Sept. 3, 1940. R. TEMPLE, JR 2,213,435

TOOL

Filed Nov. 29, 1937 2 Sheets-Sheet 1

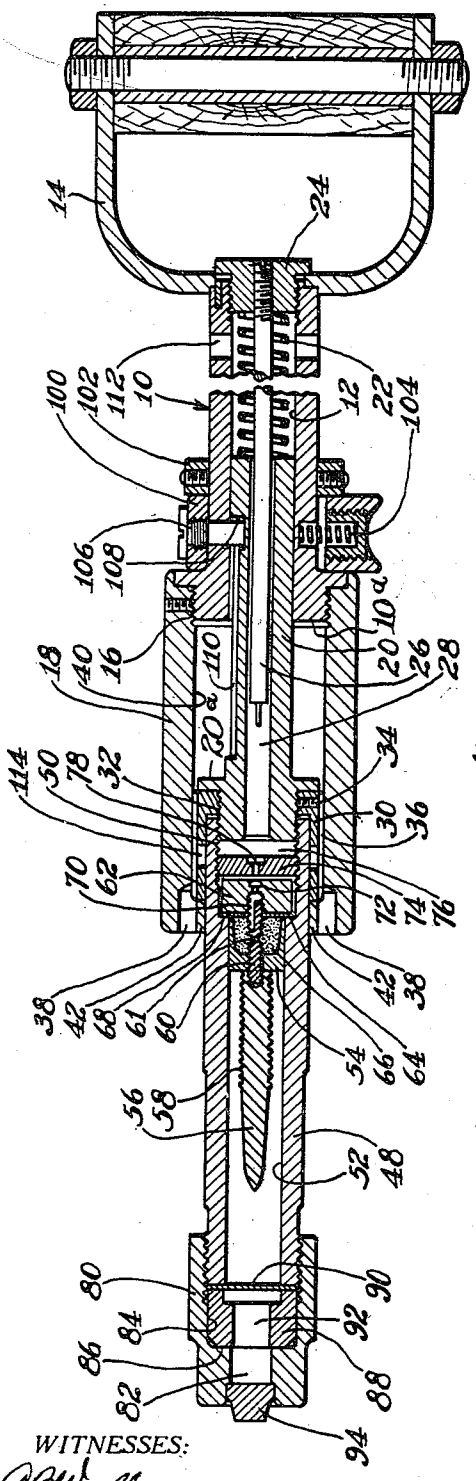

Fig. 1.

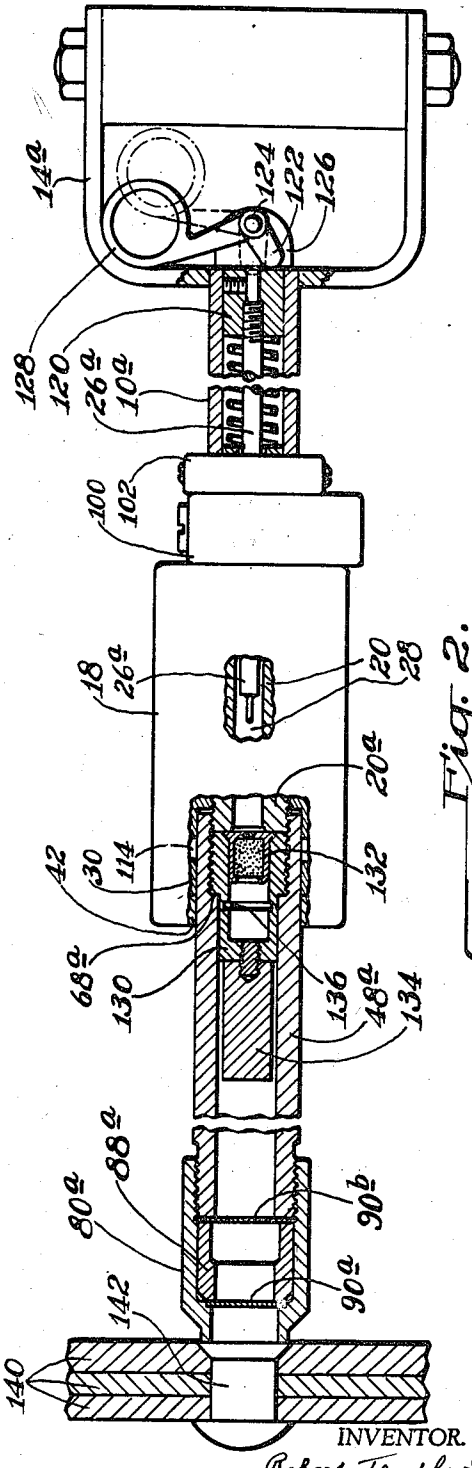

Fig. 2.

WITNESSES:
A. H. Wallace.
A. H. Oldham

INVENTOR.
Robert Temple Jr.
BY Brown, Critchlow & Flick
his ATTORNEYS.

