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FIP8303 OR 1,349,414

K. DOUGAN.

SUBMARINE GUN.

APPLICATION FILED JUNE 19, 1915.

1,349,414. **Patented Aug. 10, 1920.**

4 SHEETS—SHEET 1.

Fig. 1

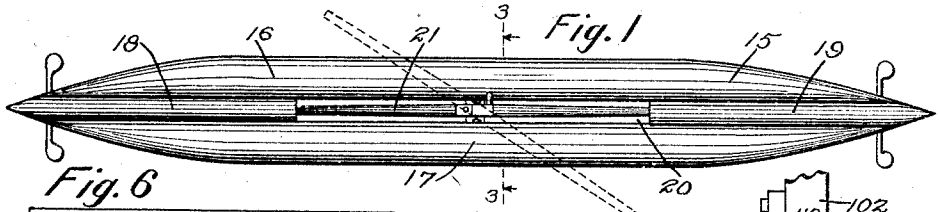


Fig. 6

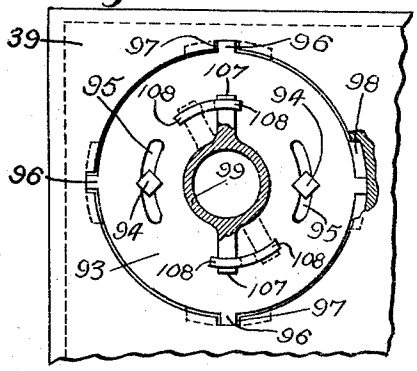


Fig. 7

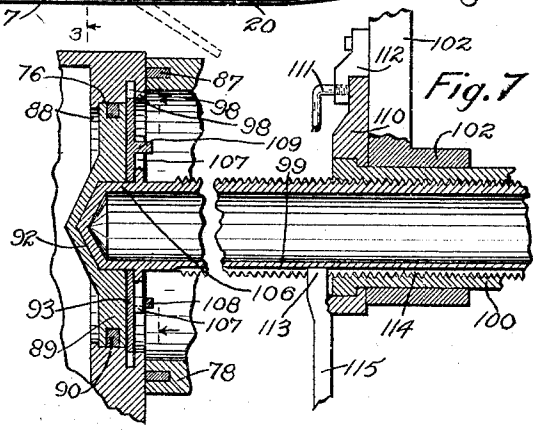


Fig. 2

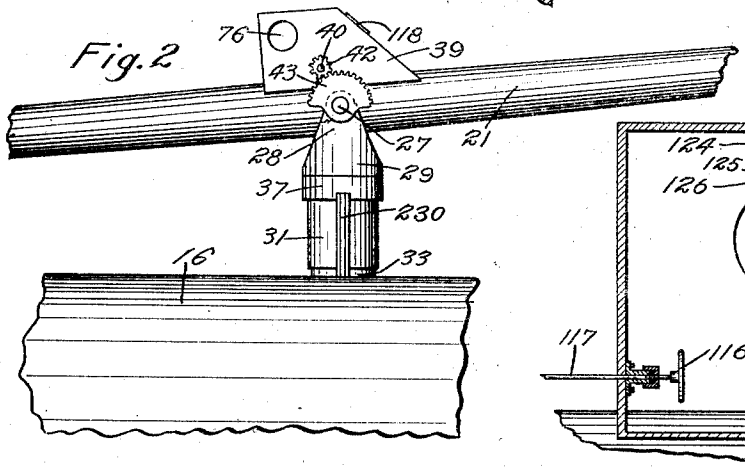


Fig. 8

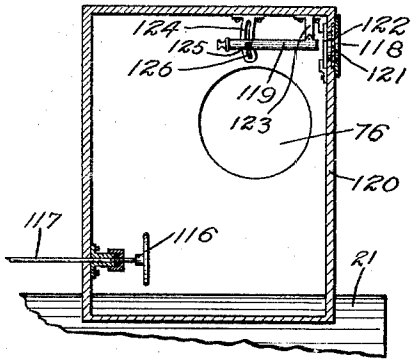


Fig. 9

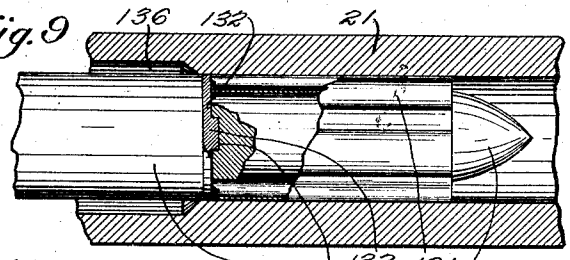
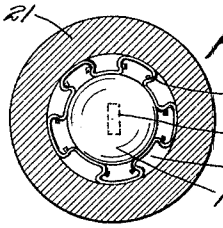


Fig. 10



Witnesses:
Alex Lagaard
N. A. Boothman

Inventor:
Kennedy Dougan
By H. A. Whiteley
his Attorney.

K. DOUGAN.

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4 SHEETS—SHEET 2.

