L. P. BARLOW.

BOMB OR TORPEDO.

APPLICATION FILED AUG. 30, 1916.

1,317,608.

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Fig. 1.

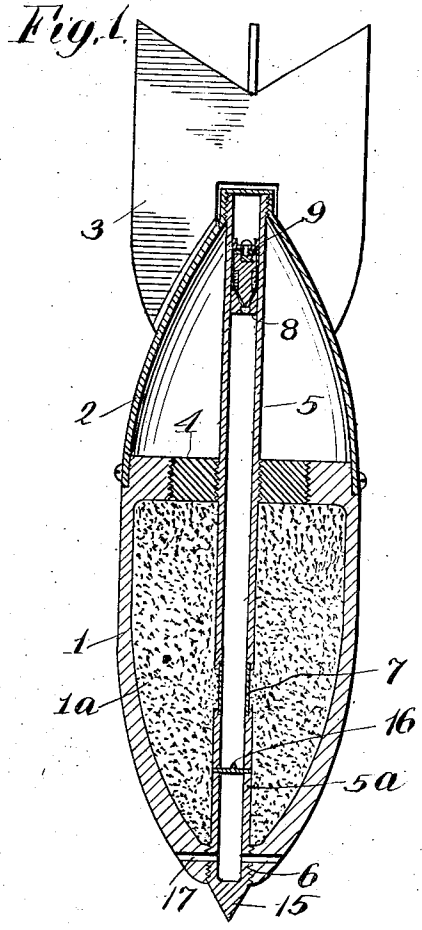


Fig. 2.

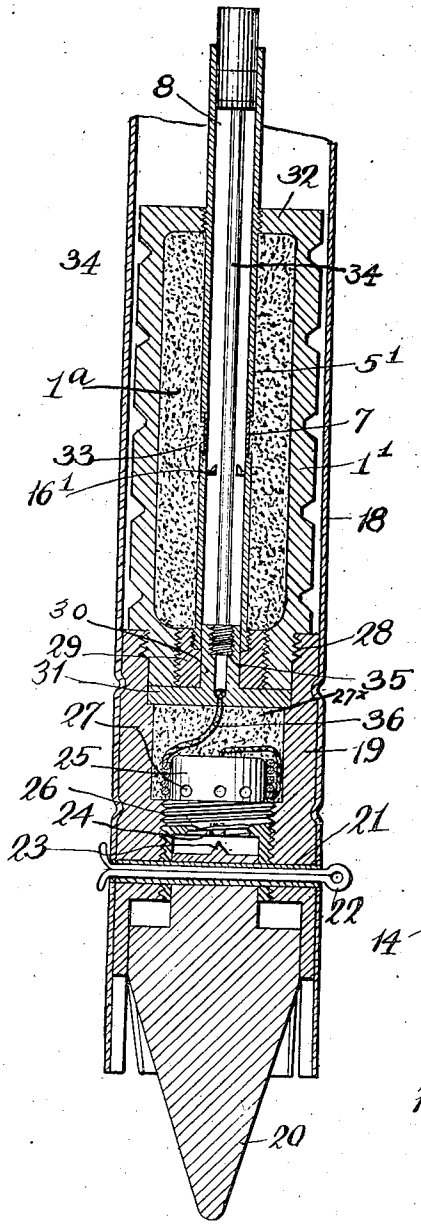
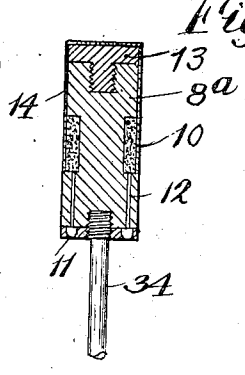


Fig. 3.



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BOMB OR TORPEDO.

1,317,608. Specification of Letters Patent. Patented Sept. 30, 1919.

Application filed August 30, 1916. Serial No. 117,579.

To all whom it may concern:

Be it known that I, LESTER P. BARLOW, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Bombs or Torpedoes, of which the following is a specification.

