L. S. CLARKE.

EXPLOSIVE PROJECTILE.

APPLICATION FILED NOV. 27, 1915.

1,320,447.

Patented Nov. 4, 1919.

3 SHEETS—SHEET 1.

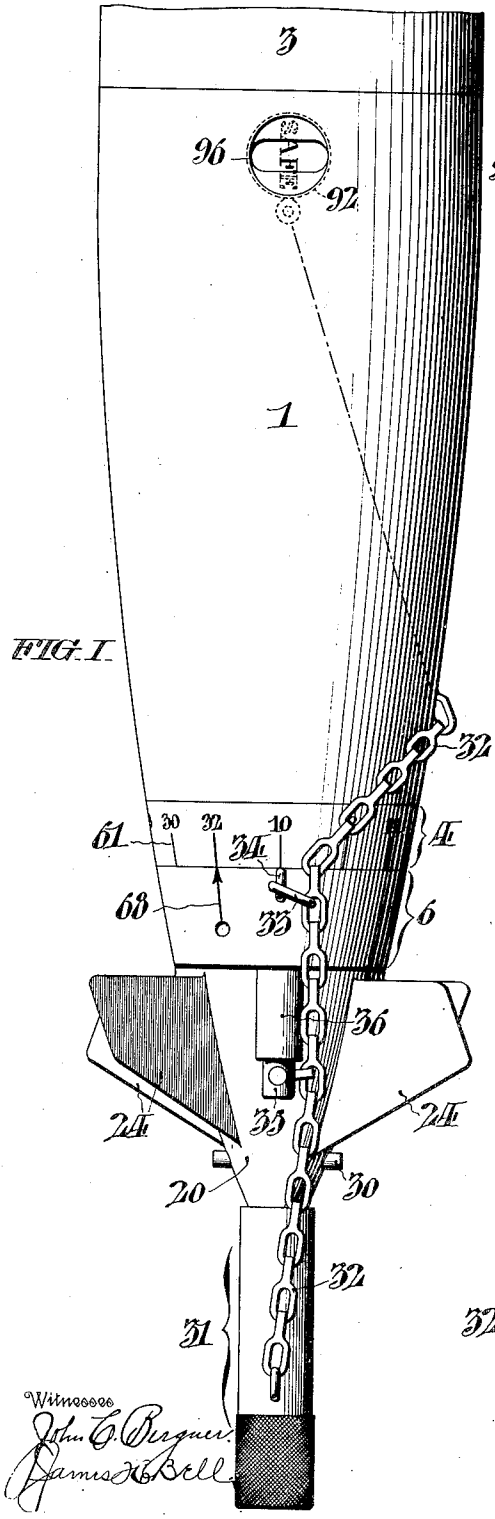
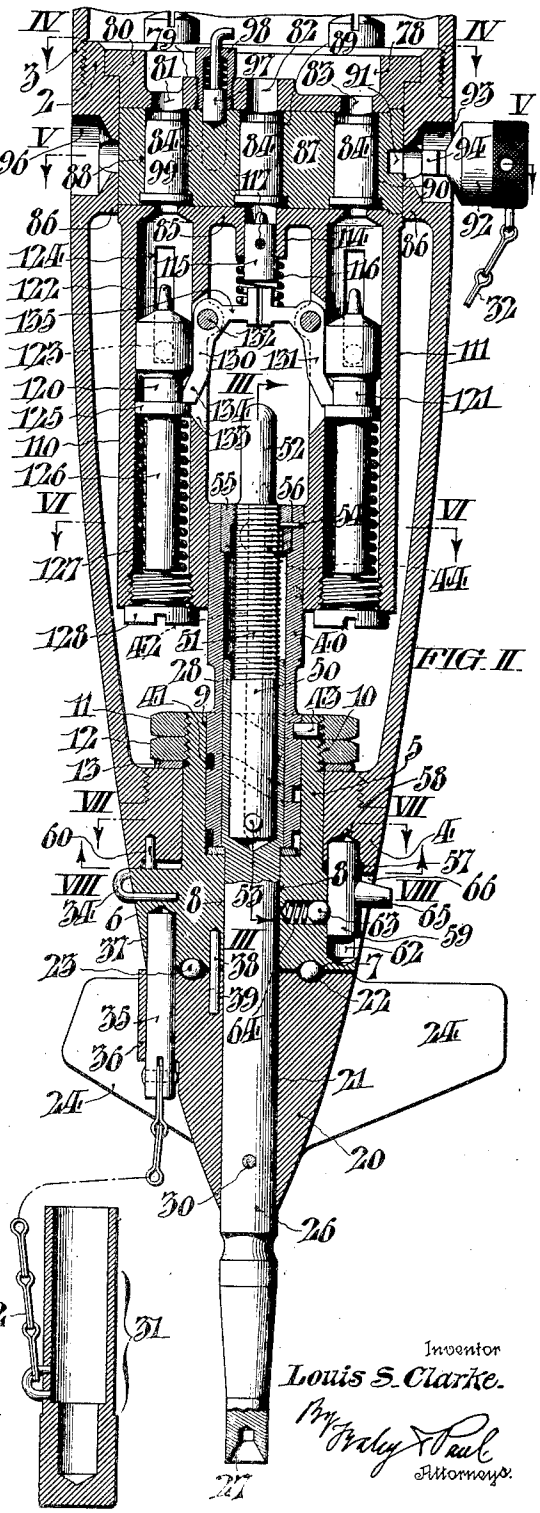


FIG. I.



