Nov. 26, 1963 R. TEMPLE ETAL 3,111,927

CARTRIDGE FOR MULTIPLE MINE-ANCHOR CUTTER

Filed Nov. 7, 1961 2 Sheets-Sheet 1

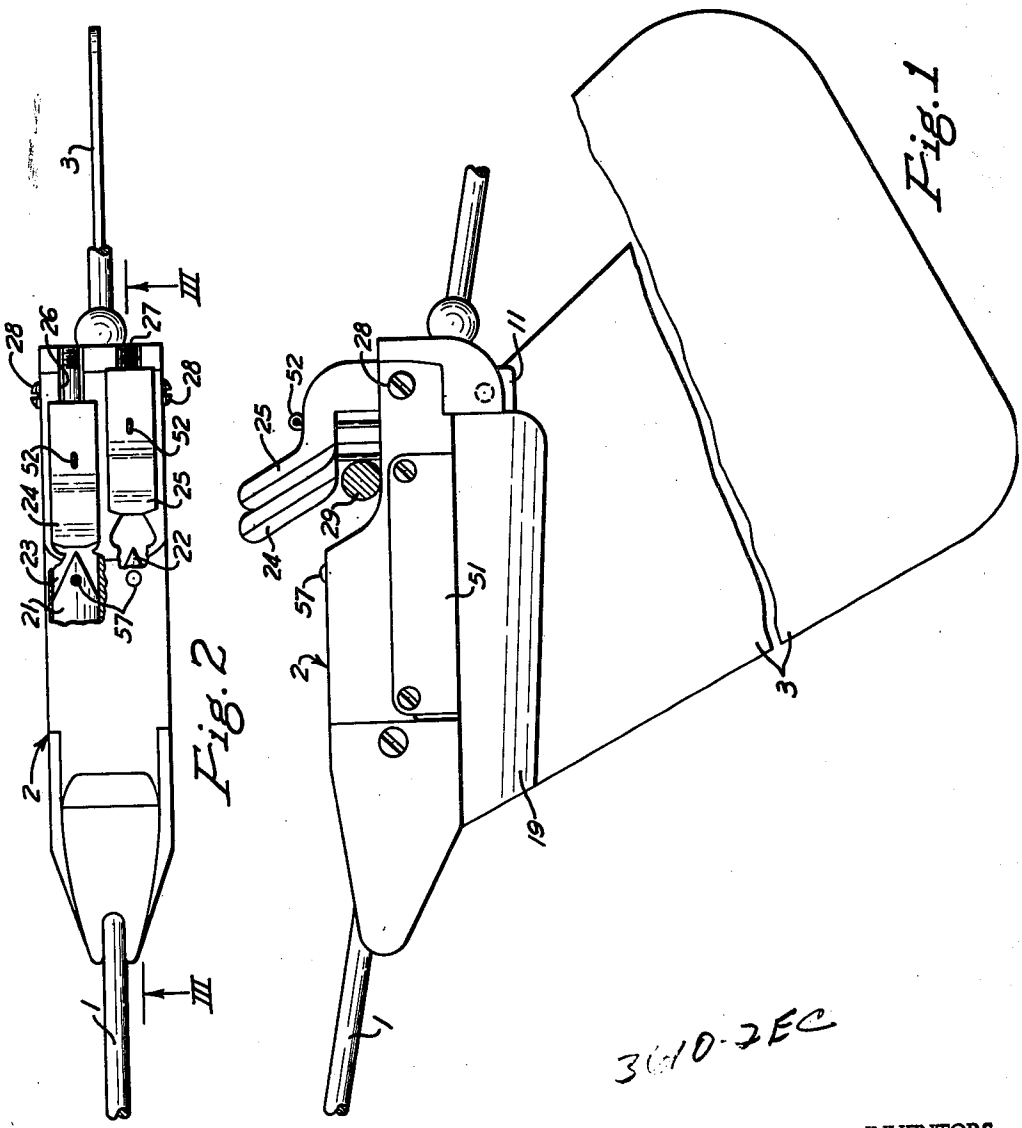


Fig. 1

Fig. 2

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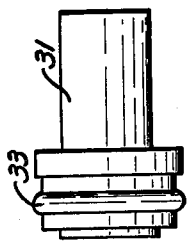