My invention relates to a bomb, torpedo or the like explosive body and is particularly concerned with the arrangement of the detonator therefor prior to the explosion of the detonator and bomb, and the manner of causing the explosion of the detonator within the magazine chamber of the bomb at the proper moment.

My invention is in some respects an improvement upon that disclosed in my prior application No. 92,093, filed April 19, 1916, detonator for a bomb, torpedo war head or the like. It may also be considered as in some respects an improvement upon the invention disclosed in my application Serial No. 117,578, filed August 30, 1916, and entitled Improvements in aerial mortars. My application Serial No. 92,093 referred to describes a construction in which a detonator is removably supported exterior to the body, or the magazine chamber, of the bomb or torpedo, the detonator being guided into the magazine chamber after the bomb has been discharged or released, and exploded therein at or shortly after the time that the body has struck its mark. By supporting the detonator outside the explosive chamber until after the bomb has been released, or until the proper time for explosion, the danger of a premature explosion of the bomb is largely avoided; the detonator being removed at a safe distance from the magazine section of the bomb it will not be affected by blows imparted to the bomb, or missiles penetrating the same or careless handling thereof.

In the construction referred to, however, a hollow detonator is used which is at all times contained within its guiding tube. Accordingly, when the detonator is exploded the force of the explosion must rupture the shell of the detonator and the containing tube in which it is movably mounted. Also the products of the explosion are not all effective for exploding the high explosive charge in the magazine chamber, since part of the force of the explosion of the detonator will be directed axially of the containing tube and therefore be wasted. By my present invention the explosion of the detonator is caused to take place within the magazine chamber in the bomb at a point at which there is a gap in the tube in which the detonator slides. Also the detonator which I prefer to use with this construction is a solid cylindrical body carrying its explosive charge in pockets or in a belt around its periphery, in alinement with the gap or gaps in the tube at the moment of explosion. The result of this construction is that the detonator bridges the gap at the moment of its explosion and the latter takes place entirely outwardly in the surrounding high explosive of the magazine chamber, the solid body of the detonator preventing any dissipation of the force of the explosion within the tube axially of the same. Also the tube is made sufficiently strong to resist collapse during the explosion of the high explosive in the magazine chamber surrounding the tube. The detonator also has the advantage, due to its construction, of not breaking into fragments when exploded, so that it is not dangerous in itself if accidentally fired at any time.

The arrangement may be such that the detonator, bridging the gap in the tube, is balanced in such position, the possibility of an unbalancing force acting upon the detonater axially of the tube being avoided.

The objects of my invention are accordingly to provide a detonator of the character referred to and a construction within a bomb or other explosive body adapted to coact with the detonator in the manner described.

In order that my invention may be more clearly understood, attention is hereby directed to the accompanying drawings forming part of this application and illustrating certain embodiments of my invention. In the drawings Figure 1 represents a longitudinal section of a bomb or torpedo war head, adapted to be exploded at or shortly after the impact of the same, with the object struck, Fig. 2 is a longitudinal section through a different form of bomb or other

explosive body, in which the bomb proper is so mounted as to be expelled upwardly or rearwardly from its inclosing casing after impact, and before the explosion of the bomb, and Fig. 3 is a longitudinal section taken through a detonator illustrating one of the features of my invention.

Referring first to Fig. 1 of the drawings, the numeral 1 designates a bomb or the war head of a torpedo whose magazine chamber 1^a is charged with a high explosive as is usual in such cases, such, for example, as tri-nitro-toluene. Extending from the base of the shell and secured thereto is the casing 2 which may be provided with vanes or wings 3 to aid in stabilizing the flight of the bomb.