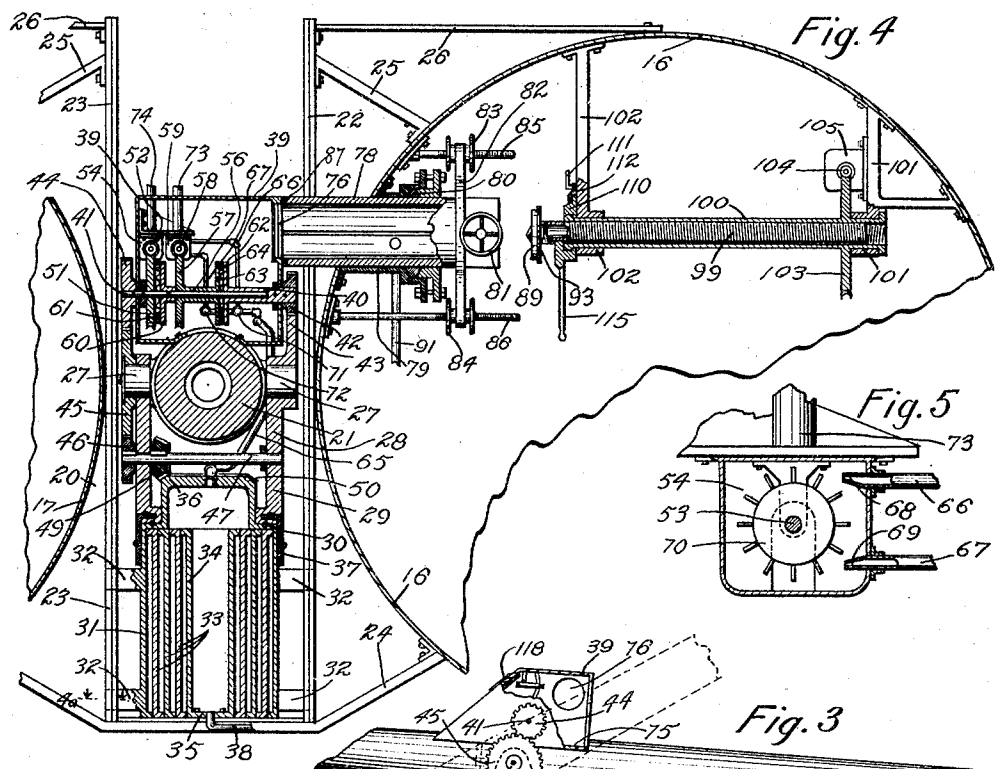


Fig. 4

Fig. 5

Fig. 3

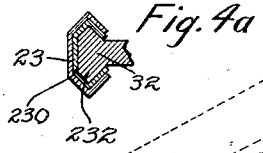


Fig. 4a

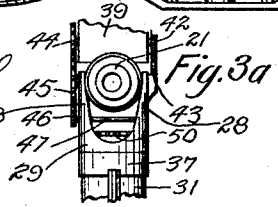


Fig. 3a

Witnesses:
Alex. Lagaard
H. A. Bowman.

Inventor:
Kennedy Dougan
By P. O. Whiteley
his Attorney.

K. DOUGAN.

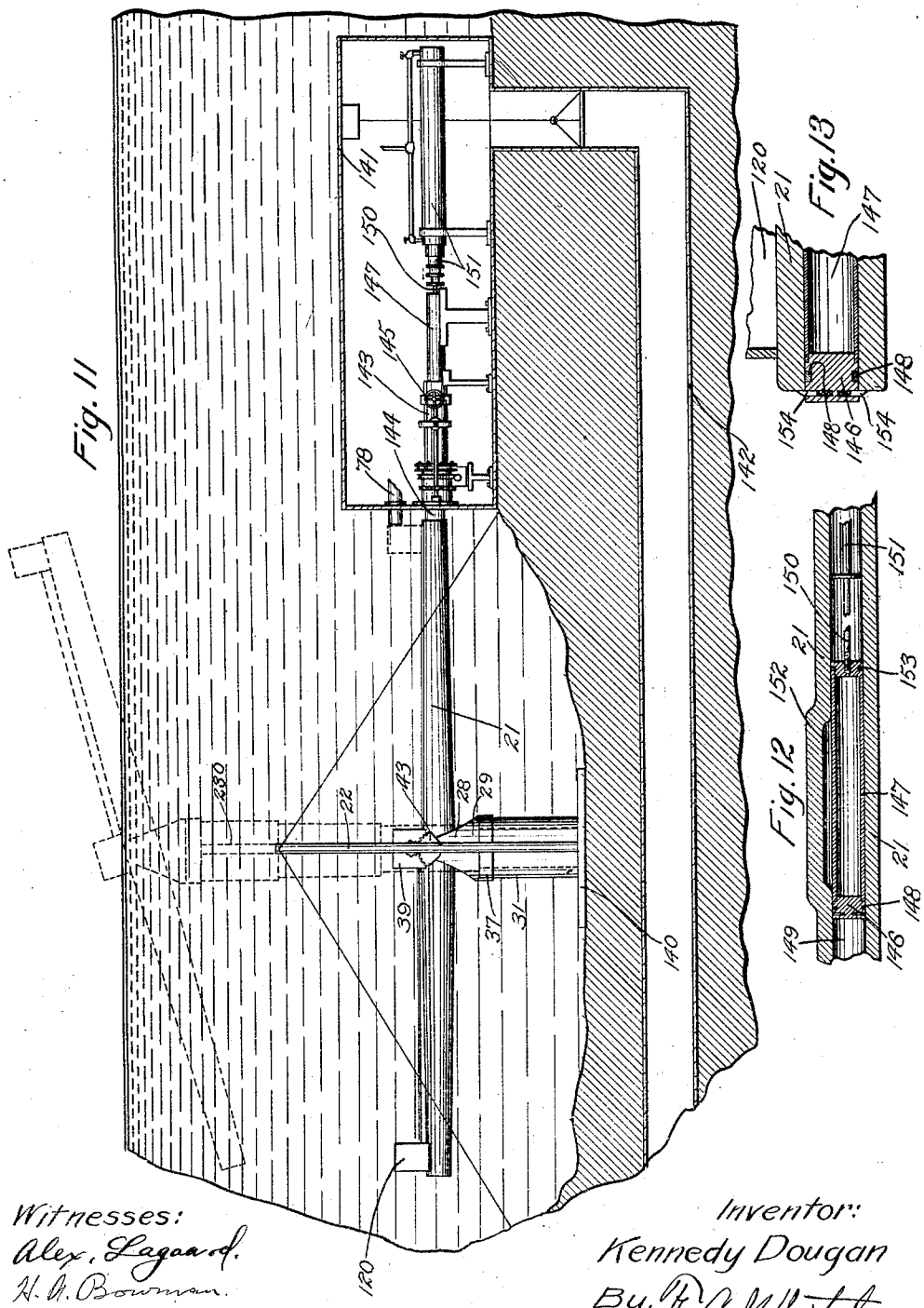
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4 SHEETS—SHEET 3.



