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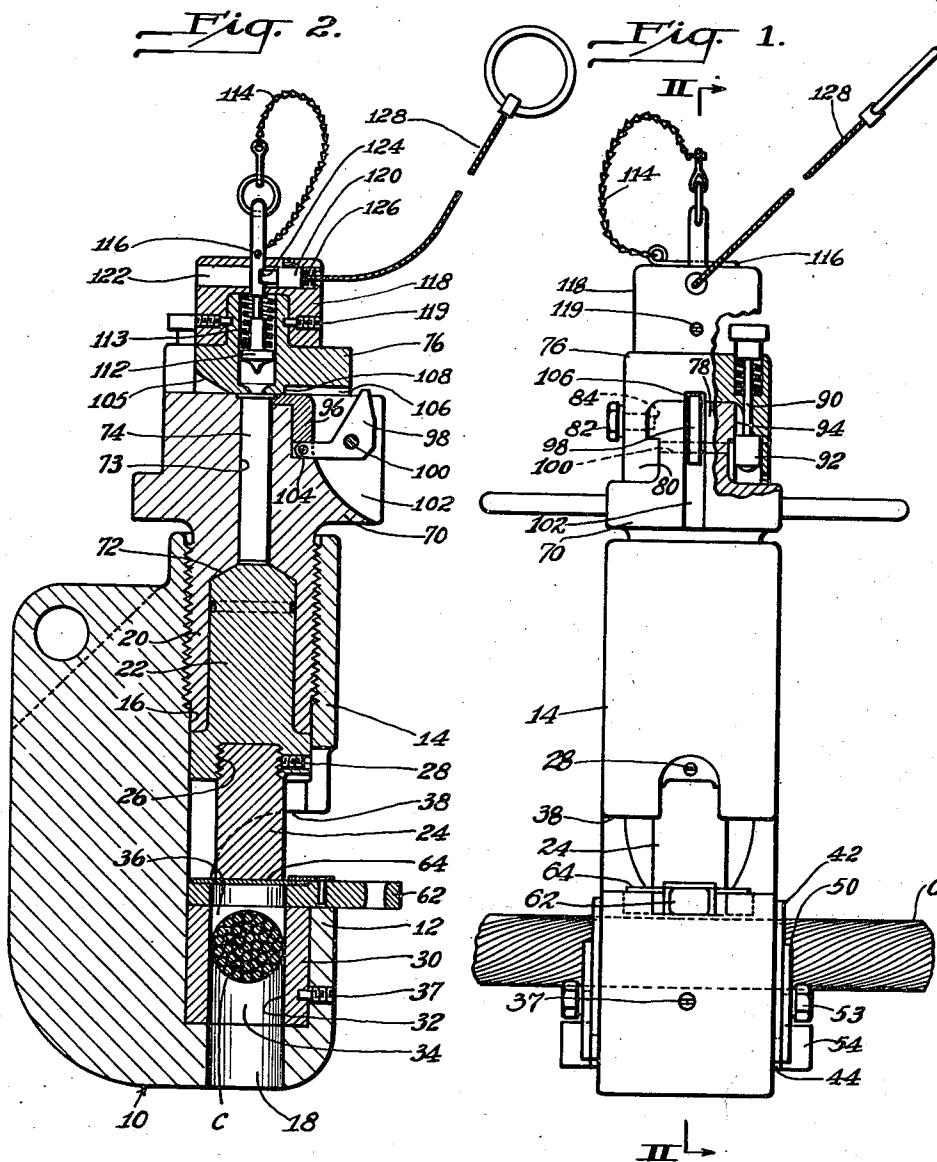
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2,140,338

CABLE CUTTER

Filed April 19, 1937

2 Sheets-Sheet 1



WITNESSES
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2 Sheets-Sheet 2

Fig. 3.

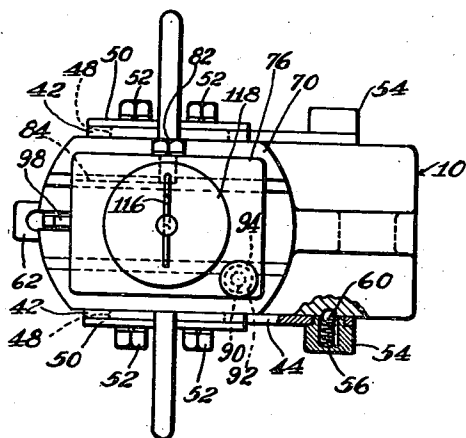


Fig. 4.