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3 SHEETS—SHEET 2.

FIG. III.

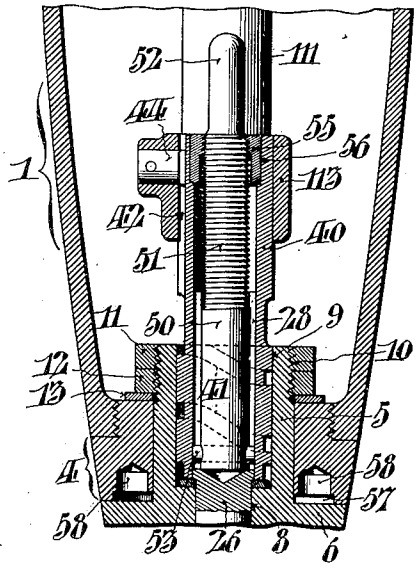


FIG. IV.

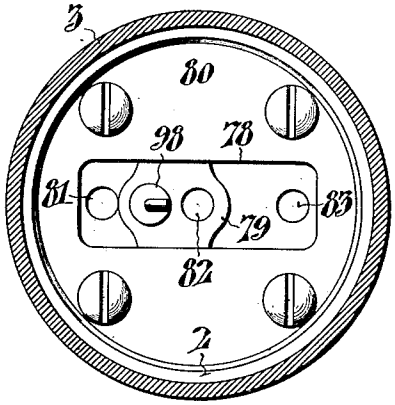


FIG. V.

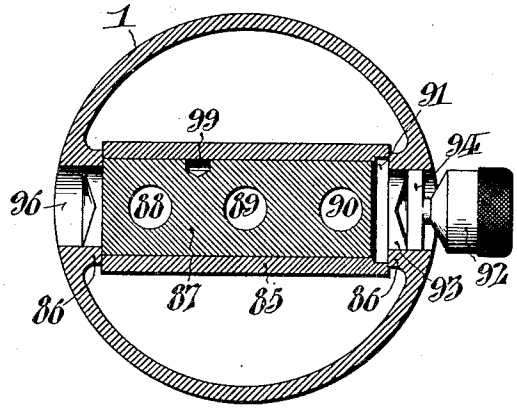


FIG. VI.

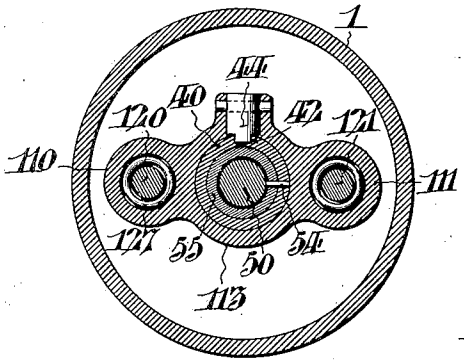


FIG. IX.

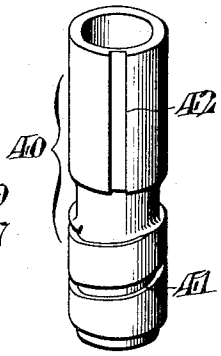


FIG. VII.

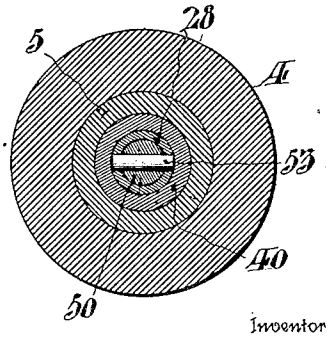
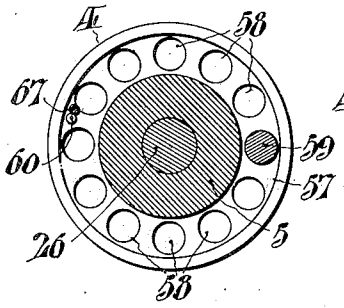


FIG. VIII.



Witnesses

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3 SHEETS—SHEET 3.