Witnesses:
Alex. Lagaard.
H. A. Bowman.

Inventor:
Kennedy Dougan
By. F. A. Whiteley
his Attorney.

1.7

K. DOUGAN.

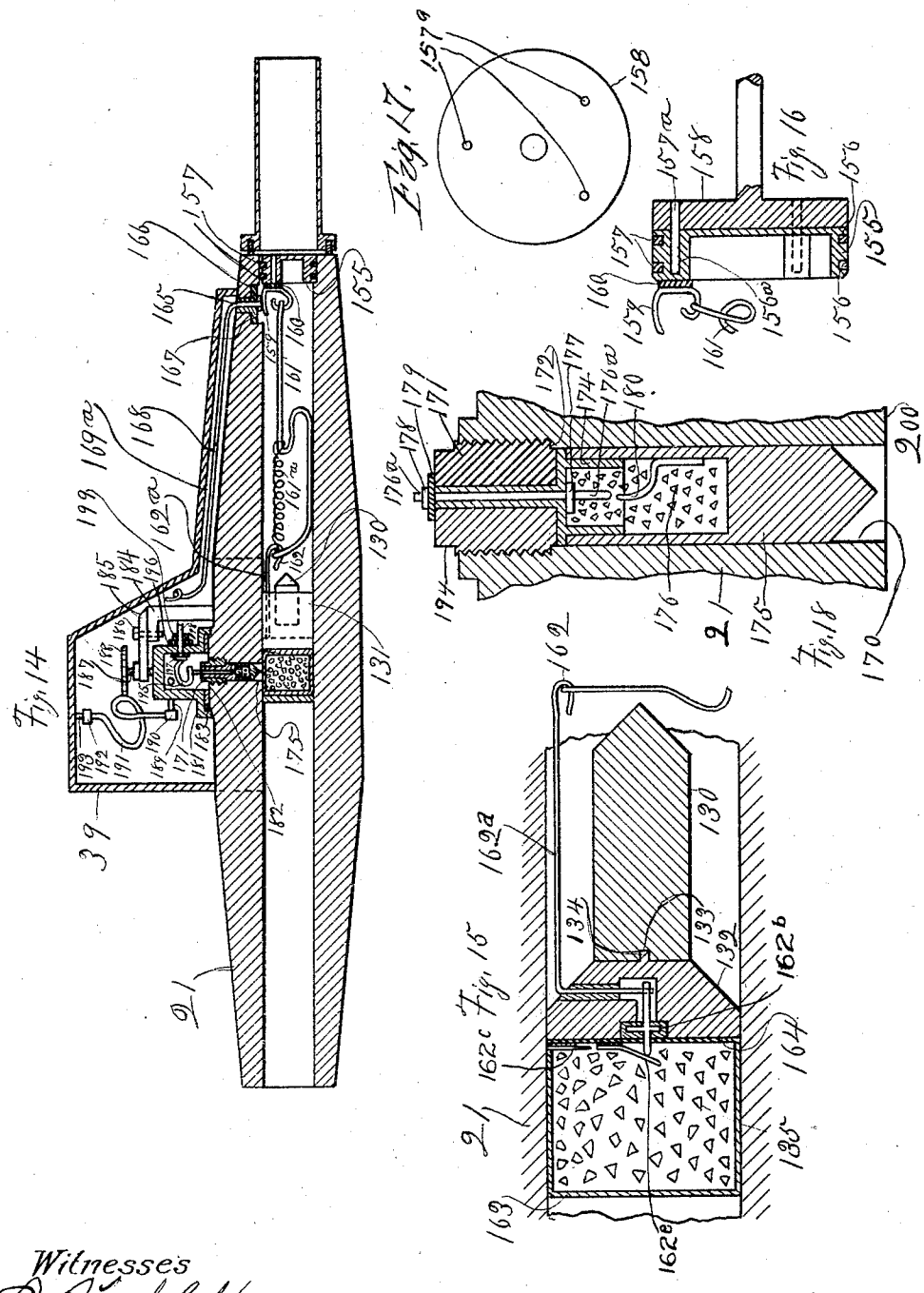
SUBMARINE GUN.

APPLICATION FILED JUNE 19, 1915.

1,349,414.

Patented Aug. 10, 1920.

4 SHEETS—SHEET 4.



Witnesses
D. D. Tufeldt
Fred Gardner

Inventor.
Kennedy Dougan

ORDNANCE,
1.7

UNITED STATES PATENT OFFICE.

KENNEDY DOUGAN, OF MINNEAPOLIS, MINNESOTA.

SUBMARINE GUN.

1,349,414. Specification of Letters Patent. Patented Aug. 10, 1920.

Application filed June 19, 1915. Serial No. 34,989.

To all whom it may concern:

Be it known that I, KENNEDY DOUGAN, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Submarine Guns, of which the following is a specification.

My invention relates to submarine guns and has for its object to provide means for controlling and firing a gun which has been loaded under water in the manner shown in my co-pending application, Serial Number 32,827, filed June 8, 1915, so as to elevate the gun from the point of loading to a point above the surface of the water and to control the gun after it is so elevated for training and firing. The gun may be a reactionless gun of the type shown in the aforesaid application, or may be an ordinary reaction gun; and it is not necessary that the gun be mounted upon a submarine war vessel, as the invention is capable of practice in a gun having connection with submarine fortifications or fixed loading chambers, where it may be loaded beneath the water and raised above the water for training and firing in exactly the same manner as herein shown and described.

In a battle between a submarine war vessel equipped with even one eighteen inch reactionless gun and several large sized battle-ships of the dreadnaught type, the battle-ships would, except for accident to the submarine, be most certainly destroyed. This is true because the battle-ships at two or three miles distance would present such a mark as could certainly be hit, and when struck by a projectile from an eighteen inch gun the injury to the battle-ship would most probably be fatal. On the other hand, the battle-ships would have nothing to shoot at but the gun which would be turned end toward the battle-ship during the brief period that the gun would be above the surface of the water for the purpose of firing. With the construction herein shown the gun can, of course, be fired on a very flat trajectory, or when the gun is tipped at a slight angle; but it is also true that the gun may be fired at high angles with only a few feet of the muzzle protruding above the water, as is the case in the gun of the aforesaid co-pending application.