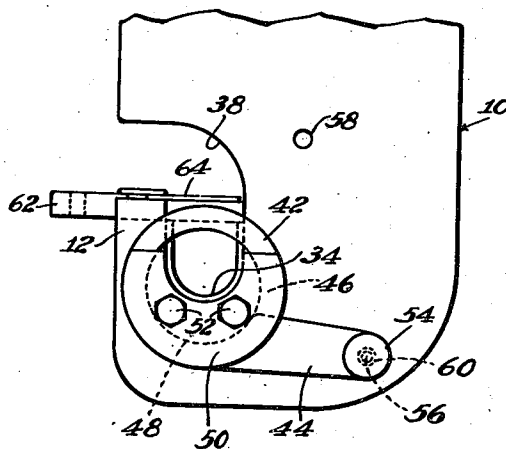


Fig. 5.

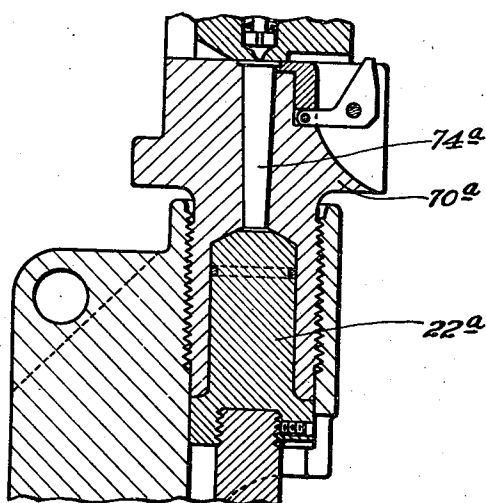
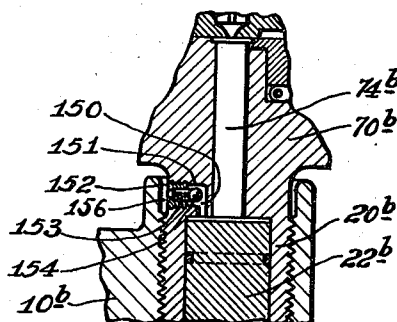


Fig. 6.



WITNESSES

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UNITED STATES PATENT OFFICE

2,140,338

CABLE CUTTER

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Application April 19, 1937, Serial No. 137,711

17 Claims. (Cl. 164-47)

This invention relates to explosively actuated tools, such as are adapted to cut cables and the like, and more particularly is concerned with portable apparatus of the type indicated capable of under-water use.

Heretofore explosively operated tools, such as cable cutters, have been provided wherein explosive means, for example blank cartridges, provide the power when detonated to operate the work performing tools. While there has been some attempt to employ apparatus of the indicated character under water, I have found that their operation, and particularly their repeated operation under water, is difficult and often impossible. Moreover, with known types of explosively actuated shears a pair of cutter blades either pivotally or reciprocally mounted are provided and in this construction there is always a tendency for the cutting edges of the blades to become misaligned during the cutting operation with the resultant binding action. Further, in known apparatus the full force of the explosive charge has not always been employed. In addition, with present constructions mechanisms for clamping the work to be operated on, ejecting the explosive means after detonation, reloading, insuring safety in operation, and the like have either not been provided, or are difficult to operate or expensive to construct.

It is the general object of my invention to avoid and overcome the foregoing difficulties of and objections to prior known explosively actuated devices by the provision of an improved apparatus operated by explosive means.

Another object of my invention is the provision of an explosively operated tool which can be repeatedly used for under-water work and wherein reloading while under water is readily accomplished.

Another object of my invention is the provision of a shear for cutting cables and the like wherein the cutting operation is performed by complementary male and female dies while holding the member to be sheared tightly in the desired shearing position.

Another object of my invention is to provide an explosively actuated apparatus which is readily reloaded and wherein automatic means for ejecting the explosive means are included together with safety means for preventing accidental operation of the apparatus.

Another object of my invention is the provision of an explosively operated shear wherein readily replaceable cutting dies are provided so as to adapt the apparatus to handle any particular

operation and wherein readily replaceable means of desired strength are provided for preventing the shearing operation until the full force of the detonated explosive charge has been realized.