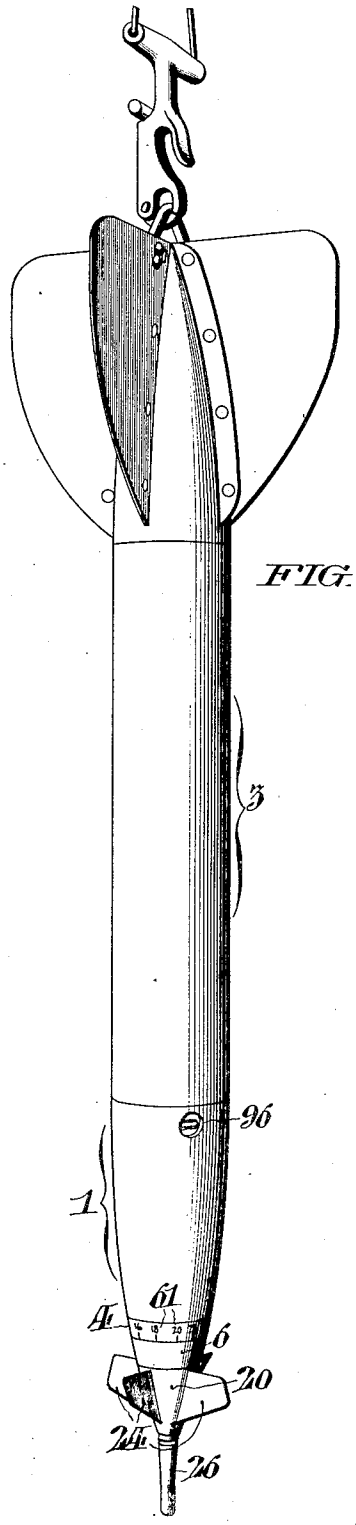


FIG. X.

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UNITED STATES PATENT OFFICE.

LOUIS S. CLARKE, OF HAVERFORD, PENNSYLVANIA.

EXPLOSIVE PROJECTILE.

1,320,447. Specification of Letters Patent. Patented Nov. 4, 1919.

Application filed November 27, 1915. Serial No. 63,719.

To all whom it may concern:

Be it known that I, LOUIS S. CLARKE, of Haverford, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Explosive Projectiles, whereof the following is a specification, reference being had to the accompanying drawings.

The primary purpose of my invention is for use in connection with a bomb intended to be dropped from an aerial craft for attack upon a vessel, especially a submarine, or upon a mine field.

By way of explanation it may be stated that the efficiency of a dropped bomb is not so great when it explodes in the air, upon the deck of a vessel, as when it explodes against the side thereof, and under water. Hence, in a certain sense, it may be said that it is desirable for such a bomb to miss the object at which it is aimed, provided the explosion can be made to occur in close proximity thereto, and after submersion of the bomb itself.

My invention comprises a detonating device, which can be operated by direct impact, and, in combination therewith, means whereby the detonating device shall be operated by travel through water alone, the last mentioned operating mechanism being capable of adjustment, so that the detonation may be made to take place after any selected distance of water travel, within certain practicable limits.

Combined with the primary features which permit this method of operation are numerous adjuncts, in the nature of safety devices, to prevent premature explosion, either in handling the bomb, or in that portion of its flight beyond which the explosion must be delayed.

The operating features comprised in my invention are assembled in a portion of the bomb which is usually distinct from the chamber containing the explosive, and as ordinarily constructed, such operating portion would be termed the head, or nose-piece of the projectile. In using these expressions, however, I have no intention to limit the nature or location of the working group.

In the accompanying drawings, Figure X, represents in perspective a general view of the projectile in a preferred form, from which it will be seen that it comprises an elongated, or tapered casing, provided with means, whereby it may be conveniently suspended from an air craft and detached. These features, however, constitute no part of my invention, and hence, said figure is merely explanatory of the general external structure.

Referring now to the detailed drawings, Figs. I to IX, both inclusive;

Fig. I, represents an exterior view of the head with various safety devices set in their protective position.

Fig. II, is an axial vertical section through the parts shown in Fig. I, with one of the protective devices removed.

Fig. III, is a partial axial section on the plane III—III, of Fig. II, the direction of view being at right angles to that of Fig. II.

Figs. IV, V, VI, VII, and VIII, are transverse sections on the planes indicated by the respective numerals of said figures in Fig. II.

Fig. IX, is a view in perspective of an element which constitutes part of the mechanism whereby the water depth at which explosion is to take place may be regulated.

In the following description I use the terms front and rear with reference to the direction of flight of the projectile.

The head comprises a hollow tapered casing 1, which is provided at its rear end with an externally threaded inset flange 2, adapted to engage with the internally threaded extremity 3, of the explosive chamber. This latter need not be described, as it may be of any of the types ordinarily used.

At its front end, the casing 1, is provided with an internally threaded shoulder adapted to engage with a correspondingly threaded flanged annulus 4, externally tapered in prolongation of the casing 1.

By reference to Fig. VIII, it will be seen that the front face of the annulus 4, is recessed as indicated at 57, and that a plurality of holes 58, extending in an axial direction, are formed at symmetrical intervals. Said holes serve as sockets to receive a securing pin 59, whereby an adjacent member about to be described can be secured in different rotative positions within the range provided by the holes 58. A stop pin 60, is also mounted in the recess, which, by contact with a stop 67, upon said adjacent member, limits the arc of possible rotation of the latter. The exterior periphery of the annulus 4, is graduated with a scale as shown at 61, in Fig. I, the calibration of said

scale being determined in accordance with conditions hereinafter described. The annulus 4, which may conveniently be termed a "dial-ring", receives and rotatably supports the rearwardly projecting cylindrical socket portion 5, of an element which, for purposes of convenience, may be termed the "depth-adjuster", as will hereafter be explained. The portion 6, of said element is externally tapered in prolongation of the general outline of the casing, and its front face is flat and provided with a circular ball-race as indicated at 7. A cylindrical axial hole 8, is formed through said front portion 6, and leads to the larger cylindrical cavity 9, of the socket portion 5. The external periphery of the socket 5, is threaded at its rear region as indicated at 10, to engage the nuts 11, and 12, beneath which is a washer 13.