These results are obtainable by the fact that the gun is supported upon trunnions on which it may be oscillated in a vertical plane coincident with the axis of the gun, the platform in which said trunnions are journaled being rotatably mounted upon a telescoping support. By the use of hydraulic pressure the support may be extended, thereby lifting the gun bodily out of the water above the submarine vessel or loading chamber to which the support is connected.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and are particularly pointed out in the claims.

In the drawings, illustrating the application of my invention in one form,—

Figure 1 is a plan view of a submarine war vessel having my improvements connected therewith. Fig. 2 is a fragmentary side elevation of a portion of the submarine war vessel showing the gun in elevated position. Fig. 3 is a similar view taken on line 3—3 of Fig. 1. Fig. 3ª is a fragmental end view of a portion of the gun shown in Fig. 3. Fig. 4 is an enlarged transverse sectional view of the parts shown in Fig. 3 with the telescoping support closed. Fig. 4ª is an enlarged sectional view on line 4ª of Fig. 4. Fig. 5 illustrates a form of motor which may be employed to operate the gun-controlling means. Fig. 6 is a plan view and Fig. 7 a side sectional view showing details of the means for obtaining admission to the firing chamber when the same is submerged, which is further shown in Fig. 4. Fig. 8 shows the position of a firing chamber at the muzzle end of the gun. Figs. 9 and 10 illustrate a form of shell which may be advantageously employed in large bore guns such as those preferably employed in the practice of the invention of this application. Fig. 11 is a sectional view showing the application of my invention to a permanent submerged fortification. Figs. 12 and 13 are sectional details showing the manner of plugging the muzzle end of the gun.

Figs. 14 to 18 inclusive show means for firing the gun.

Fig. 14 is a longitudinal, vertical section through the gun and gunner's casing.

Fig. 15 is an enlarged vertical section through the projectile and the explosive charge.

Fig. 16 is a vertical section, enlarged, through the disk for excluding water from the muzzle of the gun.

Fig. 17 is an elevation of the disk 155.

Fig. 18 shows an enlarged view of the main feature in the second mentioned means for exploding the charge.

In Fig. 1 is shown a submarine 15 of the type disclosed in my aforesaid co-pending application comprising a pair of shells 16 and 17 with connecting loading chambers 18 and 19 and a space 20 between the ends of the loading chambers and the aforementioned shells. The gun 21, here shown as of the reactionless type, as disclosed in my co-pending application above noted and in my co-pending applications, Serial Number 23,869, filed April 26, 1915, and Serial Number 32,471, filed June 13, 1908, renewed June 5, 1915, is carried by a supporting framework which is connected with the shells 16 and 17 so as to extend within the space 20 at a point approximately midway between the ends of loading chambers 18 and 19. The supporting framework shown in detail in Figs. 3 and 4 comprises a pair of guide standards 22 and 23 rigidly secured at their bottom upon a transverse frame system 24 rigidly connected with both shells 16 and 17, said framework extending across the bottoms of uprights 22 and 23, as clearly shown. At their upper portions the uprights 22 and 23 are firmly and powerfully braced to the shells 16 and 17 by frame members 25 and 26, said uprights being directly secured to the shells at an intermediate point. The gun 21 is provided with trunnions 27 which are journaled in brackets 28 extended from a supporting ring 29, which ring is supported by suitable ball bearings upon a flanged portion 30 of a cylinder 31 provided with guide members 32 engaging in the guide uprights 22 and 23. The guide members 32 are provided with heads 232 of the form shown in Fig. 4a, which heads engage within a separate sliding guide member 230 which telescopes in guide member 23, or 22. When the cylinder 31 is raised, as is hereafter pointed out, the heads 232 will slide within inner guide member 230 until the upper of said heads contacts with the closed upper end of guideway 230, when said inner guideways 230 will slide in guideways 22 and 23 for further elevation of cylinder 31 and the parts carried thereby, as clearly shown in Fig. 3. Within the cylinder 31 is a plurality of telescoping cylinder sections 33 and a central cylinder 34 closed at the bottom, open at the top and rigidly secured to frame members 24, as indicated at 35. The upper end of cylinder 31 is closed by a cap 36 which extends from the supporting portion 30. A flanged collar 37 is made fast to cylinder 31 and provides additional bearing support for the turret or gun supporting ring 29. The system of cylinders 31, 33, 34 comprises a telescoping hydraulic jack. Water under high pressure is introduced through a pipe 38 into the interior of cylinder 34, said pipe extending along the frame system 24 to pumping means in the shell, not shown. Under the influence of the water pressure through this pipe the telescoping jack will move into the position shown in Fig. 3, thus elevating the turret 29 and the gun 21 and parts connected therewith into a position entirely above the submarine support. In this position the gun may be swung at any angle to the submarine and may be trained at comparatively slight elevation to shoot a projectile at an object relatively near, such training being indicated in full and dotted line views of the gun in Fig. 3. For very high angles the gun may be oscillated between the submarine shells with the muzzle only protruding, as is shown and described in my aforesaid co-pending application, Serial Number 32,827, filed June 8, 1915.

