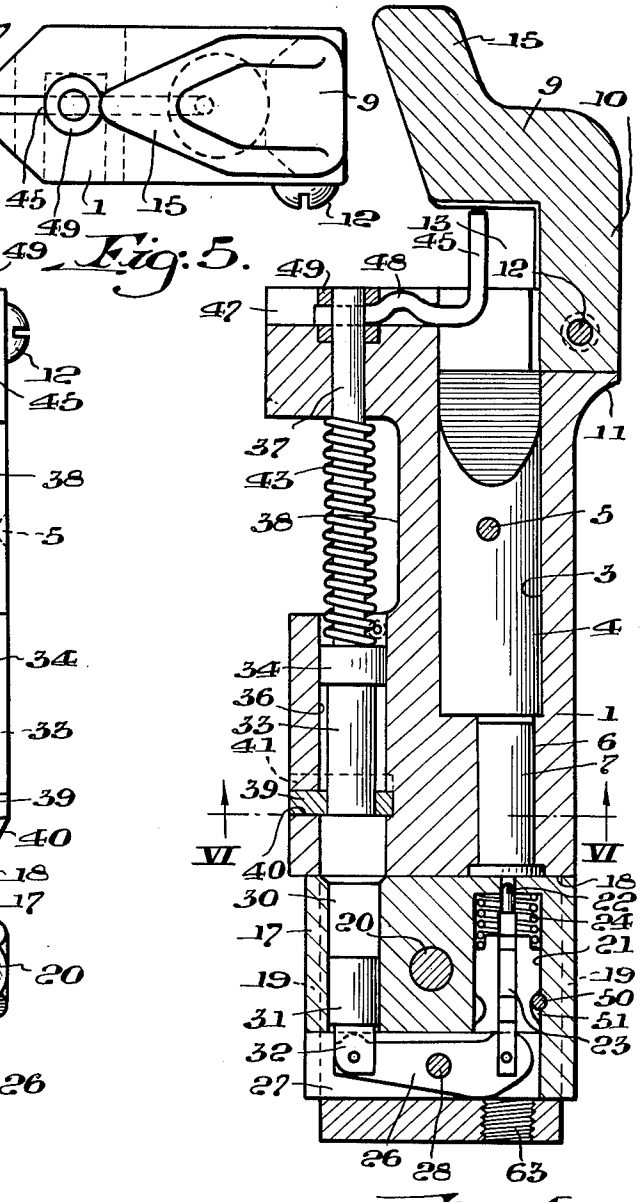

Fig. 4.

Fig. 5.

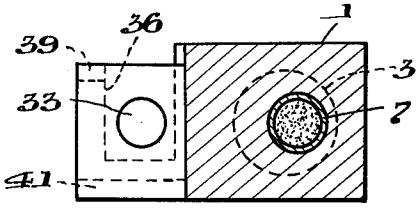

Fig. 6.

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MINE ANCHOR LINE CUTTERS

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8 Claims. (Cl. 114—221)

This invention relates to explosive actuated devices, propelled by sweep lines through bodies of water, for cutting the lines by which explosive mines are anchored in the water.

Such cutting devices are well known and are used extensively, but they are quite heavy so that only a very few can be supported by any given sweep line. Consequently, when sweeping water that has been thickly sown with mines, the mine sweeper can advance only a short distance before all of the cutting tools have been operated. The sweep line then must be pulled in and the tools reloaded. I, therefore, proposed that the weight of the cutting tools be reduced by changing their construction, and that several tools be placed close together so that they could be carried by a single fin. This would enable many more cutters to be carried by each sweep line. It was found in practice, however, that when a cutter was discharged in use, the anvil that was knocked off of it struck the next anvil down the sweep line and knocked it off its frame, thereby making the second cutter useless.

It is among the objects of this invention to provide a mine anchor line cutting tool which is lighter in weight than heretofore, which is simplified in construction, which will not hook onto another mine anchor line after the cutter has been discharged, and which can be used with like tools engaging it in a group on a single fin without the operation of any cutter affecting the operation of the others.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a plan view of my cutting apparatus, with one of the tools discharged;

FIG. 2 is a side view taken from the left of FIG. 1;

FIG. 3 is an enlarged side view of one of the cutting tools shown in FIG. 1;

FIG. 4 is a central horizontal section through a tool;

FIG. 5 is a view of the front end of a tool; and

FIG. 6 is a cross section taken on the line VI—VI of FIG. 4.