The foregoing and other objects of my invention are achieved by the embodiment of the invention illustrated in the accompanying drawings wherein Fig. 1 is a front elevation partly broken away to illustrate details of the lock for the breech block; Fig. 2 is a vertical transverse sectional view taken on line II-II of Fig. 1; Fig. 3 is a top view of the apparatus of Fig. 1 with a portion thereof broken away to show details of the cable clamping mechanism; Fig. 4 is a side elevation of the lower portion of the shear illustrating the mechanism for clamping a cable or the like in shearing position; Fig. 5 is a view similar to Fig. 2 with the breech and piston portions only being illustrated and of a modified form of the invention; and Fig. 6 is a view similar to Fig. 5 but illustrates another modification of the invention.

Although certain features of my invention are broadly applicable to explosively actuated tools and are so claimed hereinafter, they are particularly adapted to the construction of and use with shears for cutting cables and the like and accordingly have been so illustrated and will be so described.

In the accompanying drawings the numeral 10 indicates generally a C-shaped frame having opposed leg portions 12 and 14. The leg portion 14 is formed with a bore 16 whose axis is in alignment with a bore 18 formed in the leg 12. The end of the bore 16 remote from the leg 12 is threaded or otherwise adapted to removably and adjustably receive a barrel 20 which slidably carries a piston 22 for movement to and from the leg 12.

The piston 22 removably carries a male cutting die 24 as by the provision of a threaded connection 26 and a locking set screw 28. The leg 12 carries a female cutting die 30 having an opening 32 therein complementary to and receiving the end of the male cutting die 24 at the end of the shearing operation. In the embodiment of the invention illustrated the male cutting die 24 and the bore 32 of the female cutting die 30 are circular in cross-section. I, however, contemplate other cross-section shapes as, for example, square or rectangular.

In all events the female cutting die 30 is formed with anvils 34 at each side of the bore 32 and with a cradle-like opening 36 above the anvil portions 34. The sides of the frame 10 are re-

cessed at 38 so that a cable C or other member to be sheared can be moved laterally into the recess 38 through the cradle-like opening 36 and down against the anvils 34 of the female cutting die where it is positioned ready to be sheared. The female cutting die 30 is normally held in position in the leg 12 in quickly releasable manner, as by set screw 37, so that if desired a female cutting die of other characteristics or size can be substituted for that illustrated.

In order to hold the cable C or other member in the proper position in the female cutting die 30 before and during the shearing operation, I preferably provide readily releasable clamping means. In the embodiment of my invention shown these clamping means include hook-shaped members 42 having operating arms 44 and openings 46 between the arms and the curved ends of the hook-shaped members. The hook-shaped members are pivotally carried upon circular bosses or studs 48 provided on the sides of the leg 12 and cut away so as to provide for the reception of the cable C on the anvils 34. Cover plates 50 secured to the bosses 48 as by cap screws 52 secure the members 42 in position. As best seen in Fig. 3, the end of each arm 44 is provided with a knob 54 carrying a spring-pressed detent, indicated generally at 56, which is received by a recess 58 and a recess 60 to hold the member 42 in the open or the clamping position, respectively.

It is highly advisable in the operation of an explosive shear, and particularly where the shear is to be employed under water, to utilize the full force of the explosive operating charge. This is accomplished in the embodiment of my invention illustrated by the provision of a holder 62, shaped like a frying pan, which removably receives a shear plate 64, ordinarily of soft metal such as copper. The holder 62 is adapted to be received in a complemental opening in the leg 12 and rests on the upper end of the female cutting die 30. The lower end of the male die 24 engages with the shear plate 64, as best seen in Figs. 1 and 2, and as will be understood the thickness of the plate determines the amount of retarding force provided thereby. Usually the plate 64 is formed with opposed radially extending slots so that after the center of the plate is sheared out the plate is in two halves which can be readily separated from the male die 24. Instead of employing the shear plate 64 I may use a replaceable shear pin between the piston 22 and the barrel 20 or the leg 14 although this is not preferred.

The barrel 20 is provided with a breech 70 which is preferably integral with the barrel and which is ordinarily formed with a bevel 72 adjacent to and in alignment with a bevel formed on the end of the piston so that little or no explosion chamber is provided between the end of the piston and the breech of the barrel. This is important in under-water operation as hereinafter described. The breech 70 has an axial bore 73 in alignment with the piston 22 and receives an explosive charge, ordinarily in the form of a blank cartridge 74.