A hole or socket 62, is formed in the portion 6, of the depth-adjuster, and receives one extremity of the locking pin 59, the other extremity of said pin being adapted to fit closely in any one of the holes 58, of the dial-ring. The socket 62, of the pin 59, is extended sufficiently to permit the retraction of the pin, so as to clear the dial-ring 4, and thus permit rotation of the depth-adjuster with relation thereto. A spring-actuated detent 63, is mounted in a socket 64, in the portion 6, and enters a shallow groove in the side of the pin 59, so as to prevent accidental displacement of the pin when it is inserted in one of the holes 58, while permitting the pin 59, to be manually moved by means of a finger 65, which extends outwardly through the slot 66, communicating with the hole 62. The rear face of the portion 6, is provided with the raised stop (shown in cross section in Fig. VIII) which, by contact with the pin 60, upon the dial-ring 4, prevents more than one complete rotation of the depth-adjuster with relation thereto. The external periphery of the depth-adjuster is provided with an index as shown at 68, in Fig. I, in proper relation to the scale 61, upon the dial-ring.

The front extremity, or nose, 20, of the head, continues the external taper to a blunt point as shown, and is perforated with a cylindrical axial cavity 21, corresponding in diameter to the cavity 8, of the portion 6. The rear face of the nose 20, is flat, as shown, and is provided with a circular ball-race 22, the balls 23, being interposed between the parts 6, and 20, so as to provide an easy running thrust-bearing for free rotation of the nose 20, with relation to the remainder of the casing. The nose 20, is provided with propeller blades 24, whose pitch is adapted to cause rotation of the nose, by traveling contact with water, at a rate directly proportioned to the linear extent of travel. In the instance shown, and with a structure of the actual size represented in Figs. I to IX, the pitch of the blades may be of twenty-four (24) inches, which would normally effect one rotation of the nose for each two feet of water traversed. The work to be performed by the rotation of the nose is so light, that there is little or no slip of the blades with relation to the water. The blades 24, are represented as four in number, but obviously this and other details may be varied.

An axial spindle 26, extends through, and protrudes forwardly beyond, the cavity 21, of the nose, and is prolonged rearwardly through the cavity 8, of the portion 6, being somewhat enlarged in diameter at its rear extremity, which is hollow, as indicated at 28, forming a cylindrical socket. It will be noted, however, that the external diameter of said socket 28, is considerably less than the internal diameter of the cavity 9, in the depth-adjuster, so as to permit the intervention of an elongated cylindrical sleeve 40, whose details and purpose will be described later on.

The front end of the spindle 26, is preferably made of hardened steel, which is cupped out as indicated at 27, to provide a sharp annular edge, the purpose of this detail being that if the projectile strikes a metal surface, such as the sloping deck of a vessel, the end will tend to cut into it, rather than to glance off, as is the tendency where the extremity is reduced to a point.

The spindle 26, is keyed to the nose 20, by means of a cross pin 30, of relatively soft metal, such as brass, the purpose of this construction being that if the extremity 27, strikes a hard surface (in which case the bomb is to be exploded by impact), the pin 30, will be sheared off by the blow, and the spindle 26, can then act as a plunger.

Failing such severance of the pin 30, the spindle 26, thus keyed to the nose 20, constitutes what may be considered as a propeller shaft, extending rearwardly and rotatably operated by means of the propeller blades 24, for operative effect upon other members of the train. The respective modes of operation of the spindle 26, in its alternative characters of an impact plunger and a propeller shaft, will be described later on.

As a safety device during carriage and handling of the projectile, I provide an elongated hollow cap 31, adapted to sheath the front end of the spindle, the rear face of said cap bearing against the outer face of the nose, and being secured in position by means of a chain 32, which is attached by a link 33, to a hook 34, removably mounted upon the part 6, said chain also preferably carrying a plug 35, which passes through a socket 36, in the nose, and enters a cavity 37, in the part 6, so as to prevent accidental rotation of the tip so long as the plug remains in position.

I also provide a permanently seated, but relatively frail, retaining device, consisting of a wire of lead, or other soft metal, 38, engaging in sockets 39, formed in the proximate faces of the nose and of the part 6, whose purpose is to prevent rotation of the nose with relation to the part 6, under the effect of travel through air, said wire being strong enough to resist the effect of air pressure upon the propeller blades, but being instantly sheared off by the rotation of the nose which occurs when the blades 24, strike water.

Passing now to the rear extremity of the spindle 26, it will be noted that the sleeve 40, which surrounds the socket portion 28, thereof, and which is shown in perspective in Fig. IX, fits snugly within the cavity 9, of the depth-adjuster socket 5, and is provided with an external cam groove 41, having a relatively steep spiral pitch. A stud 43, rigidly mounted in the part 5, projects into this cam groove. The sleeve 40, is also provided with a longitudinal spline groove 42, which engages with a stud 44, (see Fig. VI) projecting radially inward from the stationary bridge piece 113, of the housing which carries the firing-plungers proper, and which will be described later on. Said bridge-piece also acts as a support and guide for the sleeve 40, which slides freely therein. It will be seen that since the spiral cam groove 41, of the sleeve 40, engages operatively with the pin 43, rigidly secured to the part 5, of the depth-adjuster, and since the sleeve 40, is, by means of the stud 44, secured against rotation, rotative movement of the depth-adjuster will cause the pin 43, to act upon the cam surface of the groove 41, and shift the sleeve 40, longitudinally inward or outward, in accordance with the direction of such rotative movement.