Sept. 3, 1940. R. TEMPLE, JR 2,213,435

TOOL

Filed Nov. 29, 1937 2 Sheets-Sheet 2

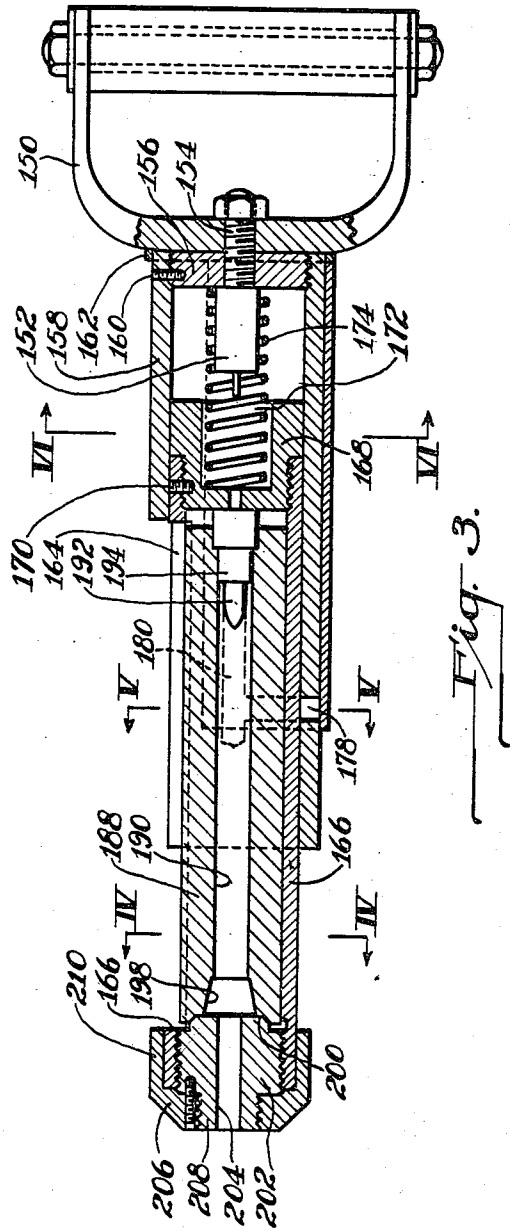

Fig. 3.

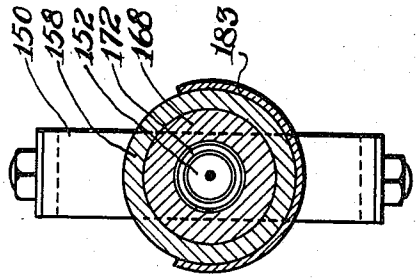

Fig. 6.

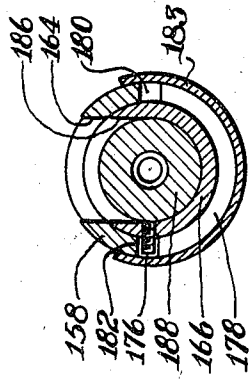

Fig. 5.

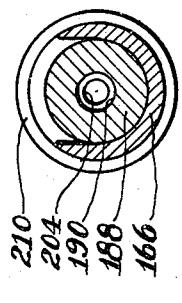

Fig. 4.

WITNESSES:
A. B. Wallace.
A. H. Oldham

INVENTOR.
Robert Temple Jr.

BY Brown, Critchlow & Flick
his ATTORNEYS.

Patented Sept. 3, 1940 2,213,435

UNITED STATES PATENT OFFICE

2,213,435

TOOL

Robert Temple, Jr., Pittsburgh, Pa.

Application November 29, 1937, Serial No. 177,067

16 Claims. (Cl. 164—47)

This invention relates to velocity power tools wherein a die, piercing pin or like element is driven by detonated explosive means to perform useful work and is particularly concerned with tools of this character adapted for use in or out of water and for facilitating ship repair as by the removal of rivets or the driving of connector elements through superimposed metal plates.

Velocity power tools of the type described have been provided heretofore but these have been open to certain objections. Often such tools can not readily be used or reloaded under water and, moreover, they have not been constructed to carry the explosive forces and the stresses on the parts of the apparatus directly to the stock or handle thereof. Further, I have found that known tools may on occasions be inadvertently fired with the attendant danger of injury to the operator, or persons or property near-by. Perhaps the best explosively operated tools known today and the only ones which have had any widespread use are those disclosed in my father's Patents Nos. 1,365,869 and 1,365,870. These tools have been proven to be quite satisfactory in use.

However, my present invention is concerned with further improvements to the apparatus disclosed in my father's patents.

It is the general object of my invention to avoid and overcome the above and other difficulties of and objections to certain known types of velocity power tools operated by detonated explosive charges and this is accomplished by the provision of improved tools which can not be accidentally fired, which are relatively lightweight but strong and rugged, and which can be readily operated and reloaded both in and out of water.

Another object of my invention is to provide an improved explosively operated tool in which the forces of the powder charge when detonated are absorbed directly by the stock and handle of the apparatus.

Another object of the invention is the provision of an improved tool of the character described, which is capable of knocking out rivets and which can be readily operated and reloaded under water.