Slidably carried by the breech 70 for movement to cover or expose the cartridge 74 is a breech block indicated, as a whole, by the numeral 76. The slidable mounting of the breech block 76 upon the breech 70 is provided for in the form of my invention illustrated by forming the breech block 76 of inverted U-shape and the breech 70 with an upstanding rib 78 received between the

inverted legs 80 of the breech block. Interlocking ribs or shoulders on the rib 78 and lugs 80 provide a gibbed connection between the breech block 76 and the breech 70, as best seen in Fig. 1. A cap screw 82 secured to one of the legs 80 and having its end received in a groove 84 milled in the side of the rib 78 of the breech 70 limits the sliding movement of the breech block 76 on the breech 70.

In order to lock the breech block 76 in firing position relative to the breech 70, I provide a spring-positioned plunger 90 on one end of the breech block 76 and having a key 92 carried at its lower extremity and adapted to be received by a keyway 94 cut vertically in the shoulder of the rib 78 formed on the breech 70. With the breech block 76 in the proper position relative to the breech 70 the key 92 carried by the spring-positioned plunger 90 is received in the keyway 94 to lock the breech in position. When it is desired to move the breech block away from the breech so as to expose the cartridge 74, the spring-positioned plunger 90 is depressed to move the key 92 out of the key slot 94 whereupon the breech block can be moved laterally with the key 92 riding below the shoulder formed on the rib 78 of the breech 70.

In the movement of the breech block 76 to the open position the cartridge 74 is adapted to be ejected by suitable mechanism which in the form of my invention illustrated includes a finger 96 gibbed to the breech 70 for sliding movement parallel to the axis of the barrel 20. The finger 96 is received in a suitable recess in the end of the breech 70 and includes a portion extending beneath the shoulder of the cartridge 74. A bell crank 98 pivotally mounted upon a pin 100 in a slot 102 cut in the breech 70 is pivotally secured by a pin and slot connection 104 to the finger 96. The upper end of the bell crank 98 is slidably received by a groove 106 formed in the breech block 76 and terminating in a shoulder 108 which engages with the bell crank 98 during the final opening movement of the breech block to rock the bell crank, raise the finger 96, and eject the cartridge 74 from the breech 70. The forward under portion of the breech block 76 is provided with an inclined surface 105 which aids in the insertion of a cartridge in the breech, as hereinafter described.

The breech block 76 carries a firing pin 112 which is urged toward the cartridge 74 by a compression spring 113. To the upper end of the firing pin is secured a flexible chain 114 of some six inches in length and this secured at its other end to a safety pin 116 which, as shown in Figs. 1 and 2, normally extends through the firing pin behind a cap 118 rotatably secured to the breech block 76 as by cap screws 119 having ends extending into a circular groove formed on the end of the breech block 76. The rotary mounting of the cap 118 allows it to be turned in any direction to facilitate firing of the apparatus. Thus with the safety pin 116 in position the firing pin 112 is held positively in a retarded inoperative position. The trigger or release mechanism for controlling the operation of the firing pin 112 includes a detent 120 slidably received in a suitable bore 122 formed in the cap 118 and normally urged by a compression spring 126 into a groove 124 cut in the side of the firing pin. The detent 120 is connected to a flexible wire or cord 128 which can be of any length so that the release may be operated any desired distance from the shear.

It is believed that the operation of my improved shear will be evident from the foregoing description. However, briefly reviewing the operation and with the parts in the position shown in Figs. 1 to 4, the safety pin 116 is removed and the person operating the shear goes to any desired position remote from the shear and pulls the wire 128. This moves the detent 120 out of the groove 124 in the side of the firing pin 112 and the firing pin is driven down against the end of the cartridge 74 to detonate it. The piston 22 is held against movement by the shear plate 64 until a predetermined pressure has been built up by the exploded cartridge at which time the male cutting die 24 shears the plate 64. The die 24 now is driven down against the cable C by the pressure behind the piston. This pressure combined with the momentum built up by the piston in its travel from the initially held position to engagement with the cable C causes the die 24 to cut out a short length of the cable C and drive the severed length down through the bores 32 and 18. The shear plate 64 acts as a cushion between the lower end of the piston and the upper end of the holder 62 to stop the movement of the piston.