Referring to the drawings, each cutting tool has a metal frame 1 which extends at right angles to the sweep line 2, by which the tool is dragged through the water in the general direction of the arrow in FIG. 1. The frame, near the side that is nearest to the trailing end of the sweep line is provided with a barrel 3 that extends backward therein from the front end of the frame, as shown in FIG. 4. A chisel-like cutter 4 is slidably mounted in the barrel, where it normally is held in retracted position by a shear pin 5 extending through it and the frame. The pin also keeps the cutter from turning in the barrel. Behind the barrel the frame is provided with a bore 6 that receives an explosive cartridge 7. The frame can be made narrower, and thus lighter, by locating the axis of this bore between the axis of the barrel and the adjacent side of the frame.

A short distance directly in front of the barrel there is an anvil 9 which has an integral leg 10 at one end extending back to the frame. The thickness of the rear end of the leg is reduced so that it can extend into a notch 11 in the front end of the frame between the barrel and the nearest side of the frame. The notch and the leg extend laterally entirely across this portion of the frame so that the transversely curved inner surface of

the leg forms part of the side wall of the front end of the barrel. The notched portion of the frame projects outward beyond the rest of the frame to give the necessary width for the anvil leg. A soft metal, threaded shear pin 12 extends through the frame and leg to hold them together. A space 13 between the frame and the anvil and its leg forms a three sided recess for receiving and holding a mine anchor line 14 (FIG. 1) that is to be cut. To help guide the line into the recess, the free end of the anvil has a forwardly inclined integral guide member 15. When a mine line is caught in the recess, it is cut against the anvil by means of the cutter 4 which is driven against the line by the force of the explosion of the cartridge.

To detonate the cartridge, a firing mechanism is mounted in the rear end of the frame. This mechanism includes a breech block 17 which is removably mounted in a rectangular recess 18 that extends entirely across the back portion of the frame and most of the way down through it. The breech block fits snugly between the front and rear walls of this recess and has side flanges 19 (FIG. 3) that overlap and engage the opposite sides of the frame to hold the block against lateral movement. The block is locked in place by means of a central screw 20 that extends through it and is threaded in the frame. The block is provided near one side with a passage 21 in axial alignment with the cartridge, the front end of this passage being of materially reduced diameter and containing a firing pin 22, the rear portion of which is provided with four laterally projecting wings 23 that slidably engage the wall of the passage to center the pin without trapping water in the front end of the passage. The pin is normally held in a retracted position by an encircling coil spring 24 compressed between the wings and the reduced end of the passage. The rear ends of the top and bottom wings are extended back across the top and bottom of one end of a horizontal lever 26 that is disposed in a transverse slot 27 in the rear end of the breech block. The central portion of the lever is pivotally mounted on a vertical pin 28.

The side of the breech block opposite to the firing pin is provided with a passage 30 parallel to the firing pin passage and containing a piston 31 that has rearwardly extending ears 32 pivotally connected to the adjacent end of lever 26. The piston extends only about half way through the passage. It will be seen that when the piston is moved backward, it will rock the lever on its pivot and thus force the firing pin forward against the cartridge, which thereby will be discharged to drive the cutter toward anvil 9.

To prevent the piston from being moved accidentally, and thereby causing the cartridge to be discharged, the firing mechanism is so formed that it cannot be operated unless the piston passage 30 in front of the piston is full of water. This occurs only when the tool is in use. To force this water against the piston so that it will be moved, a plunger 33 is mounted in the frame in axial alignment with the piston passage. The plunger and passage have the same shape, preferably cylindrical, and substantially the same diameter. The front end of the plunger is supported by an integral rectangular block 34 that is slidable lengthwise of the frame in a guiding slot or channel 36 which faces upward. A rod 37 that is fastened to block 34, extends forward across a large side recess 38 in the frame and then slidably through the portion of the frame in front of that recess. The rear end of the plunger is supported and guided by a collar 39, through which it slides. This collar extends up through a slot 40 in the frame and its upward movement is limited by a shoulder 41 on its lower end, as shown in FIG. 3. The slot extends across the channel and into

its inner side wall. The collar is held in place by the plunger, and the plunger is held in alignment with piston **31** by means of the collar.

The plunger **33** is urged toward the breech block by a coil spring **43** encircling rod **37** and compressed between the plunger block **34** and the front wall of frame recess **38**. To avoid any chance of the plunger being pulled too far forward in the frame when the device is cocked, a pin **44** is inserted in the bottom of the frame near the front end of channel **36**, into which it projects.