To train the gun it will be necessary to oscillate the same upon the turret 29 about a vertical axis and also to oscillate the gun upon the trunnions 27. The means for accomplishing this are fully shown in Fig. 4. Mounted upon the gun 21, immediately above the trunnions 27, is a casing 39 which is rigidly connected to the barrel of the gun 21 throughout a considerable length thereof. Extending transversely across casing 39 is a sleeve member shaft 40 and another shaft 41 journaled for a considerable portion of its length in the sleeve member shaft, the two shafts 40 and 41 having conjoint bearings in the walls of the casing 39. Shaft 40 is provided with a pinion 42 meshing with a segment gear 43 fast on one of the trunnion brackets 28. Shaft 41 is provided with a gear 44 meshing with a gear 45 loose on the other trunnion 27; gear 45 in turn meshing with a pinion 46 fast on a shaft 47 journaled in the brackets 28. Fast upon shaft 47 is a bevel gear 49 meshing with a bevel gear 50 formed on the cap 36. Loose upon shaft 41 is a worm wheel 51 meshing with a worm 52 fast on the shaft 53 of a water motor 54, shown in detail in Fig. 5. Also, loose on shaft 41 is a sleeve 56 having integral therewith a worm wheel 57 meshing with a worm 58 on the shaft of another motor 59. Fast with shaft 41 is a disk 60 which is engaged by powerful spring friction means, indicated at 61, with the side of worm wheel 51. The shaft 40 and sleeve 56 are provided with complemental disks 62 and 63 engaged by powerful friction devices, indicated at 64, between said disks. When motor 54 is operated it will, through friction disk 60,

drive shaft 41 and through intermediate gearing rotate bevel pinion 49, which will cause the turret 29 to revolve about a vertical axis. At the same time when the motor is stopped, thereby locking worm wheel 51 with worm 52, the momentum of the heavy moving gun will be gradually checked by the yielding action of the friction means 61. Similarly, when motor 59 is operated the shaft 40 will be driven through friction disks 62 and 63 and friction means 64, and by operation of pinion 42 upon segment 43 will oscillate the gun upon its trunnions 27, the spring friction means 64 permitting gradual termination of movement when the motor is stopped without injury to the locked worm and worm wheel. The motors 54 and 59 are driven by the same water-pressure means which extends the telescoping jack, this water being admitted through a pipe 65 having entrance to the cap 36 and being flexible in character together with sets of branch pipes 66 and 67 going to each of said motors 54 and 59. As shown in Fig. 5, the branch pipes terminate in nozzles 68 and 69 positioned to engage a Pelton wheel 70 on the motor shafts. Valves indicated at 71, 72 control the flow of water through pipes 66 and 67 whereby the operator may cause water to be injected through either nozzle to turn the Pelton wheel in either direction, the water so used escaping through exhaust pipes 73, 74 as indicated in Fig. 4.

The casing 39 provides a position for the operator or gunner, as indicated at 75 in Fig. 3, the gunner obtaining admittance to the casing through an opening indicated at 76, in the manner which will now be described.

It will be understood that the gun is loaded while submerged and it will, of course, be necessary for the gunner to obtain admittance to the chamber within casing 39 while the same is submerged. Means for accomplishing this is clearly shown in Figs. 3, 4, 6 and 7. When the gun is held in alining position between the loading chambers 18 and 19 the opening 76 will be positioned immediately opposite a cylindrical plug member 78 which projects through a casing 79 attached to a wall of the shell 16 and rendered water-tight by a packing 80, a gate valve 81 serving to shut off communication from the interiors of member 78 and shell 16. A crossbar 82 is connected with member 78 and at its ends is connected with hand nuts 83 and 84 threaded upon projecting rods 85 and 86. By manipulating the hand nuts 83 and 84 while the gate valve 81 is closed, the open end of tubular member 78 is brought into water-tight conjunction with the side of casing 39, as best shown in Fig. 7, a rubber gasket 87 effecting this seal. The water within member 78 may then be drawn off through pipe 91 and the gate valve can then be lifted, thus providing open communication between the interior of members 78 and of shell 16.

The inner side of opening 76 is flanged, as indicated at 88 in Fig. 7, and within the opening so as to rest against said flange is a closure 89 provided with a gasket 90 of rubber or similar material which engages the inner wall of opening 76, thereby rendering the same water-tight. The closure 89 is preferably circular in outer outline and has a central circular cavity 92. Lying upon the outer surface of closure 89, and also having a circular opening in alinement with opening 92, is a plate 93 rotatably secured to closure 89 by means of bolts 94 extending through circular slots 95 and plate 93. The plate 93 is provided with a series of extensions 96 which are adapted to pass through openings 97 in the front wall of slots 98 formed in the closure side of casing 39. It will be apparent that when the closure is in position and the extensions 96 on plate 93 have been passed through openings 97 and the plate turned to bring such extensions into the slots 98, the closure will be locked in position upon the side of the casing 39. The object of providing the rotatable plate for effecting this locking is because the closure itself when set into opening 76 will, by reason of the gasket 90, be so firmly bound as to be practically incapable of rotation.

For withdrawing and replacing the closure 89 after communication with the interior of shell 16 has been effected through member 78, I provide the device best shown in Figs. 4 and 7. This consists of a plunger having a threaded shank 99 within a threaded sleeve 100 which is journaled in hangers 101, 102, the sleeve having a worm wheel 103 thereon adapted to be rotated by a worm 104 driven by a motor 105. The plunger shank 99 is provided with a head 106 adapted to enter the cavity 92 and is also provided with a pair of arms 107 which will come upon the surface of plate 93 when the head 106 is in cavity 92, and when rotated will come beneath open-ended keeper bars 108. These keeper bars are arranged in oppositely-extended pairs secured to the plate 93 at a central point, as indicated at 109. It is to be noted that the shank 99 extends through a key piece 110 which is rotatably mounted upon the extended end of the sleeve 100 adjacent hanger 102 to which it may be secured to hold the same against rotation by means of a clamp screw 111 extending through a keeper member 112 secured to hanger 102. A toe 113 on member 110 extends into a groove 114 which is formed longitudinally along an element of the shank 99. It thus follows that when

sleeve 100 is rotated the shank 99 will be held from rotation, and by reason of the action of the threads of sleeve 100 upon the threads of shank 99, the shank and head 106 will be projected through member 78 until the head is finally brought into cavity 92 of closure 89 and the arms 107 are brought upon the face of plate 93. Clamp 111 is then loosened and by means of a lever 115 the arms 107 are brought beneath one set of oppositely-disposed keepers 108, which, by further rotation of shank 99, sleeve 100 and arms 107, will turn plate 93 so as to bring extension lugs 96 opposite openings 97. Member 110 will then again be clamped and sleeve member 100 rotated in the opposite direction, which will withdraw the shank 99 and with it the closure 89, as shown in Fig. 4. The operator or gunner, one or more as may be desired, then can enter the firing chamber within casing 39 through the tubular member and opening 76, after which, through the operation of the device above described, the closure 89 can be restored within the opening 76 and the firing chamber hermetically sealed. After this the member 99 will be withdrawn, gate valve 81 closed, member 78 also withdrawn, and, through operation of the telescopic hydraulic jack the gun will be lifted above the top plane of its support and above the surface of the water, as indicated in Fig. 3. Grooves 97 are provided along the inside of member 39 along which the extensions 96 will pass as the closure is withdrawn through such member.