Fig. 4

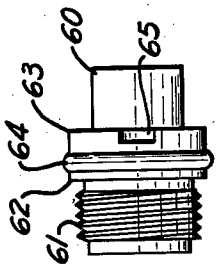


Fig. 5

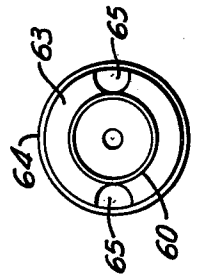


Fig. 6

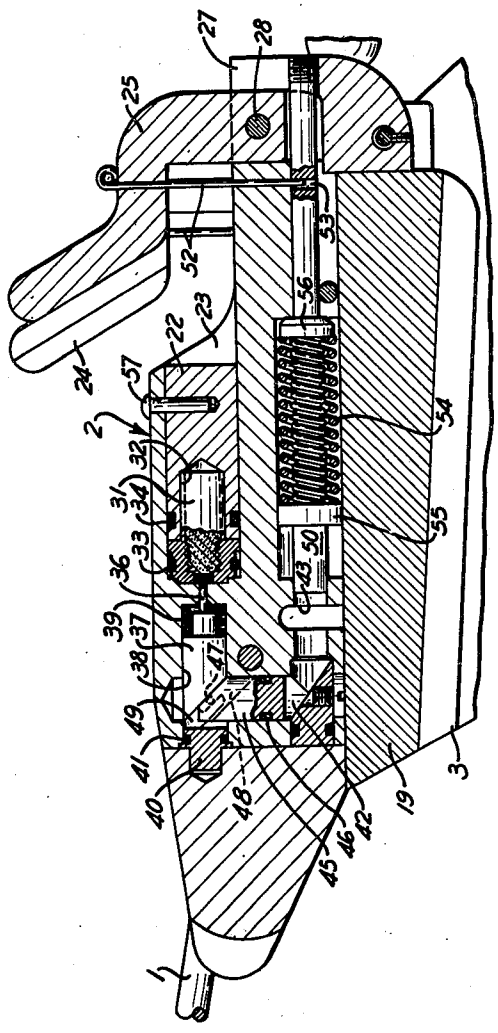


Fig. 3

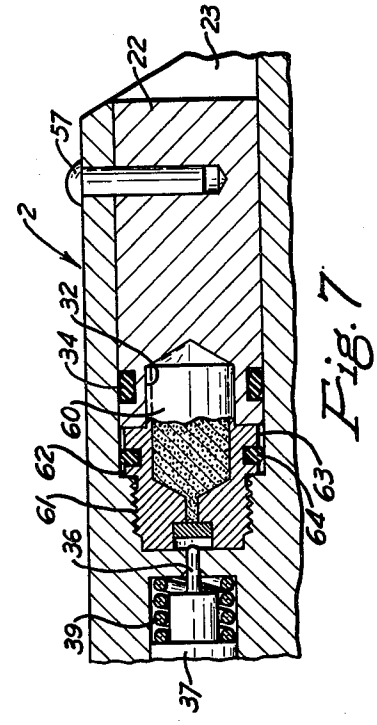


Fig. 7

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United States Patent Office 3,111,927 Patented Nov. 26, 1963

3,111,927
CARTRIDGE FOR MULTIPLE MINE-ANCHOR CUTTER

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Filed Nov. 7, 1961, Ser. No. 150,707
2 Claims. (Cl. 114—221)

This invention relates to cutting devices, by which the lines that anchor explosive mines can be severed, but more particularly to the explosive cartridges that operate such devices. This application is a continuation-in-part of our copending application, Serial Number 786,736, filed January 14, 1959, now Patent No. 3,020,871.

It is among the objects of this invention to provide a mine anchor-line cutter cartridge which allows a relatively short cutter frame to be used, which seals the cutter against admission of sea water to the firing pin chamber past the cartridge, and which can be screwed into position in the cutter frame.

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

FIG. 1 is a plan view of our cutter mounted on a sweep line;

FIG. 2 is a front view thereof;

FIG. 3 is an enlarged fragmentary horizontal section taken on the line III—III of FIG. 2;

FIG. 4 is an enlarged side view of the cartridge shown in FIG. 3;

FIG. 5 is a side view of a modified cartridge;

FIG. 6 is a front view of the empty modified cartridge; and

FIG. 7 is a fragmentary horizontal section through a cutter equipped with the modified cartridge.