The socket 28, at the rear end of the spindle 26, receives the cylindrical front end of a plunger-bolt 50, having a screw-threaded portion 51, the pitch of the thread being twenty-four (24) to the inch in the instance shown. Said bolt 50, has also a protruding end 52, which is the member which directly actuates the triggers of the firing-plungers to be described later on. The plunger-bolt 50 is provided with a cross-pin 53, (see Fig. VII) which extends into longitudinal slots formed at diametrically opposite points through the wall of the socket 28. The front end of the plunger-bolt 50, when in its extreme retracted position, rests upon the bottom of said socket, and the threaded portion 51, engages with an annular nut 55, carried within the cavity 56, at the rear end of the sleeve 40. A locking wire 54, (see Fig. VI) of relatively frail material, extends through an opening in the nut 55, and through the proximate wall of the sleeve 40, so that said nut is retained against rotative movement under normal circumstances, but under the impact of the spindle 26, upon a rigid surface, the locking wire 54, will be sheared by the longitudinal movement of the plunger-bolt 50, which will then carry with it the nut 55.

The above description comprises what may be considered as the operating group for actuating the firing devices proper, the ultimately active element of said operating group being the protruding end 52, of the plunger-bolt 51, which may be called the "trigger-finger," because it is the rearward movement of this finger, which releases the actual firing devices, when the predetermined firing point is reached.

In the event of direct impact of the point 27, of the spindle 26, upon a rigid object, the spindle is forced rearward bodily, shearing off the cross-pin 30, (which connects the spindle to the nose 20) and the wire 54, (which connects the nut 55, to the sleeve 40), and hence the parts carried by the spindle (terminating in the trigger finger 52) will be forced rearwardly to the firing point.

If, on the other hand, the projectile strikes water, the spindle 26, is not directly forced rearward, but revolution of the propeller blades commences, the wire 38, being sheared off by rotation of the nose 20, practically as the immediate result of striking the water. Under these circumstances the spindle 26, will be rotated and will rotate the plunger-bolt 50. Since said plunger-bolt can move axially with relation to the containing socket 28, of the spindle, but is compelled to rotate therewith by reason of engagement of the stud 53, with the wall of the socket 28, the threaded portion 51, of the plunger-bolt acts as a cam by engagement with the fixed nut 55, and causes the rearward protrusion of the trigger-finger 52, to an extent corresponding with the rotative effect of the propeller blades, and pitch of the screw thread at 51. With the proportions of the respective parts above indicated and assuming that a complete rotation of the nose 20, and spindle 26, will occur in travel through two feet of water, rearward travel of the trigger-finger will occur to the extent of one-twenty-fourth of an inch for each rotation of the spindle. Therefore, assuming a given firing point, at which the rearward movement of the trigger-finger will release or actuate the detonating mechanism, it is obvious that by initial adjustment of the end of said finger with relation to the firing point, any desired extent of travel of the finger, and consequent delay of the explosion, can be predetermined.

Such adjustment is effected by means of the depth adjuster, acting upon the sleeve 40, in the following manner: Assuming that the locking-pin 59, has been disengaged, the depth-adjuster is turned by hand (carrying with it the nose and spindle) and the rota-

tive travel of the stud 43, with relation to the cam groove 41, of the sleeve 40, will cause said sleeve to be protruded rearwardly from the socket 9, or withdrawn into said socket, according to the direction of rotation, and said movement of the sleeve 40, bodily shifts the plunger-bolt 50, toward or from the firing-point. When the desired position of the depth-adjuster is reached, the locking pin 59, is inserted in the hole 58, corresponding thereto. In the position of the parts shown in Fig. II, the sleeve 40, is at the extreme limit of its forward movement, and the plunger-bolt 50, is withdrawn into the socket 28, to the fullest extent; hence the trigger-finger 52, is at its most remote position with relation to the firing point.

As an incident to the rotation of the depth-adjuster, the spindle 26, is also turned, and consequently the screw thread at 51, will effect some longitudinal movement of the plunger-bolt 50.

As, however, the pitch of the cam incline 41, upon the sleeve 40, is very rapid, and the pitch of the screw at 51, is relatively slow, this incidental displacement of the plunger-bolt is very slight, and proper allowance can readily be made therefor when the device is calibrated.

The index 68, and scale 61, provided upon the external peripheries of the casing and depth-adjuster, may be so graduated as to express the arc of rotation of the depth-adjuster in terms of feet of water travel. Thus, the device can readily be set by the operator for a firing moment determined by any desired extent of water travel.

It remains to describe the group of parts which constitute the immediate firing mechanism operated by the trigger-finger 52, of the plunger-bolt. In the instance shown, this group comprises a plurality of interdependent devices, whose immediately operative elements are longitudinally moving plungers, and to conveniently distinguish these latter from the plunger-bolt previously described, I shall term them firing-plungers.