The foregoing and other objects of my invention are achieved by the provision of an explosively actuated tool including a stock, a firing pin adapted to be fixedly held in the stock, a barrel slidably carried in the stock, a projectile tool received in the barrel, and a powder charge and detonator behind the tool and the barrel. The barrel is adapted to be moved back into the stock to engage the firing pin and the detonator and to simultaneously engage the inner end of the barrel with the stock so that the back-fire of the detonated powder charge is carried directly to the stock. Means are included in the combination for locking the barrel positively in its outermost position and these means may include other means for repositioning the firing pin so that the apparatus can not accidentally be fired. I further preferably include in the combination a barrel carrier in the stock and surrounding the firing pin, and quickly releasable means for securing the barrel and barrel carrier together whereby reloading of the apparatus is facilitated both in and out of water. I have discovered further that by shaping the projectile tool in the form of a punch I am able to knock out instantaneously and quietly either flat-head, round-head or countersunk rivets by driving the punch through the axis of the rivet to punch out the stem.

For a better understanding of my invention reference should be had to the accompanying drawings in which Fig. 1 is a longitudinal cross-sectional view of one embodiment of my invention; Fig. 2 is a view similar to Fig. 1 but with only portions of the apparatus being shown in section and illustrates another embodiment of my invention; Fig. 3 is a view similar to Figs. 1 and 2 and shows still another form of my invention; and Figs. 4, 5 and 6 are transverse cross-sectional views taken on lines IV—IV, V—V, and VI—VI, respectively, of Fig. 3.

While the principles of my invention can be used broadly to construct a variety of tools capable of use in many relations, they are particularly beneficial in the manufacture of tools of the driver type in which a projectile tool, such as a punch, die, pointed pin, or the like is adapted to be driven with high force and velocity against work, such as superimposed plates, positioned against the end of the apparatus. Hence my invention will be described in conjunction with driver types of tools and has been so illustrated.

Referring particularly to Fig. 1, the numeral 10 indicates generally a stock having a longitudinal bore 12 therethrough and a handle 14 secured to the end of the stock. The end of the stock 10 opposite the handle 14 is preferably formed of an enlarged external diameter to which is secured, as by complementary threads 16, a barrel guard 18 which forms in effect a continuation of the stock 10. The barrel guard 18 may be made integral with the stock 10 but this is not preferred inasmuch as the construction, assembly and repair of the parts is greatly facilitated by the two-part construction described.

Slidably received in the bore 12 of the stock 10 is a barrel carrier 20 which is normally urged by a helical compression spring 22 outwardly of the stock 10. A plug 24 closes the end of the bore 12 of the stock 10 adjacent the handle 14 and likewise serves to support a firing pin 26 axially of the bore 12, which pin extends into a longitudinal aperture 28 provided in the barrel

carrier 20. The barrel carrier 20 is formed of an enlarged external diameter at its end remote from the spring 22 and has secured thereto a carrier retainer 30. This may be accomplished as illustrated in the drawing, by complementary threads 32 and locking screws 34.

The carrier retainer 30 is provided with longitudinally extending grooves 36 which are open at the carrier end to the inside of the guard 18 and which extend at their other ends into communication with holes 38 drilled at circumferentially spaced points into the end of the barrel guard 18. The carrier retainer 30 has sliding engagement with the inner surface 40 of the barrel guard 18, as will be evident from the drawings. The end of the barrel guard 18 adjacent the holes 38 is formed with an internal flange 42 which retains the barrel carrier 20 and the carrier retainer 30 in the barrel guard by engagement of the carrier retainer 30 with the flange.

A barrel, indicated as a whole by the numeral 48, includes an internally threaded end 50 adapted to be screwed over the threaded end of the barrel carrier 20, as is illustrated in the drawings so that the barrel carrier 20 in effect forms a continuation of the barrel. The end 50 of the barrel slides within the flange 42 of the barrel guard and within the carrier retainer 30 so that a readily releasable threaded connection is provided between the barrel and the barrel carrier 20. The barrel 48 is formed with a bore 52 which receives a cup 54 carrying a projectile tool, such as a pointed pin 56 having a threaded back portion 58. The pin 56 is secured to the cup 54 by a threaded rod 60 which also secures the cup to a primer block 62 with an interspaced cartridge sealing washer 64 serving to seal a body of explosive powder 66 within the cup 54. The rod 60 is preferably formed with a center portion 61 of reduced diameter so that the rod breaks in the operation of the apparatus as hereinafter described.

As illustrated in the drawings, the primer block 62 and sealing washer 64 are of greater over-all diameter than the cup 54 and engage with a shoulder 68 formed in the barrel. A flash slot 70 in the threaded rod 60 connects the primer cap 72 of the primer block with the powder 66 in the cup 54. The entire cartridge assembly is normally held in place in the barrel 48 by a breech nut 74 threaded to removably fit within the threaded end 50 of the barrel. The breech nut 74 includes a transverse wrench receiving slot 76 which permits the introduction of the end of the firing pin 26 into a longitudinal aperture 78 in the breech nut so that the firing pin can strike the primer cap 72.