Referring to FIGS. 1 and 2 of the drawings, a number of our mine anchor-line cutters are mounted on a sweep line 1 and towed through the water in the direction of the arrow by a mine sweeper or a helicopter. The sweep line is held at the desired angle and depth by means which form no part of this invention. Each cutter has two major parts; an elongated tool frame 2 and a tapered fin 3 that keeps the frame more or less horizontal and headed forward. Carried by opposite sides of the fin are members 19, the outer surfaces of which curve forward from the fin to the upper and lower sides of the frame and form smooth surfaces for water to flow across. The tool frame 2 is provided with at least two cutting elements, most suitably in the form of cylindrical chisels. Preferably, there are two chisels 21 and 22 slidably mounted in parallel barrels 23 formed in the front side of the frame 2 about midway between its ends. As shown in FIG. 3, the front of the frame at its rear end is cut away and the adjacent ends of the barrels are open. That is, the barrels open into mine anchor-line receiving recesses that are formed between the front of the frame and a couple of anvils 24 and 25 staggered lengthwise of the frame. The anvils have rear ends that fit in parallel slots 26 and 27 (FIG. 2) in the rear end of the frame. Slot 26 extends lengthwise of the frame farther than the other so that anvil 24 will be located closer to chisel 21 than the other anvil is located relative to chisel 22. The anvils are held in the slots by shear screws 28. Each anvil extends forward perpendicularly to the frame and then laterally a short distance toward the opposite end of the frame and then forward again at an oblique angle. When the frame engages the first mine anchor-line 29 (FIG. 1) the frame will slide across the line, which will be directed by the front end of the forward anvil 24 into the recess that the anvil and frame form in line with chisel 21.

To drive the chisels out of the barrels, an explosive cartridge 31 is disposed in each barrel. As shown in FIG. 3, each cartridge has a hollow base portion with a thick slide wall located directly behind the chisel and substantially filling the inner end of the barrel. The rest of the cartridge has a thin side wall that extends forward into an axial bore 32 in the inner or rear end of the chisel. This telescoping of chisel and cartridge permits the length and weight of the frame to be reduced. When such a cartridge is fired, its side wall is ruptured where the thin wall joins its heavy wall. This allows the expanding gases to engage the rear end of the chisel around its central bore and thereby the gases act upon a greater area of the chisel than just the inner end of the bore. Of course, the thin wall portion of the cartridge usually leaves the cutter with the chisel. The force of the explosion also expands the base portion of the cartridge, which remains in the frame after firing, so that the base portion will not be thrown out of the barrel when the second cartridge is fired, which would allow water and mud and the like to foul the first firing pin. The base portion of each cartridge is threaded internally so that a threaded rod (not shown) can be inserted in the barrel and screwed into the cartridge base in order to pull it out of the barrel to permit the tool to be reloaded.

Another feature of this invention is that the base portion of each cartridge also is provided with a peripheral groove, in which is mounted a sealing ring 33 (FIG. 4) that is compressed against the side of the barrel to prevent water from seeping past the cartridge, especially after it has been fired. It is likewise preferred to mount an additional sealing ring 34 in a groove around the chisel to keep water from even reaching the cartridge before it is fired.

In order to fire the cartridges, a firing pin 36 is slidably mounted in a small hole in the frame directly behind each cartridge. Each pin is supported by a cylindrical slide 37, preferably integral with it, that is movable back and forth in a bore 38 in the frame. The pin is urged away from the cartridge by a coil spring 39 compressed between a shoulder on the slide and the front end of the bore. The rear end of the bore is closed by a plug 40 that is encircled by an O-ring 41 which seals that end of the bore. Extending out of one side of the rear end of the bore, preferably at right angles to it, is a passage 42, which has an outer end portion that extends back through the frame toward the anvils. The outer end of the passage opens into a small slot 43 in the frame, which is open to the surrounding water.

Slidably mounted in the portion of passage 42 that is perpendicular to bore 38, is a piston 45 provided with a circumferential groove in which a sealing ring 46 is compressed to prevent water from passing the piston and getting into the slide bore. The adjoining ends of the piston and firing pin slide engage each other along surfaces inclined to their axes, so that if the piston is pushed farther into the bore, it will push the firing pin toward the cartridge. The meeting ends of the piston and slide are held together by a hook and pin. Preferably the pin 47 is mounted across a slot 48 extending diagonally across the piston, and the hook 49 projects from the inner end of the slide into the slot and part way around the pin. If the tool is dropped, this pin and hook connection will prevent the jar from accidentally forcing the firing pin against the cartridge. The connection also prevents the recoil due to firing of one cartridge from causing the other firing pin slide to move toward the other cartridge and fire it.