If the cable is under tension when cut the ends may whip and it is for this reason that a wire or operating cord 128 of desired length is provided to permit the operator to retreat to a safe distance before operating the shear. When cables under no tension or only light tension are cut the operator can, of course, stand where desired. The spring-positioned plunger 90 is now pressed down as heretofore described to release the breech block 76 and to allow the operator to slide it laterally off the end of the breech 70 to expose the end of the cartridge 74. Engagement of the shoulder 108 with the bell crank 98 causes the finger 96 to eject the cartridge 74 during the final movement of the breech block to open position.

After the cartridge 74 is removed, the arms 44 are rotated to bring the spring detents 56 thereof into engagement with the recesses 58 on the sides of the frame which moves the hook-shaped members 42 to open position to allow the reloading of the shear. The piston 22 and male cutting die 24 are returned to their full line position and the barrel 20 and associated breech 70 are screwed partly out of the frame 10 so as to carry the male cutting die 24 away from the recesses 38 in the frame so that a new length of cable or the like to be severed can be positioned in the female cutting die. The arms 44 of the hook-shaped members 42 are then rotated back to the full line position shown in Fig. 4 to clamp the new member to be sheared in position.

A shear plate 64 of the desired thickness carried in the holder 62 is now positioned at the top of the female cutting die 30 and the barrel 20 and breech 70 are screwed back into the frame 10 until the lower end of the male cutting die 24 is in snug engagement with the shear plate 64. A new cartridge is now inserted in the breech 70 until it engages with the upper end of the finger 96. Movement of the breech block 76 to cover the breech causes the inclined surface 105 of the block to engage with the upwardly extending finger 98 and cartridge to progressively move the cartridge and finger to the full line position shown in Fig. 2 as the breech block moves to its full line position. When in the full line position the spring-positioned plunger 90 automatically moves the key 92 into engagement with the keyway 94 of the breech 70 to lock the parts in the indicated position. The parts are now in the position illus-

trated in the drawings and the operation can be repeated.

The embodiment of my invention illustrated in Figs. 1 to 4 and heretofore described can be operated or fired above or below water. It can be reloaded above water but also can be reloaded under water without trapping water between the cartridge and the piston if there is sufficient clearance between the bore 73 and the cartridge to allow water displaced by the insertion of a new cartridge to escape by a bleeding action. To this end I contemplate providing a loose fit between the cartridge and the bore, making the bore or the cartridge slightly oval, or providing bleeding vents or grooves on the surface of the bore.

The embodiments of my invention shown in Figs. 5 or 6 illustrate other specific constructions facilitating underwater operation and reloading. In Fig. 5 parts similar to parts of Fig. 2 have been indicated by like numerals except that the suffix *a* has been added. This embodiment of my invention is the same as that above described with the exception that the cartridge 74a is formed with a longitudinal taper and is received by a tapered breech. The tapers make an angle of about five degrees with the axes of the cartridge and bore. Reloading of the apparatus under water is readily accomplished for the reason that as the tapered cartridge 74 is introduced into the breech, which is of course filled with water, the water is displaced by and flows past the sides of the cartridge so that only a few drops of water remain between the cartridge and the end of the piston 22a after the cartridge is positioned completely within the breech.

In the embodiment of my invention shown in Fig. 6, parts similar to the shear indicated in Figs. 1 to 4 have been indicated by like numerals except that the suffix *b* has been added. In this form of my invention the breech 70b is provided with a small escape or bleeding passage 150 adjacent the end of the piston 22b. The passage 150 communicates with a bore 151 extending to the outer surface of the breech. An apertured plug 152 is threaded into the bore and by a spring 153 holds a ball 154 away from sealing relation with a valve seat formed on the end of the plug. The frame 10b is recessed as at 156 so that regardless of the several different possible positions for the breech 70b and barrel 20b in the frame 10b the escape passage 150 and bore 151 are always open to the outside. In a reloading operation under water the slow steady insertion of the cartridge 74b into the breech causes the displacement of the water through the escape passage 150 and around the ball 154 in the bore 151. However, when the cartridge is detonated the heavy sudden pressure causes the spring 153 to yield to allow the ball 154 to seat on the plug 152 and close the passage and bore.

The operation of the embodiments of my invention illustrated in Figs. 5 and 6 is substantially the same as that heretofore described in conjunction with the form of the invention shown in Figs. 1 to 4 except that reloading of the shear under water is facilitated.