The end of the barrel 48 opposite to the breech is externally threaded and receives a muzzle cap 80 having a longitudinal bore 82 and an enlarged bore 84 terminating in a shoulder 86. The bore 84 receives an arresting block 88 which engages with the shoulder 86 and which functions to clamp a muzzle sealing disc 90 of relatively soft metal, such as copper, against the end of the barrel 48. The arresting block 88 is formed with a reduced bore 92 and associated shoulder which, in the operation of the apparatus, engages with the cup 54 to prevent its movement out of the end of the barrel to thereby prevent the escape of the explosive gases and reduce the noise of the operation of the apparatus. A centering plug 94 is mounted in the end of the bore 82 of the muzzle cap 80 and serves to center the apparatus over a work piece without interfering with the normal operation of the piercing pin 56 since the centering plug is made of relatively soft, easily displaced metal or if made of harder metal is made relatively thin.

Incorporated with my improved apparatus just described are means for positively locking the barrel carrier 20 in its outermost position and in the embodiment of my invention illustrated these means include a ring 100 extending around the stock 10 and secured in position by a collar 102. The internal diameter of the ring 100 is slightly greater than the external diameter of the stock so that it can be moved in a radial direction with respect to the stock. Normally the ring 100 is held to one side of the stock 10 as by compression spring 104 having an end received in a suitable recess in the stock and positioned in diametrically opposite relation to a pin 106 secured to the ring 100 and extending through a radial hole in the stock 10. Pin 106 is received at its radially inner end in a recess 108 formed in the barrel carrier 20. The barrel carrier 20 is further provided with a longitudinal groove 110 in alignment with the recess 108 but of less depth than the recess.

Completing my improved apparatus are radial apertures 112 in the stock 10 adjacent the handle 14 to permit the escape of liquid within the stock and between the plug 24 and the barrel carrier 20. Likewise I form the carrier retainer 30 with radial apertures 114 to permit the escape of any liquid from between the end 50 of the barrel and the barrel carrier 20 or the retaining means 30 during the assembly or operation of the parts.

In the operation of the apparatus just described, the cartridge is first assembled in the removed barrel 48 by inserting it into position, as shown, and then tightening the breech nut 74 firmly into place. The other end of the barrel 48 is provided with a sealing disc 90, muzzle cap 80 and if desired with a centering plug 94. Now with the pin 106 of the positive locking means in firm engagement with the recess 108 so that the barrel carrier 20 is in its outermost position, the end 50 of the barrel 48 is slipped in the flange 42 of the barrel guard 18 and within the carrier retainer 30 until its internally threaded end is in engagement with the threaded end of the barrel carrier. Relative rotary movement of the parts now effects a quickly releasable but positive and tight connection between the barrel 48 and the barrel carrier 20. With the parts in this position the tool can be handled substantially as desired and can not accidentally be fired.

When it is desired to operate the apparatus, the end of the barrel carrying the muzzle cap 80 is positioned with respect to the work and, if the centering plug 94 is used, so that the plug aligns the apparatus and the work. Now the ring 100 adjacent the spring 104 is pressed radially to move the locking pin 106 out of the recess 108, and pressure on the handle 14 moves the locking pin 106 out into the groove 110 of the barrel carrier 20 and the barrel carrier moves back into the bore 12 of the stock 10 against the action of the spring 22. Continued movement of the handle toward the barrel moves the barrel guard 18 over the barrel 48 and brings the firing pin 26 into detonating engagement with the primer cap 72. This causes the explosion of the powder charge 66 which, after a predetermined force has been reached by the charge, breaks the threaded rod 60 near its weakened portion 61 and moves the cup 54 and pin 56 rapidly and with great

force through the barrel 48 to pierce the sealing disc 90 and the centering plug 94 so that the pin is driven into the work at least up to the threaded portion 58. The cup 54 engages with the shoulder of the arresting block 88 and the pin 56 pulls loose from the short threaded end of the threaded rod 60.

At the time of firing, the barrel carrier 20 is back in the barrel guard 18 and is substantially in engaging relation with the end of the stock 10. Specifically, the surface 20a of the barrel carrier 20 engages with the surface 10a of the end of the stock 10. Thus the kick backward of the barrel 48 upon the forward movement of the cup 54 and pin 56 is directly carried to the barrel carrier 20 and to the stock 10 and into the handle 14 held by the operator. After firing, the handle 14 and stock 10 are moved away from the work and the spring 22 forces the barrel carrier 20 and the barrel 48 outwardly of the stock 10 and barrel guard 18 until the end of the carrier retainer strikes the flange 42, at which time the parts are in the original full line position except that the pin 56 has been fired out of the barrel. At this time the pin 106 drops into the recess 108 and the barrel 48 can be unscrewed.