The main operating portions of the firing mechanism are supported in an internal housing structure carried at the rear end of the casing 1.

The rear portion of said housing is a disk 80, having in this instance a rectangular slot 78, which is elongated in diametrical relation to the disk. Immediately in front of the disk 80, and preferably integral therewith is a transverse cylindrical sleeve 85, which constitutes the bearing for a rotatable barrel 87. A boss 79, upon the rear face of the sleeve extends bridgewise across a portion of the slot, and affords a support for a stop-pin 97, which will be described later on.

Diametrical holes 81, 82 and 83, are formed through both walls of the sleeve, the central hole 82, extending also through the boss 79. A barrel 87, fits rotatably within the sleeve 85, said barrel being provided with diametrical holes 88, 89, and 90, registering respectively with the holes 81, 82, and 83, of the sleeve.

The holes 88, 89, and 90, are provided with circular recesses at one extremity, as shown in Fig. II, so as to receive the flanged head of an ordinary cartridge shell such as 84, these shells being of the kind usually employed for containing the fulminating compound which is to cause explosion of the bomb. It will be noted by reference to Fig. II, that the diameter of the barrel 87, and depth of the recesses at one extremity of the holes therein, is such as to completely receive the shells 84, and thus permit the barrel to be axially rotated when charged with shells.

The barrel 87, is provided at one end with a key groove 91, whereby the barrel may be rotated by means of a key 92. An elongated opening 93, is formed through the wall of the casing 1, so as to permit the insertion of the key 92, which is provided with a transverse bar 94, adapted to engage in the key groove 91, said bar being preferably of such length that it can only be inserted in the key groove or withdrawn therefrom in a given rotative position of the barrel 87.

Adjacent to the opposite end of said barrel, an elongated opening 96, is formed in the wall of the casing, which permits the adjacent end surface of the barrel, to be seen. The word "Safe" may be marked upon that end of the barrel, the dimensions of the letters, with relation to the opening 96, being such that, as shown in Fig. I, the entire word is not visible when the position of the barrel is that which brings the shells 84, into line with the respective openings 81, 82, and 83. When, however, the cylinder 87, is turned at right angles to the position shown in Fig. II, (so that the shells cannot be struck by the firing-plungers) the entire word "Safe" will be visible through the elongated slot 96.

In order to limit the range of rotation of the barrel 87, I provide a spring-actuated stop 97, inclosed in a socket 98, mounted upon the boss 79, which stop engages in a groove 99, upon the barrel 87, (see Fig. V and dotted lines in Fig. II). Said groove has the range of a quadrant, and is provided at each end with a slight depression, as shown in Fig. V, so that the pointed end of the stop 97, can enter and hold the barrel 87, against accidental rotation, the engagement, however, being sufficiently light to be manually overcome by the turning of the key 92.

At the front side of the sleeve bearing 85, and preferably integral therewith, are

three tubular sockets 110, 111, and 114, the cavities of which communicate with the holes 81, 82, and 83, respectively.

The sockets 110, and 111, are elongated and are united at their front extremities by a bridge piece 113, (see Figs. II and VI). The front ends of the sockets 110, and 111, are closed by means of screws such as 128.

The elongated sockets 110, and 111, carry the firing-plungers 120, and 121, respectively, which are similar to one another, and hence a description of one will suffice for both. The firing-plunger 120, is provided at its rear end with a tip 122, which is in line with the axis of the hole 81, of the sleeve 85, and with the axis of the hole 88, of the barrel 87, when said barrel is turned into appropriate position. In order to set or "cock" the firing-plunger 120, it is preferably provided at its enlarged head portion with a pin 123, (shown in dotted lines in Fig. II), which protrudes through a slot 124, in the wall of the socket 110. The firing-plunger 120, is also provided with a circular collar 125, beyond which its diameter is reduced as shown at 126, the reduced portion being surrounded by a coiled spring 127, which bears at one end against the collar 125, and at the other end against the screw 128, whereby the front end of the socket 110, is closed. This arrangement of the protruding pin permits the firing-plunger to be manually pushed forward, so as to compress the coiled spring 127, before the head is secured in position. Obviously, however, the setting of the firing-plunger may be effected by other means, such as the insertion of a rod through the hole 81, of the sleeve, and hole 88, of the barrel when the axis of the last mentioned hole is in alinement with the axis of the plunger.

The central tubular socket 114, is relatively short, and receives the firing-plunger 115, whose tip is in line with the axis of the central hole 82, of the sleeve, and whose other end portion is surrounded by a coiled spring 116, which bears at one extremity against the top of the socket 114. A shearable protecting wire 117, extends through the firing-plunger 115, and into the walls of the socket 114, to prevent accidental displacement of said firing-plunger.

The coiled springs, such as 127, of the firing-plungers 120, and 121, are compressed, in the act of setting or cocking, to an extent sufficient to supply the necessary force for driving the firing-plungers against the bases of their respective cartridge shells, so as to explode the fulminating compound therein.