An opening in the base of the shell is closed by a screw plug 4 having a central opening therein through which extends the tube 5 which is secured in the plug 4 preferably by a screw-threaded engagement. The tube 5 extends upwardly through casing 2 and may be secured at its upper end within the upper terminal of casing 2. Tube 5 also extends downwardly below plug 4 a substantial distance into the magazine chamber 1^a. A second tube 5^a is mounted in the lower end of the bomb as by means of the screw-threaded engagement shown at 6. This tube is in alinement with the upper tube 5, its upper end being close to but separated from the lower end of tube 5 to form a gap between the same. A thin sleeve 7 of celluloid or the like may be secured around the gap between tubes 5 and 5^a to prevent the explosive in chamber 1^a entering the tube. An equivalent construction would consist in using a single continuous tube in place of the tubes 5 and 5^a with a series of openings extending around the same in place of the continuous gap indicated in the drawing between tubes 5 and 5^a.

The thin sleeve 7 should, for the best results, be located substantially in alinement with the inner surfaces of tubes 5 and 5^a, so that an air gap will not be formed between the high explosive in chamber 1^a and the detonator, when the latter bridges the gap between tubes 5 and 5^a, at the moment of the explosion of the detonating charge. Such an air space would act as an insulator, to weaken the force of the detonating wave, and should therefore be avoided.

The movable detonator 8 is normally held in the upper end of tube 5 within casing 2, that is, at a safe distance from the magazine chamber 1^a. Detonator 8 may be held in such a position by any means which will be releasable when the forward end of the bomb strikes against an object to enable the detonator to slide down the tube. I have illustrated the detonator as provided with a friction washer 9 which will hold the detonator in its upper position by engaging frictionally the inner wall of tube 5 until it is released therefrom by the impact of the bomb against an object struck.

The detonator comprises a solid cylindrical body 8^a, preferably of steel, carrying its detonating charge, such as fulminate of mercury, in a series of shallow pockets 10 spaced about its periphery midway of the height thereof. One or more fuse-caps 11 in the lower end of the detonator are connected by a passage or passages 12 with the detonating substances in pockets 10. Preferably the detonator is provided with a screw-cap 13 having a sleeve portion 14 extending downwardly therefrom, fitting closely over the pockets 10 in the detonator, this sleeve portion 14 being of celluloid or other thin and readily breakable substance either as to its entire length or as to the portion thereof which extends around the pockets 10. The object of this provision is, of course, to hold the detonating material within pockets 10 after the same has been filled in place.

It should also be noted that, as shown in the drawings, the body 8^a of the detonator is made comparatively thick, with reference to the cross-sectional area of the detonating material in pockets 10. This is for the purpose of providing a structure which will not be shattered into fragments by the explosion of the detonating material. Not only is the body 8^a given a sufficient transverse dimension between the detonating material on opposite sides to resist rupture, and form an efficient plug for the cap between tubes 5 and 5^a, but the thickness of the steel in both directions from pockets 10, lengthwise of the detonator, is sufficient to prevent breaking off of these sections by the explosion of the detonator. Also the screw-cap 13, if used, is so separated from pockets 10 that it is not liable to be blown off. The only part which may be broken into fragments is the thin sleeve 14 covering pockets 10, and this is too slight to constitute any considerable element of danger. Accordingly it may be said that the detonator described is practically unshatterable, so that its accidental explosion at any time will not do any substantial damage.

The bomb is provided at its forward end with a striking nose 15 which may be formed on the forward end of tube 5^a or on the shell 1. A firing pin or pins 16 are mounted in position in the tube 5^a to strike the cap or caps 11 in the detonator when the latter falls. In the form illustrated in Fig. 1 a single firing pin 16 is shown, adapted to be struck by the fuse-cap 11, which is connected by suitable passages with the detonator sections 10. In the form of device illustrated in Figs. 2 and 3, it will be noted that a plurality of fuse-caps 11 are mounted on the lower face of the detonator, connected

by passages 12 with pockets 10, as shown, these fuse caps 11 striking against projections which are suitably mounted within the bore of the tube when the detonator falls.