Ordinarily in under-water operation when it is desired to fire the apparatus a second time, a complete new barrel with the cartridge assembly therein is screwed into place on the barrel carrier. However, in operation above water a new cartridge assembly can be substituted for the discharged cartridge while making use of the same barrel and this can be accomplished by removal of the barrel from its holder and the removal of the muzzle cap 80 from the barrel. The sealing washer 90 is ordinarily replaced although this is not necessary for use of the tool above water. The holes 112, 38 and 114 permit the assembly and operation of the parts in or out of water or other liquid without jamming, as will be recognized, and in operation in water the parts of the apparatus which would be affected by water are carefully sealed against the entrance of water so that the apparatus is particularly adapted for ready and repeated operation below the surface of water.

In the embodiment of my invention illustrated in Fig. 2 many of the parts are similar to those illustrated in Fig. 1 and described above in detail, and where this is true the parts have been indicated by the same numerals except that the suffix *a* has been added.

One important difference in the apparatus of Fig. 2 is that the firing pin 26a is secured to a plug 120 which plug is slidably mounted in the end of the stock 10a adjacent the handle 14a of the apparatus. The plug 120 is normally in the full line position illustrated and is held against movement out of the stock 10a by a bell crank 122 pivotally mounted as at 124 upon a pair of lugs 126 provided on the handle 14a. With the plug 120 in the full line position shown, the firing pin 26a is slightly retracted so that the parts can never be moved into detonating relation. The bell crank 122 is provided with a ring 128 at the end of its arm remote from the plug 120 so that the operator can readily stick his finger through the ring and move the bell crank 122 from the full-line position shown to the dotted-line position, which moves the plug 120 into the stock 10a a short distance and thus carries the firing pin 26a forward to operating position.

Instead of employing the cartridge assembly illustrated and described in conjunction with Fig. 1, the embodiment of my invention shown in Fig. 2 employs a cartridge assembly of the type shown in my Patent No. 2,064,503. This assembly includes a cylindrical member 130 slidably received in the breech portion of the barrel 48a and held against movement out of the breech portion and through the barrel by cooperating shoulders 68a. The cylindrical member 130 is formed in effect of two parts, namely a cup or piston and a breech portion. These parts may be made separately and connected together in any way so that the breech portion removably receives a blank cartridge 132 and the piston or cup portion carries a tool, such as a punch 134. Upon detonation of the blank cartridge 132 the breech portion of the cylindrical member 130 remains fixed in the barrel 48a between the shoulder 68a and the end of the barrel carrier 20a. The cup portion of the cylindrical member is retained in engagement with the breech portion until the force of the detonated blank cartridge exceeds a predetermined maximum, at which time the full force of the powder charge is realized and the cup portion of the cylindrical member is moved away from the breech portion.

While the exact type of connection between the cup portion and the breech portion of the cylindrical member 130 can take a variety of forms to obtain the function just described, it is convenient to make the cylindrical member 130 from an integral piece and to provide a groove 136 or other zone of weakness between the cup portion and the breech portion of the cylindrical member. The thickness of the metal beneath the groove 136 controls the breaking force required to separate the cup portion and the breech portion of the cylindrical member 130.

The muzzle cap 80a of the apparatus is removably secured as by complementary threads to the end of the barrel 48a and an arresting block 88a is secured between the end of the barrel and the muzzle cap. Sealing discs 90a and 90b are clamped at the ends of the arresting block 88a so as to prevent the entrance of liquid into the barrel 48a when the apparatus is used under water.

The embodiment of my invention just described is particularly adapted to knock out rivets or perform similar operations under water to facilitate ship repair or the like. Thus, I have specifically shown in the drawings a plurality of plates 140 secured together by a rivet 142 of any known type including either countersunk, flat or round heads. In the operation of the apparatus, which is similar to that above described and which will not be repeated in detail, the axis of the apparatus is aligned with the axis of the rivet 142 with the muzzle cap 80a against the rivet head. The punch 134 is of a size slightly less than the diameter of the rivet body and in the operation of the apparatus is driven with high force and velocity against the rivet head to punch the stem of the rivet out of the rivet hole and release the plates 140.

In the punching operation the cup portion of the cylindrical member 130 engages with the arresting block 88a to prevent the escape of gases from within the barrel 48a and thus eliminate noise and shock in the use of the apparatus. The relatively short threaded connection between the punch 134 and the cylindrical member 130 is severed, usually by stripping of the thread, to permit the above-stated operation of the punch. The repeated use and reloading of the apparatus in or out of water is facilitated by changing the

complete barrel although it should be understood that in use out of water the same barrel can be used over and over again by providing a new cartridge assembly and sealing discs if desired. In this connection it should further be appreciated that with the apparatus of either the form shown in Fig. 1 or the form shown in Fig. 2 I am able to use a punch, die, pointed pin or other shaped projectile in the same barrel and that barrels carrying different types, sizes and weights of projectiles and different types or sizes of cartridges or powder charges are readily interchangeable with each other and the tool can be adapted to perform work of any desired character.