In order to engage and detain the firing-plungers, when their actuating springs have been thus set, I provide a pair of triggers 130, and 131, respectively. These triggers are similar, and hence it will be only necessary to describe one in detail. The trigger 130, is pivotally mounted upon a pin 132, within a slot 133, formed through the wall of the socket piece 110, and is, in effect, a right angled bell-crank lever, one extremity 134, of which engages with the rear face of the collar 125. The other arm 135, of the trigger extends radially inward toward the axis of the projectile, and is provided with a projection which enters within the spiral spring 116, before referred to as embracing the firing-plunger 115.

These projections upon the pair of triggers 130, and 131, afford a retaining device for said spring 116, which latter is under compression even when the triggers are in their set position shown in Fig. II.

With the foregoing explanation of the firing group, the operation of the actuating group will be readily understood, and is substantially as follows: If the projectile strikes upon a rigid surface, so that operation occurs by direct impact, the blow upon the spindle thrusts the trigger finger 52, against the radial arms of the triggers, the continuance of this movement disengaging the other arms 134, from the collars 125, of the firing-plungers 120, and 121, which then are forced by their springs 127, to strike the shells in the holes respectively opposite to them. The finger 52, also continues its movement and ultimately strikes the firing-plunger 115, which is driven against the central cartridge shell of the three. In this case there is a threefold detonating device.

If, however, the projectile merely strikes water, the nose is rotated by the effect of water-travel, upon the propeller blades, and when an extent of travel has been reached, corresponding to the setting of the depth-adjuster, the continued rotation of the spindle 26, will, through the cam action of the screw thread 51, shift the trigger actuating finger 52, into operative contact with the radial arms 135, of the triggers, the movement continuing until a position is reached where the ends of the other arms 134, are withdrawn from the collars 125, thus disengaging the plungers 120, and 121, whereupon the springs 127, become operative and force said firing-plungers into the ends of the cartridge shells to which they are respectively opposed.

For convenience of description, I use the term firing-point, to indicate the position which the trigger finger occupies with relation to the firing mechanism when the latter is disengaged, or becomes actively operative.

It is, of course, unnecessary to describe the features of the bomb which relate to the explosive agents, and their inclosing devices, since these may be of any desired character, and since the functions of the parts which comprise my invention terminate, theoretically, with the act of causing detonation of the cartridge shells 84.

Having thus described my invention, I desire to call attention to a characteristic which I believe distinguishes it from projectiles heretofore employed.

I recognize that it is common to delay the explosion of a projectile, either comprehensively (as during a period of flight), or more minutely (as after impact). So far as I am aware, however, the organizations for that purpose have been preventive in their character, the object being to retard the active effect of the detonating mechanism, until a definite interval of time or of distance traveled has elapsed.

Disinguishing characteristics of my invention reside in the fact that the time element, as such, has no relation to the desired result, and that travel is not employed to delay explosion, but to cause it, at a predetermined limit of movement and in the absence of impact, in the ordinary sense of that term as applied to projectiles. In other words, the explosion of the bomb is effected by power which is the resultant of definitely protracted travel through water.

Believing this principle of operation to be broadly new, I do not desire to limit myself to the specific embodiment shown and described, many of whose details might be greatly varied. For instance, the system of firing-plungers and triggers above described is merely typical of an organization capable of effecting explosion when some controlling member is moved to a predetermined firing-point. It is obvious that such controlling member might be varied in accordance with the character of the firing devices; thus, where the latter are spring-actuated as in the present case, the controlling member releases a detent, but in the case, for instance, of electrically operated firing mechanism, the function of the controlling member might be to close an electric circuit.

Hence, in my broader claims I refer to this group of firing mechanism as a single element, and I use the expression trigger-finger, not as a term of limitation, but as conveniently descriptive of the element whose movement, to a definite point, actuates the firing mechanism.

I also term the element, whose travel in contact with a medium, such as water, results in operative motion, a propeller, without meaning to limit the character of such element.

I also employ the term bomb as comprehensive of any explosive projectile.

I further point out that while the numerous protective adjuncts above set forth and which are cumulative in their character, are desirable, they have no essential relation to the main features. In connection with the retaining means for these protective devices, and also with reference to the means for attaching the spindle to the propeller, I employ the terms severable, and severably as convenient to indicate that said means can be sheared or broken by such force as is stated to be developed by the conditions of travel and resistance above described.

I claim:

1. In a bomb, the combination, with firing mechanism; of a trigger finger arranged in operative relation thereto and at a definite interval from the firing point thereof; a propeller adapted to be operated by travel of the projectile through water, said propeller having a predetermined amount of rotative movement for a given unit of linear travel through water; means for actuating the trigger finger, said means being operable by the rotative movement of the propeller, and having a resultant movement in correspondence with the definite interval between the trigger finger and the firing point, and means for preventing the movement of the propeller due to air pressure while the bomb is traveling through air.

2. In a bomb, the combination, with firing mechanism; of a trigger finger arranged in operative relation thereto and at a definite interval from the firing point thereof; a propeller adapted to be operated by travel of the projectile through water, said propeller having a predetermined amount of rotative movement for a given unit of linear travel through water; means for actuating the trigger finger, said means being operable by the rotative movement of the propeller, and having a resultant movement in correspondence with the definite interval between the trigger finger and the firing point; means for adjusting the initial position of the trigger finger with relation to the firing point, and means for preventing the movement of the propeller due to air pressure while the bomb is traveling through air.