In Figs. 2, 3 and 4 the firing chamber 39 is shown positioned immediately above the trunnion support of the gun, while in Figs. 8 and 11 a similar chamber and casing 120 is shown positioned close to the muzzle end of the gun. Either of these positions for the firing chamber may be employed, it merely being necessary in the latter case to have hand wheels 116 and connections 117 extending to sets of valves 71 and 72 for regulating the controlling motors. In either case a sight opening 118 is provided through which a vision may be had through a telescopic sight 119 adjustably mounted within the chamber 39 or 120. The sight opening will be covered with a glass plate 121 and inside the chamber a sliding metallic plate 122 may be employed for sealing the chamber in case the glass 121 should be broken from accident or any other cause. The adjustment of the telescope 119 may be readily and simply effected, as shown in detail in Fig. 8, by hingedly connecting the front end of the telescope to a hanger 123 and securing the other end of the telescope to a hanger 124 along which it is adapted to be moved by thumb screw mechanism 125 working in conjunction with an arc-shaped slot 126. The advantage of the control chamber upon the end of the gun consists in the fact that in view of the length of the gun much greater elevation to the gunner is possible than if the control chamber were above the trunnions. It will be understood, of course, that whatever the position of the control chamber the operator or gunner will be enabled to train and to fire the gun, the firing being effected by electrical means operated by a switch in a well-known manner.

As above stated, the gun 21 may be of any desired form, a preferred form being a reactionless gun of the type disclosed in my aforesaid co-pending applications. In any event the gun may be one of exceptionally large bore. A means of greatly increasing the effective bore of the gun in respect to the pressure exerted by the gases in relation to the shell fired is shown in Figs. 9 and 10. As there shown, a shell 130 is of considerably smaller diameter than the bore of the gun, being held in a casing 131 formed of convoluted sheet metal, as indicated in Fig. 10, said sheet metal casing being secured at on end to a base plate 132. The base plate is provided with a rectangular lug 133 which is adapted to seat in a corresponding socket 134 in the end of the shell 130. The powder charge 135 in the explosion chamber 136 comes directly in contact with the plate 132, which is in close contact with the inner tube of the gun bore and therefore will be affected by the rifling therein. Under such conditions when the gun is fired the high pressure of the gases is effective upon an area equal to the total area of plate 132 and the shell 130 is caused to rotate by the rifling because of the connection through socket 134 with lug 133. When, however, the shell and casing leave the gun the shell will immediately free itself from the casing and travel independently thereof. This is possible because the inner portion of casing 131 is normally larger than the diameter of the shell, being contracted in the bore of the gun to engage the shell.

In Figs. 11, 12 and 13 my invention is shown applied to permanent fortifications. The elevating and controlling mechanism as there shown is the same as that heretofore described in detail excepting that the inner section of the telescoping jack is secured to a foundation plate 140 resting upon the floor of the sea. A loading chamber 141 is provided, also fixed upon the bottom of the sea, to which access may be had through a subterranean passageway 142. Within chamber 141 is mechanism 143 for effecting communication with the interior of gun 21, said mechanism being in all respects similar to that shown in detail and described in my co-pending application, Serial Number 32,827. This includes a cylindrical plug member 144 adapted to be closed by the gate

valve 145 and loading and cleaning of the gun is effected through said plug member. Within the inner end of plug member 144 is placed a muzzle plug 146 engaged by a rammer cylinder 147. The plug 146, as shown in Figs. 12 and 13, comprises an exhaust 148 for effecting a water-tight closure with the walls of the bore 149 of gun 21. Cylinder 147 is connected by means of a piston 150 with a telescoping hydraulic rammer 151. When it is desired to load the gun the hollow plug member 144 is inserted within the breech end of gun 21 and the plug 146 and pusher 147 are inserted in the end of the hollow plug member in conjunction with gate 145. This is then elevated and the hydraulic rammer 151 forces the plug 148 and rammer cylinder 147 first through hollow plug member 144 and then through the door of the gun 21 until the plug 146 reaches a position at the muzzle end of the gun, as indicated in Fig. 13. This operation forces the water in the bore of the gun out of the same, the pusher cylinder 147 in conjunction with an exhaust 153 thereon operating to exclude water as the plug is passing the expanded firing chamber 152, as indicated in Fig. 12. The firing chamber has its lower wall continuous throughout, the expanded operation being in the upper wall so that when the pusher cylinder 147 is withdrawn all the water in the gun will be carried out.

The plug 148 is provided with spring clips 154 which engage over the muzzle of the gun and hold the plug in position against the pressure of the water thereon, as indicated in Fig. 13. After the plug 148 is positioned the pushed cylinder 147 is withdrawn and the load is forced into position by means of the hydraulic pusher 151. The gun is then elevated and turned around, bringing the muzzle of the gun and the casing 120 upon the same around toward the chamber until the casing comes opposite the member 78, through which the operator is admitted to the casing by the means heretofore described and shown in detail in Fig. 4. The gun is then elevated to bring the same above the surface of the water and is trained and fired by the operator. In this connection it is important to note that the loading chamber 141 is positioned at the seaward side of the support of the gun, so that the water discharged from the barrel as the gun is being shot in any direction out at sea will shoot the water away from the loading chamber and not injure the same.