The form of my invention shown in Figs. 3 to 6 differs from those illustrated in Figs. 1 and 2 in that the apparatus of Figs. 3 to 6 is not adapted, ordinarily, for use under water but is most advantageously employed above water where it can be readily reloaded in the field in a minimum of time and without special tools. Having particular reference to Figs. 3 to 6 the numeral **150** indicates a handle to which is secured a firing pin **152** by bolt **154**. The bolt **154** likewise secures a disc **156** to the handle which is externally threaded to engage with the internal threaded end of a stock **158**. A screw **160** may be provided to secure the disc **156** and stock **158** together at all times and a circular flange **162** may be provided on the handle **150** to receive the end of the stock **158**. The stock **158** is of tubular shape near the handle **150** as best seen in Fig. 6, but is provided adjacent its end remote from the handle with a longitudinal slot or opening **164** illustrated in Figs. 3 and 5 which opening extends somewhat more than half the length of the stock and which is of such width as to receive a barrel as hereinafter described.

Slidably received in the stock **158** is a tube or barrel carrier **166** to which is secured a breech block **168** also adapted to be slidably received in the stock **158**. The breech block and tube have been illustrated as being connected together by complementary threads which are held against movement apart by a screw **170**. The breech block **168** is formed with a cup-shaped cavity **172** which receives one end of a coil compression spring **174** having its other end surrounding the firing pin **152**. It will be recognized that the spring **174** normally pushes the tube **166** and breech block **168** outwardly of the stock **158**. The outward movement of the tube **166** in the stock **158**, as influenced by the spring **174**, is limited by a pin **176** secured to the tube and received in a slot **178** which extends circumferentially of the stock through approximately 180 degrees. At one end of the circumferential slot **178** the stock **158** is formed with a longitudinally extending slot **180** which, as shown in Fig. 3, is of such length as to receive the pin **176** and permit movement of the tube **166** inwardly of the stock **158** until the firing pin **152** is forced into operating relation with the breech block **168** as hereinafter described. At the other end of the circumferential slot **178** a short longitudinal slot **182** is provided which extends in the stock only in a direction away from the handle **150**. When the pin **176** is received in the slot **182**, as shown in Fig. 5, the apparatus can not be operated since the tube **166** can not be pushed back into the stock **158** because the pin **176** engages with the end of the slot **182** adjacent the end of the circumferential slot **178**. The slots **178**, **180** and **182** are covered by a U-shaped metal shell **183** which is secured tightly around the stock **158** so that an operator's fingers cannot be pinched in the slot and so the slots are kept free of foreign matter.

The tube **166** like the stock **158** is formed with a longitudinal slot or opening **186** which is of the same transverse size as the opening **164**. The openings **164** and **186** are of a width substantially equal to the internal diameter of the tube **166** and permit the lateral movement into the tube **166** of a barrel **188** formed with a longitudinal bore **190** and provided at one end with a breech which removably receives a working element **192** and explosive means **194** including a detonator portion adapted to register with the breech block **168**. The working element, explosive means, and detonator constitute preferably a unitary element which can be readily dropped into the breech portion of the barrel and which can be plucked out after firing simply by hand or with the aid of ordinary tools, such as a pair of pliers.

The end of the barrel **188** opposite the breech portion is usually formed with a flared bore **198** and a recessed or shouldered portion **200** adapted to cooperate with an arresting block **202** having a longitudinal bore **204** therethrough of such a diameter as to readily permit the passage of the working element **192** therethrough but too small to permit the passage of any piston or cup associated with the explosive means **194** as heretofore described. The arresting block **202** is adjustably mounted on the end of the tube **166** and a satisfactory manner of accomplishing the desired result is to provide internal threads at the end of the tube and to externally thread the arresting block **202**. A knurled knob **206** is secured to a projecting boss **208** on the arresting block and is provided with a flange **210** extending slidably over the end of the tube **166**. Thus rotation of the knob **206** moves the arresting block **202** in and out of the end of the tube **166** to tighten the barrel **188** in place in the tube or to permit it to be removed laterally from the tube through the openings **186** and **164**.

In the operation of this embodiment of my invention a barrel **188** is provided with a working element, explosive means and detonator unit at its breech end and with the arresting block **202** screwed partly out of the end of the tube **166** and with the openings **164** and **186** in alignment the breech end of the barrel **188** is dropped through the aligned openings and substantially into engagement with the breech block **168**. The muzzle end of the barrel is then moved laterally through the openings into position in axial alignment with the arresting block **202**. The knob **206** is now tightened to clamp the arresting block **202** against the muzzle end of the barrel **188** and to force the breech end of the barrel and particularly the detonator portion of the explosive means tightly into engagement with the breech block **168**.

The barrel, the working element and the explosive means are now securely locked in the tube **166** but with the openings **164** and **186** in alignment the apparatus can not be fired since the pin **176** prevents movement of the tube **166** towards the handle end of the stock **158**. Thus after loading as just described the tube **166** and barrel **188** must be moved through 180 degrees with respect to the stock **158** before the apparatus can be fired. In this movement of the parts the operator grips the handle **150** with one hand and with the other holds the tube **166** so that by combined movement of his hands together and

a relative rotary movement thereof the pin 176 is moved out of the short slot 182 where it has been held by the spring 174, circumferentially through the slot 178 and into the short portion of the slot 180 most remote from the handle 150. In this position the opening 164 will be diametrically opposite the opening 186 as will be understood.