3. In a bomb, the combination, with firing mechanism; of a trigger-finger arranged in operative relation thereto and at a definite interval from the firing-point thereof; a propeller adapted to be operated by travel of the projectile through water; a carrier for said trigger-finger capable of being moved bodily to the firing-point by direct impact, said carrier being severably connected with said propeller; and means whereby the resultant movement of the propeller operatively shifts the trigger-finger with relation to said carrier and toward the firing-point.

4. In a bomb, the combination, with firing

mechanism; of a trigger-finger arranged in operative relation thereto and at a definite interval from the firing-point thereof; a propeller adapted to be operated by travel of the projectile through water; a carrier for said trigger-finger capable of being moved bodily to the firing-point by direct impact, said carrier being severably connected with said propeller; means whereby the resultant movement of the propeller operatively shifts the trigger-finger with relation to said carrier and toward the firing-point; and an adjusting member whereby the trigger-finger may be shifted longitudinally with relation to the carrier, independently of the action of the propeller.

5. In a bomb, the combination, with firing mechanism; of a threaded plunger provided with a trigger-finger arranged in operative relation to the firing mechanism and at a definite interval from the firing-point thereof; a spindle having a socket adapted to carry said plunger in splined engagement therewith; a sleeve surrounding said carrier and longitudinally adjustable with relation thereto, said sleeve being provided with a nut adapted to engage the threaded portion of the plunger; means for longitudinally adjusting said sleeve with relation to the carrier; and a propeller adapted to be operated by travel of the projectile through water, said propeller being connected to said spindle.

6. In a bomb, the combination, with firing mechanism; of a threaded plunger provided with a trigger-finger arranged in operative relation to the firing mechanism and at a definite interval from the firing-point thereof; a spindle having a socket adapted to carry said plunger in splined engagement therewith; a longitudinally movable, but non-revoluble sleeve surrounding the carrier socket, and having a cam-groove in its outer wall; a revoluble dial-ring co-axial with the spindle and carrying a stud which engages in said cam groove; a nut carried by said sleeve and engaging the threaded portion of the plunger; and a propeller adapted to be operated by travel of the projectile through water, said propeller being connected to said spindle.

7. In a bomb, the combination, with firing mechanism; of a trigger finger arranged in operative relation thereto and at a definite interval from the firing point thereof; a propeller adapted to be operated by travel of the projectile through water, said propeller having a predetermined amount of rotative movement for a given unit of linear travel through water; means for actuating the trigger finger, said means being operable by the rotative movement of the propeller, and having a resultant movement in correspondence with the definite interval between the trigger finger and the firing point; and a locking element for the propeller mechanism, resistant to the normal effect of air pressure upon the blades of the propeller, but severable upon the forcible impact of said blades upon water.

8. In a bomb, the combination of a revoluble nose piece provided with propeller blades; a revoluble dial-ring in rear of said nose piece; a casing in rear of said dial-ring, said casing carrying, at its rear end, firing mechanism, and being provided at its front end with a plurality of circularly arranged holes; a spindle extending through said nose piece and dial-ring, said spindle being provided with a socket at its rear end; a threaded plunger carried in said socket, in splined engagement therewith, said plunger being provided with a trigger finger, in operative relation to the firing-mechanism; a longitudinally movable, non-revoluble, sleeve, surrounding said socket and spindle and provided with a nut adapted to engage the threaded portion of said plunger; means whereby rotation of the dial ring effects longitudinal movement of said sleeve; and a locking pin carried by the dial-ring, and adapted to fit the respective holes in the front end of the casing.

9. In a bomb, the combination, with firing mechanism comprising a firing plunger, means for actuating said plunger and means for detaining the actuating mechanism; of a trigger-finger arranged in operative relation to said detaining means; and a revoluble barrel having a diametrical cavity adapted to receive a cartridge shell; and means for rotating said barrel, whereby either the wall thereof, or the axis of the cavity therein may be brought into registry with the line of movement of the plunger.

10. In a bomb, the combination, with firing mechanism comprising a firing plunger, means for actuating said plunger and means for detaining the actuating mechanism; of a trigger finger arranged in operative relation to said detaining means; and a revoluble barrel having a diametrical cavity adapted to receive a cartridge shell; means for rotating said barrel, whereby either the wall thereof, or the axis of the cavity therein may be brought into registry with the line of movement of the plunger; and a spring actuated stop whereby the rotative movement of said barrel is restricted to predetermined limits.

11. In a bomb, the combination of a propeller adapted to be operated by travel of the projectile through water; a trigger-finger; means whereby said trigger-finger is axially shifted by the movement of said propeller; a spring actuated firing-plunger having a retaining collar; a lever having an arm adapted to engage said collar when the plunger spring is compressed, and having another arm extending within the range of

movement of the trigger-finger; and a cartridge shell retainer arranged in operative relation to the firing-plunger and means whereby the shell retainer may be turned to position the shell out of alinement with the firing plunger, substantially as set forth.

In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this twenty-fourth day of November 1915.

LOUIS S. CLARKE.

Witnesses:
JAMES H. BELL,
E. L. FULLERTON.