It is obvious that this invention operates in principle the same whether the gun is supported by a submarine war vessel, as shown in Figs. 1, 3 and 4, or is supported upon the floor of the sea in conjunction with a submarine loading chamber as shown in Fig. 12. For coast defense purposes the latter organization may be very desirable, as in the case of a comparatively shallow sea floor such as prevails around New York harbor and the coasts of New England the guns may be placed in connection with submerged fortifications a mile or two beyond the limits at which above-water fortifications would be practicable.

The advantages of my invention will be obvious and have been fully pointed out. Either when the gun is connected with a submersible war vessel or is operated from submerged loading chambers in connection with land fortifications, there will be no mark for any enemy to fire at at any time excepting during the brief period when the gun is brought above the surface of the water, trained and fired. Immediately after firing it will, of course, be submerged again and during the period of loading be invisible to any attacking force. Even when brought above the water for the brief period of firing the mark presented, being only the end view of the gun, would be so small as to be practically invisible at a distance of two or three miles, which of course would be exceedingly close range for a large gun.

Figs. 14–18, inclusive, of the drawings, which are largely diagrammatic, show two means for firing the explosive charge electrically. In one, the current is carried from the gunner's casing to near the muzzle of the gun and through the bore of the gun by wire, back past the projectile and to the powder. A sealing disk which must always be placed in the muzzle of the gun after it is loaded and before being raised to the surface, carries the contact 159 and thus causes the completion of the circuit between the source of electricity in the gunner's casing and the powder.

In the other form, the firing is done through a hole passing at right angles from the exterior of the gun into the bore directly over the powder. In this form a small projectile about one inch in diameter and several inches in length is fired into the explosive charge. The small projectile pierces the casing containing the powder and passes through into the powder leaving a hole through which the flame follows igniting the charge. Both means are shown in Fig. 14 which is a longitudinal vertical section through the gun and gunner's casing.

The means for firing through the muzzle will first be described:

Referring to Fig. 14: 21 is the gun, 39 the gunner's housing, 155 a disk for hermetically sealing the muzzle of the gun. The periphery of disk 155 is provided with grooves 156 in which are inserted rings 157 formed of some resilient material. Formed in disk 155 are three deep holes 156^a, adapted to receive three pins 157^a, shown only in Figs. 16 and 17, and which are rigidly se-

cured in head 158. 159 is an electrical contact carried on disk 155 as shown, 160 being non-conducting material between said parts 159 and 155. 161 is a copper wire extending from contact 159 to contact 162. 163 is the powder container and has the end 164 adjacent the projectile preferably formed of metal.

For the purpose of conducting the current from the exterior to the interior of the gun, it is necessary to provide means that will not be damaged or blown out by the very high explosive pressure; this is accomplished by the means shown in Fig. 14, in which 165 is a conductor of the form shown having the enlarged portion or circular head 166. Conductor 165 is insulated from the gun by insulating material 167. It will be noted that head 166 is not flush with the bore of the gun but is set back so as to be out of contact with the projectile when passing. Connecting the outer end of part 165 with the interior of the gunner's casing, is an insulated copper wire 168, which is protected from the water by housing 169^a.

The operation of firing the gun is as follows:

When the gunner closes the circuit the current passes from the source (not shown) through the conductor 168 to the contact 159, through the contact 159 to the conductor 161, through the conductor 161 to the conductor 162^a to the contact 162^b to the contact 162^e, thence across a gap to the point 162^c at which gap the spark is produced to the ground.

The second means of firing will now be described:

170 is a hole extending from the exterior of the gun to the bore. This hole is of larger diameter at its outer end and is screw-threaded at said outer end to receive a plug 171, provided with a shoulder 172. This plug 171 forms the upper end of a cartridge consisting of powder, ball, electric contact points for firing the powder contained in the cartridge and necessary insulating means. 174 is insulating material and so designed as to carry the projectile 175, said insulating material fitting the interior of projectile 175, which is formed as shown, to contain the powder charge 176. 176^a is a copper rod having formed thereon the enlargement 177. The outer end of rod 176^a is threaded to carry a nut 178. 179 is insulating material beneath nut 178. 180 is a contact point secured to the projectile and the current passing through it is grounded through the projectile which is in contact with the gun. Since it would be practically impossible to make plug 171 gas-tight, and since gas in the gunner's casing would be fatal to the gunner, means are provided for carrying such leakage to the outside of the casing regardless of whether said casing is below or above the water. This means will now be described:

181 is a cylinder having its upper end closed and its lower end open and flanged as shown; it is shown in vertical section. A raised portion 182, circular in form, is provided on the gun. 183 is a resilient gasket, 184 an upright rigidly secured to the gun. 185 is an arm pivoted to upright 184 by stud bolt 186. Threaded into arm 185 is a screw 187, the lower end of which is adapted to press down on the top cylinder 181. Secured to the upper end of screw 187 is hand wheel 188. 189 is a pipe threaded into cylinder 181 and provided with an outwardly opening check valve 190. 191 is a flexible hose connected to check valve 190. 193 is a pipe screwed into a hole in the top of casing 39, said hole extending through said casing. Said hose 191 is coupled to said pipe 193 by a coupling 192. By means of this device gas leaking past plug 171 will pass into cylinder 181 and out pipe 189, check valve 190, hose 191, and pipe 193 to the outside of casing 39.

To insert a new cartridge screw 187 is slacked from cylinder 181 by means of hand-wheel 188, and arm 185 swung to a right angle with the position shown in the drawing, rotating on pivot 186. Cylinder 181 is then removed by hand, and plug 171 removed by means of a wrench used on the portion 194 which is formed for that purpose. 195 is a flat resilient electric conductor adapted to automatically form a contact with conductor 176^a. 196 is insulating material, 197 a flat-head to which conductor 195 and stud 198 are attached; 199 is a nut on stud 198 for the purpose of drawing head 197 tight against the insulating material in order to prevent leakage of gas past stud 198. Stud 198 is connected with the electric energy by a wire, not shown.