The plunger normally is held in retracted or forward position, with spring **43** compressed, by means of a rigid wire-like trigger **45** which extends through a hole through the projecting front end of the plunger rod. To keep the front end of the rod from projecting from the front end of the frame, the frame is provided with a narrow slot **47** extending from the front end of the barrel across to the side of the frame opposite to anvil leg **10**, and a portion of the trigger is disposed in this slot. The trigger extends out of the slot and part way across the barrel and then is bent forward to extend across the cutting recess **13** in position to be struck by a mine anchor line. The trigger is prevented from turning in the frame by providing the intermediate portion of the trigger with a forwardly bent section **48** that substantially engages the side walls of the frame slot. When an anchor line **14** enters the cutting recess it strikes the trigger and pushes the entire trigger across the recess toward the anvil leg and thereby withdraws the other end of the trigger from the plunger rod. To prevent the trigger from wearing the frame around the front end of the rod, the latter can be encircled by a hard metal bushing **49** rigidly mounted in the frame and provided with a pair of radial holes in alignment with the hole through the rod.

When the trigger is withdrawn from the rod, the coil spring **43** drives the plunger back toward the breech block and into the piston passage as shown by the cutting tool at the left-hand side of the group of tools in FIG. 1. The water in that passage is thereby forced by the plunger against the piston to move it backwards and thereby rock the lever to fire the cartridge. On the other hand, if the plunger is accidentally released when the tool is out of water, the plunger will not strike the piston because the block **34** will strike collar **39**. Nevertheless, as a further precaution, a safety pin **50** can be inserted in the breech block and extended through a notch **51** in the side of one of the firing pin wings. Such a safety pin is removed just before the tool is lowered into the water.

It is obvious that if this tool, after it has been discharged, were to hook onto another mine anchor line, the latter would not be cut but would be dragged along by the mine sweeper. This might necessitate cutting the sweep line in order to free the ship from the dangerous mine. Therefore, the shear pin **12** for the anvil is made only strong enough to hold the anvil until the line has been cut. When the cutter is shot forward, it cuts the anchor line against the anvil and then the impact of the cutter against the anvil shears pin **12** and knocks the anvil away from the frame. The anvil and the cutter are lost, but the loss is justified by the fact that separation of the anvil from the frame eliminates the cutting recess **13** in which another mine anchor line might catch.

An advantage of this small, light weight-cutting tool is that several of them can be placed side by side on a single fin so that the same number of fins as attached heretofore to a sweep line can carry a much larger number of cutters. As shown in FIGS. 1 and 2, each fin preferably has a body **55** attached to the sweep line **2**, and a tail **56** for holding the fin substantially horizontal as it is dragged through the water. The fin body has hooks **57** on its bottom that extend around the sweep line and are held in place by fasteners **58**. The back portion of the body is bent upward to form a rib **59** parallel to the sweep line. Another shorter rib **60** may extend at right angles to the back rib at the end nearest the ship. The tail part of the fin has its front end connected to the bottom of the body portion by rivets **61**. Four cutting tools are shown mounted on the body of the fin. One of them is against the short rib **60** and the others are placed side by side in engagement with each other. The rear ends of the cutters engage the long rib **59** and they all are held in place by heavy screws **62** that extend through that rib and are threaded in holes **63** (FIG. 4) in the rear ends of the cutter frames. The front ends of the cutter frames and fin project ahead of the sweep line a short distance, and mine anchor lines **14** are directed to the cutting tools by an inclined front edge **64** of the fin between the short rib **60** and the ship.

It will be seen that each anvil leg **10** engages the side of the cutting tool frame beside it. When a tool is fired, its anvil leg is confined between the side of the cutter **4** and the adjoining frame, and therefore the anvil will be compelled to move straight ahead far enough for it to clear the anvil on the adjoining frame. This prevents the first anvil from being knocked sideways against the next anvil and thus separating the latter from its frame, as happened heretofore.

In FIG. 1 the first tool is shown as it appears after it has been discharged. Its cutter and anvil are gone, so they did not interfere with anchor line **14** approaching the second tool where it will be severed as soon as it pushes trigger **45** out of the plunger rod.

The cutting apparatus disclosed herein is designed primarily for operation with small, slow moving mine sweepers where mechanical cutters will not operate. Accordingly, the new cutters have been reduced in size, weight and capacity for this specific purpose.

According to the provisions of the patent statutes, I have explained the principle 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 anchor line cutting tool suitable for engagement by like tools in a group of parallel tools extending at right angles to a supporting sweep line, comprising a frame having a front surface extending substantially straight across it from one side to the other, the frame being provided with a barrel extending backward from its front end near one side, an anvil spaced in front of the barrel and having at one end a rearwardly extending leg connected to the front part of the frame between said side and barrel, whereby a line-receiving recess is formed in front of the barrel, a cutter slidably mounted in the barrel, the frame being formed to support an explosive cartridge behind the cutter, means for detonating the cartridge to drive the cutter through an anchor line in said recess, said means including a rod slidably mounted in the frame parallel to said barrel and provided with a transverse passage through its front end adjacent to the front of the frame, a rigid trigger having one end slidably mounted in said passage for normally holding the rod in a forward position and having its other end extending forward across said recess in the general direction of movement of the cutter and spaced from said leg, whereby the pressure of an anchor line laterally against the trigger will push the entire trigger toward said leg and withdraw it from the rod, and a compressed coil spring on the rod for driving it toward the back of the frame when the trigger releases the rod.