When it is time to fire a cartridge, the water in a passage 42 is suddenly put under sufficient pressure to drive the piston therein forward against the adjoining slide 37, which is thereby forced toward the cartridge. The water pressure is created by a plunger 50 slidably mounted in a recess in the back side of the frame. The exposed side of each

recess can be closed by a cover plate 51. Each plunger normally is held in a retracted position, with its front end behind the water inlet slot 43, by means of a headed trigger pin 52 extending through a hole in the frame as shown in FIG. 3. The inner end of the pin projects into a hole 53 in the plunger near its rear end, and the outer portion of the pin extends across the cutting recess and through the adjoining anvil. When the inner end of the trigger pin is withdrawn from the plunger, the latter is shot forward by a coil spring 54 compressed between a shoulder 55 on the plunger and a washer 56 slidably mounted on the plunger and bearing against the frame. A shear pin 57 in the chisel compels the explosion to build up considerable pressure before that pin is sheared off and the chisel 21 shot out of the barrel with great force. In fact, the force is great enough to cut the anchor-line and break the shear pin 28 by which the anvil 24 is held in place, so that the anvil will separate from the frame and not catch on the next mine anchor-line. The latter is thus free to be caught by anvil 25 and to fire the other cartridge so that chisel 22 will cut the line. The rear ends of plungers 50 are threaded so that they can be gripped by a threaded socket member (not shown) and pulled back to cock the tool after new anvils and trigger pins have been installed.

It will be seen that the sealing rings keep all water away from the firing mechanism. That is highly desirable because water would interfere with the action of the firing pin. Also, where water can enter, silt, sand and mud can enter likewise, and that means that the firing mechanism would have to be dismantled and cleaned after every use of the cutter. Our invention makes such cleaning unnecessary.

The principal difference between the modified cartridge 60 shown in FIGS. 5, 6, 7, is that its rear or base portion is provided with external screw threads 61 for positively holding it in place in the cutter frame 2. A rear extension of barrel 23 is threaded to receive the threaded cartridge, which can be screwed tightly into place. The hollow base portion of the cartridge has a side wall that is considerably thicker than the cartridge side wall in front of it, which extends into the axial bore 32 in the inner end of cutting chisel 22. Like the other cartridge, when the cartridge is fired, the thin side wall of this one is ruptured where the thin wall joins the base portion.

The side of the cartridge base portion in front of its threads is encircled by two axial spaced flanges 62 and 63 that form a circumferential groove between them, in which a sealing ring 64 is mounted. The ring is compressed against the side of the barrel to aid the screw threads in preventing water from seeping past the cartridge. In order to permit the cartridge to be screwed into place and later removed after it has been fired, the front of its front flange 63 is provided with a pair of diametrically opposite

notches 65 for receiving a suitable wrench (not shown) for rotating the cartridge in either direction.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we 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.

We claim:

1. A mine anchor-line cutter cartridge comprising a hollow cylindrical base portion and a cylindrical side wall extending forward from said base portion and having a smooth outer surface, the rear end of said base portion being provided with external screw threads, the inner diameters of said base portion and side wall being substantially the same but said side wall being materially thinner than the side of the base portion, the front end of the base portion being encircled by axially spaced flanges forming a circumferential groove, and a compressible sealing gasket in said groove, normally projecting radially therefrom.

2. A mine anchor-line cutter comprising a frame provided with a barrel having a threaded inner end portion, a cartridge having a hollow base portion screwed into said threaded portion of the barrel and also having a cylindrical side wall extending forward in the barrel from said base portion, said side wall being materially thinner than the side of the base portion and spaced from the side wall of the barrel, the front end of the base portion being encircled by axially spaced flanges forming a circumferential groove, a sealing gasket in said groove pressing against the encircling side wall of the barrel, and a cutting chisel slidably mounted in the barrel and provided in its inner end with an axial bore receiving said thin wall of the cartridge in engagement therewith, the inner end face of the chisel substantially engaging the front flange of the cartridge, whereby when the cartridge is fired its thin wall will rupture between said front flange and the inner end face of the chisel.

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