The apparatus is now ready to be fired which can be readily accomplished by engaging the arresting block 204 with the work and depressing the handle 150 towards the work. In this depressing movement of the handle the tube 166 slides back in the stock 158 toward the handle 150 with the pin 176 sliding in the long slot 180 until the firing pin 152 strikes the detonator portion of explosive means 194 to detonate the explosive. The detonated explosive then drives the working element 192 usually with the aid of a piston or cup forwardly through the bore 190 of the barrel 188 and through the bore 204 of the arresting block 202 and into the work to perform the desired function. The arresting block 202 stops the cup or piston of the explosive means and prevents the escape of gases so that the noise and flame usually attending an explosion is eliminated. Once the apparatus has been fired the pressure on the handle 150 is released and the spring 174 forces the breech block and tube outwardly of the stock 158. Relative rotary movement of the tube 166 and stock 158 through 180 degrees realigns the openings 164 and 186. Rotary movement of the knob 206 away from the barrel 188 releases it so that the barrel can be tipped sideways out of the aligned openings. The discharged cartridge element is then removed from the barrel and the apparatus is again reloaded as above described and the operation is repeated. It will be recognized that reloading is relatively simple and fast and that a large number of desired working operations can be performed by a single operator in a short time.

From the foregoing it will be recognized that the objects of my invention have been achieved by the provision of relatively simple but sturdy and long-wearing velocity power tools of the driver type which are capable of ready and continued use in or out of water. The stresses of operation are absorbed directly by the stock and handle of the apparatus and one or more positively acting safety mechanisms are incorporated in the structure to completely prevent accidental operation thereof.

Although I have specifically illustrated and described two embodiments of my invention, it should be understood that my invention is not limited thereto or thereby but is defined in the appended claims.

I claim:

1. In combination, a barrel, a breech on the barrel adapted to receive a projectile and an explosive charge, a barrel carrier removably carrying the barrel, a breech block on the carrier closing the breech end of the barrel when carrying the barrel, a stock slidably supporting the barrel carrier, a firing pin supported in the stock, and resilient means yieldably holding the barrel carrier outwardly of the end of the stock carrying the firing pin but allowing the carrier to be moved into the stock to force the firing pin through the breech block.

2. An explosively actuated tool including a stock, a firing pin associated with the stock, a barrel slidably carried in the stock and having a breech portion adapted to receive a powder charge, said barrel being movable back into the stock to engage the breech portion of the barrel with the stock, said firing pin being positioned to be in operative relation with the breech portion of the barrel only when the breech portion is back against the stock, means for locking the barrel in its outermost position, a barrel carrier in the stock and surrounding the firing pin, and quickly releasable means for securing the barrel and barrel carrier together.

3. An explosively actuated tool including a stock, a firing pin adapted to be fixedly held in the stock, a barrel slidably carried in the stock and having a breech portion at its inner end, said barrel being adapted to be moved back into the stock to position the firing pin in the breech portion and simultaneously engage the inner end of the barrel with the stock, means for locking the barrel in its outermost position, a barrel carrier in the stock and surrounding the firing pin, and quickly releasable means for securing the barrel and barrel carrier together.

4. An explosively actuated tool including a stock, a firing pin adapted to be fixedly held in the stock, manually operable means for quickly changing the fixedly held position of the firing pin from firing to non-firing position, a barrel slidably carried in the stock and having a breech portion at its inner end, said barrel being adapted to be moved back into the stock to position the firing pin in firing position with the breech portion and simultaneously to engage the inner end of the barrel with the stock, means for locking the barrel in its outermost position, a barrel carrier in the stock and surrounding the firing pin, and quickly releasable means for securing the barrel and barrel carrier together.

5. An explosively actuated tool including a stock, a firing pin adapted to be fixedly held in the stock, a barrel slidably carried in the stock and having a breech portion at its inner end, said barrel being adapted to be moved back into the stock to position the firing pin in firing relation with the breech portion and simultaneously to engage the inner end of the barrel with the stock, and a removable barrel guard secured to the stock and extending over the barrel in sliding relation therewith.

6. An explosively actuated tool including a stock, a firing pin adapted to be fixedly held in the stock, a barrel slidably carried in the stock and having a breech portion at its inner end, said barrel being adapted to be moved back into the stock to position the firing pin in firing relation with the breech portion, a ring around the stock of greater internal diameter than the outside of the stock, means holding the ring against endwise movement on the stock, a pin secured to the ring and extending through the stock into releasable engagement with a recess on the barrel, and resilient means on the ring holding the pin normally in engagement with the recess.

7. An explosively actuated tool including a stock, a firing pin associated with the stock, a barrel carrier slidably mounted in the stock and surrounding the firing pin, a barrel, quickly releasable means for securing the barrel and barrel carrier together, and means normally holding the barrel carrier outwardly of one end of the stock but allowing the barrel carrier to be moved back into the stock to position the end of the barrel adjacent the firing pin.