Fig. 18 is an enlarged view of the cartridge. 21 is a fragment of the gun barrel. 200 indicates the interior of the bore.

Referring to Figs. 14 and 15: 130 is the projectile, 132 a disk or head having the same diameter as the bore of the gun. 133 is a tenon on head 132 fitting loosely into a mortise 134 in projectile 130. 135 is the powder. 131 is the casing for holding the projectile 130 in the center of the bore. This casing 131 (see Fig. 14) is omitted from Fig. 15 for the sake of clearness.

One end of the wire 161 is attached to the wire 162^a which is secured in the base of the projectile before the projectile is placed in the gun. This wire is then pulled through the bore of the gun manually from the opposite end of the gun by a cord attached to said wire 161. Attached to wire 161 near the end attached to the projectile is a comparatively long spiral spring 161^a. This spiral spring is attached to said wire

161 as shown in the drawing. When the end of said wire 161 is attached to the hook on the lower portion of contact 159 wire 161 is of such length that in order to connect it as described to contact 159, spiral spring 161[a] must be stretched. Then when head 155 is pushed into place as shown in the drawing, the spring contracts keeping that portion of wire 161 near the muzzle of the gun taut. This is necessary in order to keep the wire from being caught by the head 155.

The gun should be equipped with both forms of the firing device described; one to be held in reserve should the other fail.

I claim:

1. A gun mounted upon a submerged support and exterior thereto, means for loading said gun while the same is submerged, means for elevating said gun relative to the submerged support, a casing for the gunner movable with the gun, and means controlled from said casing for training and firing said gun.

2. In combination with a gun, a support therefor normally below the surface of the water comprising a framework having guideways, a telescoping hydraulic jack having a section thereof directly supporting the gun, guide members secured to said supporting section and slidably mounted in said guideways, and means for operating the jack to move the section and guide members along the guideways and elevate the gun above the surface of the water.

3. In combination with a gun, a support therefor normally below the surface of the water comprising a framework having guideways, said guideways formed of a plurality of telescoping members one slidable within the other, a jack for supporting and raising the gun having a portion thereof formed with projections extending within and slidable in one of said guideways, and means for operating the jack to move said projections along said guide member and said guide members along one another thereby to elevate the gun above the surface of the water.

4. In combination with a gun and means for controlling the same, a hermetically sealed gunner's casing mounted directly upon the gun and movable therewith.

5. In combination with a gun and means for controlling the same, a gunner's casing mounted directly upon the gun and movable therewith, and means in said casing for operating said controlling means.

6. In combination with a gun and means for controlling the same, a gunner's casing mounted directly upon the gun and movable therewith, an adjustable sight in said casing, and means in said casing controlled by the gunner for operating said controlling means.

7. In combination with a gun and means for supporting the same below the surface of the water and for elevating said gun to a point above the surface of the water, a submerged chamber, a casing for the gunner mounted upon and movable with the gun, and means for opening a passageway between said chamber and casing for admittance of the gunner while the gun and casing are submerged.

8. In combination with a gun and means for supporting the same below the surface of the water and for elevating said gun to a point above the surface of the water, a casing for the gunner mounted upon and movable with the gun, and means for permitting the gunner to enter and leave the casing while the gun and casing are submerged.

9. In combination with a gun, means for supporting the same below the surface of the water and means for elevating said gun to a point above the surface of the water, a submerged chamber, a casing for the gunner mounted upon and movable with the gun, a door in said casing, a tubular member extending from the chamber, means to cause said tubular member to make a watertight joint with the casing surrounding said door, and means for withdrawing the door through said tubular member thereby opening a passageway between the casing and chamber for admittance of the gunner while the gun and casing are submerged.

10. In combination with a submarine war vessel, a gun supported by said war vessel exterior thereto, and means for moving said gun bodily relative to the submarine so as to project the gun above the surface of the water when the submarine is submerged.

11. In combination with a submarine war vessel, a gun supported by said war vessel exterior thereto, means for moving said gun bodily relative to the submarine so as to project the gun above the surface of the water when the submarine is submerged, and means for training the gun.

12. In a combination with a submarine war vessel, comprising a pair of shells with a space between the same, a rotatable turret normally positioned between said shells, a gun having trunnions and supported by said trunnions upon said turret so as to oscillate between the shells, and means for elevating the turret and gun bodily to bring the gun above the surface of the water when the submarine is submerged.

13. In combination with a submarine war vessel, comprising a pair of shells with a space between the same, a rotatable turret normally positioned between said shells, a gun having trunnions and supported by said trunnions upon said turret so as to oscillate between the shells, means for elevating the turret and gun bodily to bring the gun above the surface of the water when the sub-

marine is submerged, and means for oscillating said gun upon the trunnions and means for rotating said turret.

14. In combination with a submarine war vessel, a gun supported by said war vessel exterior thereto, means for moving said gun bodily relative to the submarine so as to project the gun above the surface of the water when the submarine is submerged, a casing for the gunner mounted upon and removable with the gun, and means for opening a passageway between the interior of the submarine and said casing for admittance of the gunner while the gun and casing are submerged.

15. In combination with a submarine war vessel, a gun, a support therefor connected with the submarine and comprising an extensible hydraulic jack consisting of a plurality of telescoping cylinders, means for supplying fluid under pressure to said cylinders, means for controlling the gun for training the same, a water motor for operating said controlling-means, and means for supplying water under pressure to said motor from the same source of supply as that which operates the jack.

16. In combination with a submarine war vessel, a gun, a support therefor connected with the submarine and comprising an extensible hydraulic jack consisting of a plurality of telescoping cylinders, means for supplying fluid under pressure to said cylinders, means for controlling the gun for training the same, a water motor for operating said controlling-means, and a flexible connection from said cylinders to the water motor for supplying water under pressure to the water motor from the same source of supply as that which operates the jack.

In testimony whereof I affix my signature in presence of two witnesses.

KENNEDY DOUGAN.

Witnesses:
F. A. WHITELEY,
H. A. BOWMAN.