The firing pin or pins 16 are so positioned that when the detonator falls it will be arrested with the pockets 10 in alinement with the gap between tubes 5 and 5^a. The material in pockets 10 being exploded, the force of the explosion will be directed outwardly in all directions into the high explosive contained in chamber 1^a, thus exploding the bomb. Obviously, the solid body 8^a of the detonator prevents any part of the products of the explosion passing either up or down inside the tubes 5 and 5^a. The interior of tube 5^a may be connected with the atmosphere beneath firing pin 16, if desired, by openings 17, so that the pressure on the under side of the detonator at the time of and after its explosion will be the same as the pressure in the tube 5 above the detonator. Tubes 5 and 5^a should be strongly and rigidly made, preferably of steel of sufficient thickness to resist collapsing under the pressure of the explosion of the material in the chamber 1^a about the same.

My invention is illustrated in Fig. 2 as applied to a bomb or the like of a somewhat different construction. This form is similar to that described and claimed in my application aerial motors, Serial No. 117,578 referred to above. In this case the bomb 1^a is mounted within the gun shell or outside tube 18, from which it is adapted to be expelled upwardly after the earth or a desired object has been struck. The breech block 19 is firmly secured within the lower portion of shell 18, and a striking nose member 20 is slidably mounted in a recess in the lower end of block 19. Nose 20 is held in place within block 19 by a thin copper tube 21 extending through a portion of nose piece 20 and the surrounding portion of block 19. A cotter pin 22 is extended through tube 21 but is removed therefrom when the bomb is dropped or launched. Upon the impact of striking nose 20 the thin copper tube 21 is sheared and a firing pin 23 on member 20 strikes against a fuse-cap, indicated at 24 as mounted in a chambered cylindrical member 25.

Member 25 is fixedly secured within breach block 19 by screw-threads 26. When pin 23 strikes against cap 24, the products of the explosion of the latter pass outwardly through openings 27 in member 25 into a chamber 27^x which is filled with a bomb expelling charge of explosive, chamber 27^x being formed in breech block 19. The explosion of the material in chamber 27^x strips the slight threaded connection 28 between bomb 1′ and the breech block and drives the bomb upwardly out of casing 18. If desired what I term a "primary delay fuse" may be mounted within member 25 and be exploded by the concussion of pin 23 against fuse-cap 24 after a delay sufficient to enable the downward movement of the entire device within the earth or object struck to be entirely arrested, the explosion of this primary delay charge exploding the bomb expelling charge in chamber 27^x.

Bomb 1′ is provided at its lower end with a screw-cap 29 through a central opening in which slidably extends a cylindrical portion 30 of a member having a circular base 31. Before the expulsion of the bomb, the base 31 rests on a suitable shoulder formed within the bore of the upper chamber in breech block 19, the lower end of the bomb resting upon base 31. When the explosive in chamber 27^x is exploded, base 31 rises out of shell 18 with the bomb resting thereon.

A tube 5′ extends axially through bomb 1′, the lower end of this tube being screw-threaded in or otherwise secured to the screw-plug 29. The tube extends upwardly through the upper wall 32 of the bomb in which it may be screw-threaded, the tube extending for a further distance above wall 32. Tube 5′ is provided with a series of openings 33 therethrough at a point within the magazine chamber 1^a of the bomb; or in place of this construction a pair of alined tubes may be used with a gap between the same, as indicated at 33, in the same manner as described in connection with Fig. 1. The upper end of cylindrical portion 30 of member 31 is slidably mounted in the lower end of the tube. The detonator 8, similar to that previously described, is slidably mounted in the upper end of tube 5′ outside the closed magazine chamber of the bomb. The detonator is supported by means of a rod 34 which may be secured to the lower end of the detonator, as shown in Fig. 3. This rod extends downwardly through tube 5′ and is secured at its lower end as by screw-threads 35 within a central opening in the cylindrical member 30.