From the foregoing it will be recognized that the objects of my invention have been obtained by the provision of an improved portable tool operated by explosive means and which is particularly adapted to under-water operations and even to reloading under water. The cable or other member to be operated on is quickly and positively clamped in position and shearing operations are improved by the use of cooperating

male and female cutting dies. The full force of the explosive power means is employed and cartridges of various sizes and strengths can be utilized. The reloading in particular and the operation in general are facilitated and the apparatus is quickly adapted to perform a wide variety of operations including sheet punching.

By "cables and the like" as employed in the specification and claims, I intend to cover operations on rods, pipes, wires, strands or other similar articles. Although dies having faces substantially perpendicular to their longitudinal axes have been illustrated and described I contemplate employing dies having faces inclined to their axes, as for example, dies having opposed V-shaped cutting edges receiving the member within the legs of the opposed V's as will be understood.

While in accordance with the patent statutes several embodiments of my invention have been illustrated and described in detail, it should be appreciated that the invention is not limited thereto or thereby but is defined in the appended claims.

I claim:

1. A portable shear for cutting cables and the like comprising a C-shaped frame having opposed legs, a barrel removably and adjustably carried by one leg of the frame and having its axis extending toward the other leg, a piston slidably mounted in the barrel, a male cutting die removably secured to the end of the piston adjacent the said other leg of the frame, a female cutting die removably secured to the said other leg of the frame, the female die having an open saddle adapted to receive a cable or the like and hold it bridged over the opening in the female die, shearable means positioned between the male and female cutting dies for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block slidably mounted on the breech for movement substantially at right angles to the piston, means carried by the breech for detonating an explosive charge, means operable by movement of the breech block for ejecting the detonated explosive means from the breech, and means for clamping a cable or the like in the saddle of the female die.

2. A portable shear for cutting cables and the like comprising a C-shaped frame having opposed legs, a barrel adjustably carried by one leg of the frame and having its axis extending toward the other leg, a piston slidably mounted in the barrel, a male cutting die secured to the end of the piston adjacent the said other leg of the frame, a female cutting die secured to the said other leg of the frame, the female die having an open saddle adapted to receive a cable or the like and hold it bridged over the opening in the female die, shearable means positioned between the male and female cutting dies for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably mounted on the breech, means carried by the breech for detonating an explosive charge, means operable by movement of the breech block for ejecting the detonated explosive means from the breech, and means for clamping a cable or the like in the saddle of the female die.

3. A portable shear for cutting cables and the

like comprising a C-shaped frame having opposed legs, a barrel adjustably carried by one leg of the frame and having its axis extending toward the other leg, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a complementary female cutting die carried by the said other leg of the frame, the female die having an open saddle adapted to receive a cable or the like, means for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block slidably mounted on the breech for movement substantially at right angles to the piston, means for detonating an explosive charge carried by the breech, and means operable by movement of the breech block for ejecting the detonated explosive means from the breech.

4. A portable shear for cutting cables and the like comprising a C-shaped frame having opposed legs, a barrel carried by one leg of the frame and having its axis extending toward the other leg, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a female cutting die carried by the said other leg of the frame, the female die having an open saddle adapted to receive a cable or the like, means positioned between the male and female cutting dies for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably positioned over the breech, means for detonating an explosive charge carried by the breech, and means for clamping a cable or the like in the saddle of the female die.

5. A portable tool for cutting cables, punching sheets, and the like comprising a C-shaped frame having opposed legs, a barrel carried by one leg of the frame and having its axis extending toward the other leg, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a female cutting die carried by the said other leg of the frame, the female die having an open saddle adapted to receive a cable or the like, means positioned between the male and female cutting dies for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably positioned over the breech, and means for detonating an explosive charge carried by the breech.

6. A portable tool for cutting cables, punching sheets, and the like comprising a frame, a barrel removably carried by the frame, an anvil on the frame in alignment to the axis of the barrel, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a female cutting die carried by the anvil, the female die having an open saddle adapted to receive a cable or the like, means positioned between the male and female cutting dies for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block slidably mounted on the breech for movement substantially at right angles to the piston, means for detonating an explosive charge carried by the breech, means

operable by movement of the breech block for ejecting the detonated explosive means from the breech, and means for clamping a cable or the like in the saddle of the female die.