2. A cutting tool in accordance with claim **1**, in which an intermediate portion of the trigger is disposed in a slot in the front end of the frame and is provided with a bent section substantially engaging the side walls of the slot to keep the trigger from turning in the rod.

3. A cutting tool in accordance with claim **1**, in which the inner side of said leg forms part of the wall of said

barrel and all of the opposite side of the leg is exposed at said side of the frame, and a shear pin normally holds the leg on the frame.

4. A mine anchor line cutting tool suitable for engagement by like tools in a group of parallel tools extending at right angles to a supporting sweep line, comprising a frame, a cutter slidably mounted therein, the frame being provided with a bore behind the cutter for receiving an explosive charge, a firing pin for exploding the charge to drive the cutter ahead, means adjacent the front end of the cutter for catching a mine anchor line and holding it in position for cutting, a pivoted lever having one end for moving the firing pin ahead, a piston in front of the other end of the lever for moving it backward, the frame being provided with a channel in front of and in line with the piston, a cylindrical plunger in the channel in axial alignment with the piston, a non-circular member joined to the front end of the plunger and slidably mounted in said channel, the wall of the channel being provided with a slot behind said member, a collar extending through the slot and across the channel and provided with a cylindrical opening slidably receiving the plunger, a compressed spring urging the plunger toward the piston, means for normally holding the plunger retracted, and means operable by a mine line for releasing the plunger to force water against the adjacent end of the piston to move it backward, said collar serving as an abutment that is struck by said member and that would stop the plunger before it could strike the piston in the absence of water between them.

5. A mine anchor line cutting tool suitable for engagement by like tools in a group of parallel tools extending at right angles to a supporting sweep line, comprising a frame, a cutter slidably mounted therein, the frame being provided with a bore behind the cutter for receiving an explosive charge, a firing pin for exploding the charge to drive the cutter ahead, means adjacent the front end of the cutter for catching a mine anchor line and holding it in position for cutting, hydraulic pressure operated means for moving the firing pin ahead, the frame being provided with a channel parallel to said cutter, a plunger in the channel, a non-circular member joined to the front end of the plunger and slidably mounted in said channel, the wall of the channel being provided with a slot behind said member, a collar extending through the slot and across the channel and provided with an opening slidably receiving the plunger, a compressed spring urging the plunger toward the back of the frame, means for normally holding the plunger retracted, and means operable by a mine line for releasing the plunger to create said hydraulic pressure.

6. Mine anchor line cutting apparatus comprising a substantially horizontal fin, means at the front end of the fin for connecting it to a sweep line having a trailing end, a pair of parallel mine anchor line cutter frames mounted side by side on the fin with their front ends adjacent the front of the fin, each frame being provided with a barrel extending backward from its front end close to its side that will be nearest the trailing end of the sweep line, the front of each frame having a rearwardly extending notch in the portion of the frame between said side and barrel and extending laterally entirely across said portion, an anvil spaced from the front of each barrel and having a rearwardly extending leg fitting in said notch and extending entirely across it, whereby a line-receiving recess is formed in front of each barrel, a shear pin extending through each leg and frame to hold each anvil in place, the anvil leg farthest from the trailing end of the sweep line engaging the adojoining side of the next frame, and a cutter slidably mounted in each barrel, the frames being formed to support explosive means behind the cutters for driving the cutters through anchor lines in said recesses and against the anvils with sufficient force to shear said pins and drive the anvils forward away from the frames.

7. Mine anchor line cutting apparatus in accordance with claim 6, wherein a rib extends across the top of said fin in contact with the rear ends of said frames, the rib and frames being provided with aligned openings, and screws extend through the rib openings and are threaded in the frame openings for holding the frames on the fin.

8. Mine anchor line cutting apparatus in accordance with claim 6, in which said fin has a horizontal body and a horizontal fin tail connected to the back part of said body, and the front of said body having means for connecting it to a sweep line and the back of the body being provided with an upright rib extending across it, the front ends of said frames being adjacent the front of said body and the rear ends of the frames engaging said rib, the rib and frames being provided with aligned openings, and screws extend through the rib openings and are threaded in the frame openings for holding the frames in place.

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