A flexible cable 36 is secured at one end to member 25 which, as stated, is immovably secured to the breech block 19. This cord may be wrapped around the periphery of member 25 and its upper end is secured to member 31. When the bomb is expelled from the tube 18, it, together with member 31, will rise until cable 36 has become taut. Thereafter the bomb will continue to rise, but the upward movement of member 31, together with rod 34 and detonator 8 is arrested. Accordingly, tube 5′ moves upwardly relatively to the detonator, which is equivalent to the detonator dropping through the tube, until the fuse-caps 11 at the bottom of the detonator strike the projections 16′ formed in the interior of tube 5′ below gap 33. This results in the outward

explosion of the detonator into the bursting charge contained in the magazine chamber 1^a of the bomb, the pockets 10 of the detonator being alined with the gap or openings 33 in the tube in the same manner as already described.

It will be evident that my invention is not limited in its applicability to the two forms of bomb or torpedo which have been described, these constructions being merely illustrative of certain embodiments of the invention.

The essential points of my invention, it should be noted, are the provision of means whereby the force of the explosion of the detonator will all be directed effectively into the high explosive in the magazine chamber, none being wasted through the guiding means for the detonator, or other opening; and the arrangement whereby the force of the explosion in the high explosive will all be effective to shatter the bomb, none being wasted through the said tube or other opening. These results are achieved with the use of a detonator which has no locking or securing devices therefor, which would introduce undesirable mechanical features. Accordingly the detonator is movably mounted in a guiding means therefor (such as a tube), this guiding means having a gap or openings therein; the detonator being arranged to operate only through the gap and to plug or close the gap, and to be balanced in such position at the time of its explosion. There is no other opening, besides the gap thus closed, by which the products of the explosion in the high explosive may escape from the magazine chamber. Therefore the whole force of this explosion is effective to shatter the bomb. It should also be particularly noted that the tube or tubes in which the detonator moves should be made strong enough to resist collapse during the explosion in the magazine chamber, which, of course, is intended to shatter the outer walls of the magazine chamber. It is, of course, immaterial whether or not the tubes bend or collapse after the shattering of the outer walls and the obtaining of a perfect detonation. It is only necessary for the tubes to resist collapse until after the outer walls burst, thus causing the detonation in a perfectly confined space.

In detonating an explosive of the character of tri-nitro-toluene, the most perfect results are achieved by causing the detonation in a perfectly confined space. This is accomplished by my invention. If an avenue of escape were provided for the products of explosion of the detonator, through the tube or other opening (which is prevented by my invention), the entire mass of tri-nitro-toluene or the like in the magazine chamber might not be completely exploded.

As a specific example, I may say that with a detonator carrying 280 grains of fulminate of mercury, the tubes 5 and 5^a may be of tough steel having inner and outer diameters of one and one-quarter and one and three-quarter inches, respectively, the detonator having a diameter of approximately one inch at its narrowest point between opposite pockets.

The phrase "tube having an opening therethrough," or the like, in the claims, should be understood to include a pair of alined tubes separated by a gap, as described.

What I claim is:—

1. In a bomb, torpedo or the like explosive body, the combination of a casing having a closed chamber for a high explosive, a tube extending into said chamber having an opening therethrough within the chamber, a thin sleeve covering said opening, with its inner surface in substantial alinement with the inner surface of said tube, a detonator slidably mounted and closely fitting in said tube and adapted to slide down the same into line with said opening after the release or discharge of the bomb, and a device adapted to explode said detonator after the latter has advanced down the tube into line with said opening, said tube being sufficiently strong to resist collapse when the high explosive is exploded by the detonator through said opening, substantially as set forth.

2. In a bomb, torpedo or the like explosive body, the combination of a casing having a closed chamber for a high explosive, a tube extending into said chamber, having an opening therethrough within the chamber, and a portion extending outside the chamber, a detonator slidably mounted in said tube and adapted to be retained in the portion thereof exterior to said chamber prior to the release or discharge of the bomb, and a device in said tube below said opening adapted to explode said detonator after the latter has advanced down the tube into line with said opening, the portion of said tube within said chamber presenting closed resisting walls to said chamber at all points other than said opening of a strength sufficient to prevent collapse of the same at the time of the explosion of said detonator through said opening, substantially as set forth.