5 7. A portable shear for cutting cables and the like comprising a frame, a barrel removably carried by the frame, an anvil on the frame in alignment to the axis of the barrel, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a female cutting die carried by the anvil, the female die having an open saddle adapted to receive a cable or the like, means for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably mounted on the breech, means for detonating an explosive charge carried by the breech, means for ejecting the detonated explosive means from the breech, and means for clamping a cable or the like in the saddle of the female die.

8. A portable shear for cutting cables and the like comprising a frame, a barrel removably carried by the frame, an anvil on the frame in alignment to the axis of the barrel, a piston slidably mounted in the barrel, a male cutting die carried by the piston, a female cutting die carried by the anvil, the female die having an open saddle adapted to receive a cable or the like, means for holding the piston against movement until a predetermined force on the piston has been exceeded, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably mounted on the breech, and means for detonating an explosive charge carried by the breech.

9. A tool for cutting cables, punching sheets, and the like comprising a frame, a barrel carried by the frame, an anvil on the frame and in alignment with but spaced from the barrel, a piston slidably mounted in the barrel, a cutting die removably carried by the piston, a cutting die removably carried by the anvil, the last-named die having an open saddle adapted to receive a cable or the like, a breech associated with the barrel and adapted to receive an explosive charge which when detonated drives the piston, a breech block removably positioned over the breech, and means for detonating an explosive charge carried by the breech.

10. A portable tool for cutting cables, punching sheets, and the like comprising readily replaceable complementary male and female dies, explosive means adapted when detonated to drive the dies together, means associated with the female die for receiving and clamping a cable in a bridge position over the female die, means for holding the dies against relative movement until a predetermined force has been exceeded, and means for detonating the explosive means.

11. A portable tool for cutting cables, punching sheets, and the like comprising complementary male and female dies adapted to receive a cable or the like therebetween, explosive means adapted when detonated to drive the dies together, means for holding the dies against rela-

tive movement until a predetermined force has been exceeded, and means for detonating the explosive means, said means for holding the dies against relative movement until a predetermined force has been exceeded comprising a ring removably positioned over the female die and adapted to slidably receive the male die and a shear disc removably and replaceably carried by the ring.

12. A portable shear including a frame, a barrel adjustably carried by the frame; a piston received by the barrel, means on the piston for shearing material placed thereunder, explosive means for operating the piston, and means for moving the barrel relative to the frame to allow material to be placed under the means carried by the piston.

13. A tool adapted for operation in a substantially non-compressible fluid medium, such as water, and comprising a barrel, a piston slidably mounted in the barrel, a cutting tool mounted on the piston, a breech associated with the barrel and having a tapered cartridge-receiving bore, said bore being tapered at least about five degrees with its longitudinal axis, a tapered cartridge removably received in the bore, a breech block removably positioned over the bore, and means for detonating the cartridge.

14. A tool comprising a barrel, a piston slidably mounted in the barrel, a tool mounted on the piston, a breech associated with the barrel and having a tapered cartridge-receiving bore, said bore being tapered at least about five degrees with its longitudinal axis, a tapered cartridge removably received in the bore, a breech block removably positioned over the bore, and means for detonating the cartridge.

15. A tool adapted for operation in a substantially non-compressible fluid medium, such as water, and comprising a barrel, a piston slidably mounted in the barrel, a tool mounted on the piston, a breech associated with the barrel and having a cartridge-receiving bore, a cartridge removably received in the bore, said breech and its associated bore being so constructed and arranged that any of said fluid medium trapped by the insertion of the cartridge in the bore is bled away, a breech block removably positioned over the bore, and means for detonating the cartridge.

16. A tool adapted for operation in a substantially non-compressible fluid medium, such as water, and comprising a barrel, a piston slidably mounted in the barrel, a tool mounted on the piston, a breech associated with the barrel and having a cartridge-receiving bore, a cartridge removably received in the bore, means for bleeding away any of said fluid medium trapped by the insertion of a cartridge in the bore of the breech, a breech block removably positioned over the bore, and means for detonating the cartridge.

17. A portable tool including a frame, a barrel adjustably carried by the frame, a piston received by the barrel, a tool on the piston for operating on material placed under the tool, explosive means for operating the piston and means for moving the barrel relative to the frame to allow material to be placed under the means carried by the piston.

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