8. An explosively actuated tool comprising a stock having a longitudinal bore therethrough, a handle secured to the stock, a barrel guard se-

cured to an end of the stock and having a longitudinal bore, a barrel slidably received in the bore of the barrel guard, a barrel carrier slidably received in the bore of the stock and having a threaded end adapted to be threaded in breech block relation with the end of the barrel, a firing pin extending axially through the bore of the stock and through an axial bore in the barrel carrier and secured at one end of the stock adjacent the handle, and resilient means urging the barrel carrier outwardly of the stock.

9. An explosively actuated tool comprising a stock having a longitudinal bore therethrough, a handle secured to one end of the stock, a barrel guard secured to the other end of the stock and having a longitudinal bore, a barrel slidably received in the bore of the barrel guard, a barrel carrier slidably received in the bore of the stock and having an end adapted to be removably secured in breech block relation with the end of the barrel, a firing pin extending axially through the bore of the stock and through an axial bore in the barrel carrier and secured at one end of the stock adjacent the handle, and a centering plug associated with and closing the end of the muzzle end of the barrel.

10. An explosively actuated tool comprising a stock having a longitudinal bore therethrough, a handle secured to one end of the stock, a barrel guard secured to the other end of the stock and having a longitudinal bore, a barrel slidably received in the bore of the barrel guard, a barrel carrier slidably received in the bore of the stock and having a threaded end adapted to be threaded in breech block relation with the end of the barrel, a firing pin extending axially through the bore of the stock and through an axial bore in the barrel carrier and secured at one end of the stock adjacent the handle, resilient means urging the barrel carrier outwardly of the stock, a manually releasable lock positively holding the barrel carrier at the outermost portion of its travel in the stock, and a centering plug associated with and closing the end of the muzzle of the barrel.

11. An explosively actuated tool comprising a stock having a longitudinal bore, a firing pin mounted at one end of the stock, a tube slidably mounted in the stock, a breech block closing the end of the tube adjacent the firing pin, resilient means normally but yieldably holding the breech block away from the firing pin, a barrel removably carried by the tube, a breech on the barrel adjacent the end next to the breech block, an arresting block removably and adjustably secured to the end of the tube remote from the firing pin and adapted to clamp the barrel in the tube against the breech block, said tube and stock having lateral openings formed therein to permit the introduction or removal of the barrel laterally when the arresting block is backed off, and means connecting the tube and the stock whereby the lateral openings thereof can be moved into and out of register and the tube moved back into firing position only when the lateral openings are not in register.

12. An explosively actuated tool comprising a stock having a longitudinal bore, a firing pin mounted at one end of the stock, a tube slidably mounted in the stock, a breech block closing the end of the tube adjacent the firing pin, resilient means normally but yieldably holding the breech block away from the firing pin, a barrel removably received by the tube, means removably and adjustably secured to the end of the tube remote from the firing pin and adapted to clamp the barrel in the tube against the breech block, said tube and stock having lateral openings formed therein to permit the introduction or removal of the barrel laterally when the arresting block is backed off, and means connecting the tube and the stock whereby the lateral openings thereof can be moved into and out of register and the tube moved back into firing position only when the lateral openings are not in register.

13. An explosively actuated tool comprising a tube, a breech block closing one end of the tube, a barrel removably received by the tube, a breech on the barrel adjacent the end next to the breech block, means adjustably secured to the end of the tube remote from the breech of the barrel and adapted to clamp the barrel in the tube against the breech block, said tube having a lateral opening formed therein to permit the introduction or removal of the barrel laterally when the adjustable means secured to the tube is backed off, and mechanism for firing an explosive charge carried by the barrel and capable of operation only after complete loading of the tool.

14. An explosively actuated tool comprising a tube, a breech block closing one end of the tube, a barrel removably received by the tube, a breech on the barrel adjacent the end next to the breech block, and means adjustably secured to the other end of the tube and adapted to clamp the barrel in the tube and longitudinally against the breech block, said tube having a lateral opening formed therein to permit the introduction or removal of the barrel laterally when the adjustable means secured to the tube is backed off.

15. An explosively actuated tool comprising a stock having a longitudinal bore, a tube mounted in the stock, a breech block closing one end of the tube, a barrel removably received by the tube, a breech on the barrel adjacent the end next to the breech block, means removably and adjustably secured to the other end of the tube and adapted to clamp the barrel in the tube against the breech block, said tube and stock having lateral openings formed therein to permit the introduction or removal of the barrel laterally when the securing means is backed off, mechanism for detonating an explosive charge carried in the breech of the barrel, and means for operating the detonating mechanism only after complete loading of the tool.

16. An explosively actuated tool comprising a stock having a longitudinal bore, a tube mounted in the stock, a breech block closing one end of the tube, a barrel removably received by the tube, a breech on the barrel adjacent the end next to the breech block, and means removably and adjustably secured to the other end of the tube and adapted to clamp the barrel in the tube against the breech block, said tube and stock having lateral openings formed therein to permit the introduction or removal of the barrel laterally when the securing means is backed off.

ROBERT TEMPLE, JR.