3. In a bomb, torpedo or the like explosive body, the combination of a casing having a closed chamber for a high explosive, a tube extending into said chamber, having an opening therethrough within the chamber and a portion extending outside the chamber, a detonator movably mounted in said tube and comprising a solid cylindrical body carrying the detonating material in a pocket formed on its periphery, said detonator also

having means at its lower end adapted to explode said detonating material when brought into sharp contact with a hard surface, and a device in said tube below said opening, adapted to arrest the detonator and contact said means to explode said detonating material, when the detonator has advanced down the tube into position to aline the said detonating material with said opening, substantially as set forth.

4. In a bomb, the combination of a casing having a chamber for a high explosive, a tube extending through said chamber, having an opening therethrough around the periphery thereof, within the mass of explosive, a detonator mounted in said tube, comprising a solid body carrying the detonating material in a pocket formed on its periphery, and means within said tube for exploding the detonating material by concussion when said material is in alinement with said opening, with the solid body of the detonator extending in both directions from the opening, within the tube, substantially as set forth.

5. A detonator for a bomb, torpedo or the like explosive body, comprising a solid body carrying the detonating material in a pocket formed on its periphery, substantially as set forth.

6. A detonator for a bomb, torpedo or the like explosive body, comprising a solid elongated body, adapted to be slidably mounted in a tube-like member, the detonator carrying the detonating material in a pocket formed on its periphery intermediate its ends, and carrying a fuse-cap at one end, connected with said detonating material by a passageway, substantially as set forth.

7. In a bomb, torpedo or the like explosive body, the combination of a casing containing a closed chamber for a high explosive, a tube extending into said chamber from the upper end, the lower end of said tube being secured in the lower end of the casing, the latter having an axial opening therethrough in alinement with the bore of said tube, a member having a flange adapted to seat against the lower end of the casing, and a cylindrical portion adapted to slidably enter the opening therein, a detonator slidably mounted in said tube, a supporting rod carrying the same, having its lower end mounted in said cylindrical portion, said detonator being thus supported in the portion of said tube exterior to said chamber when said cylindrical portion is seated in said opening, and a firing pin in said tube, within said chamber, adapted to explode said detonator when relative movement is caused between said tube and detonator to cause contact between the pin and detonator, substantially as set forth.

8. In a bomb, torpedo or the like body, the combination of a casing having a closed chamber for a high explosive, a guiding means for a detonator having a gap therein within the chamber, a detonator movably mounted in said guiding means, and adapted to bridge said gap, and means for exploding the detonator outwardly through said gap into the high explosive when the detonator bridges said gap, said detonator being constructed to explode through said gap only, and to plug said gap when bridging the same, against inward passage through said gap of the products of explosion in said high explosive; and said guiding means presenting closed resisting walls to said chamber at all points other than said gap, substantially as set forth.

9. A detonator for a bomb, torpedo or the like explosive body, comprising a metallic body carrying the detonating material in a pocket formed on its periphery, the proportions of said metallic body being so chosen with relation to the dimensions of said pocket, that explosion of fulminate of mercury or detonating material of like power in said pocket will not shatter said metallic body, said pocket being surrounded on all sides but the outer by continuous integral portions of said metallic body, substantially as set forth.

10. In a bomb, the combination of a casing having a chamber for a high explosive, a tube extending through said chamber, having an opening therethrough around the periphery thereof, within the mass of explosive, a detonator mounted in said tube, comprising a metallic body carrying the detonating material in a pocket formed intermediate its ends, with metal of substantial depth on both sides of said pocket, axially of the body, said tube being of a strength sufficient to prevent collapse of the same when said high explosive is exploded by said detonating material through said opening, and means for exploding the detonating material by concussion when said material is in alinement with said opening, with the metal of said detonator extending in both directions from the opening, within the tube, said detonator being constructed to plug said opening, when extending across the same, and to explode outwardly only, substantially as set forth.

This specification signed and witnessed this 23d day of August, 1916.

LESTER P. BARLOW.

Witnesses:
DYER SMITH,
M. S. GANG.