J. B. SEMPLE.

DETONATOR FUSE.

APPLICATION FILED DEC. 31, 1918.

1,336,391. Patented Apr. 6, 1920.

FIG.1.

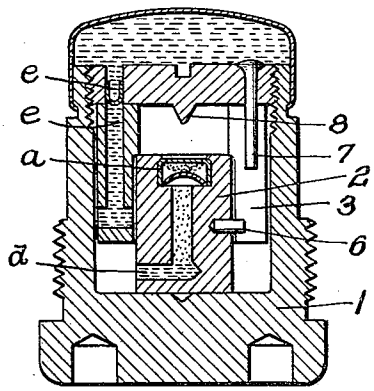


FIG.2.

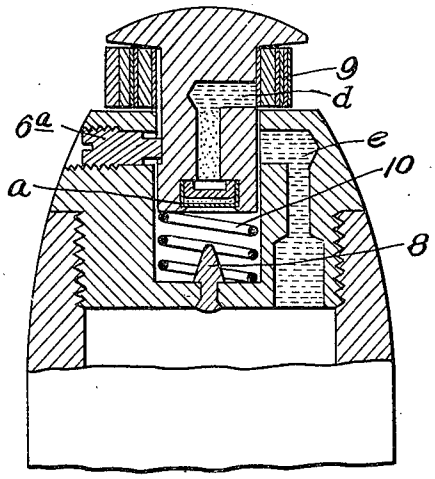


FIG.3.

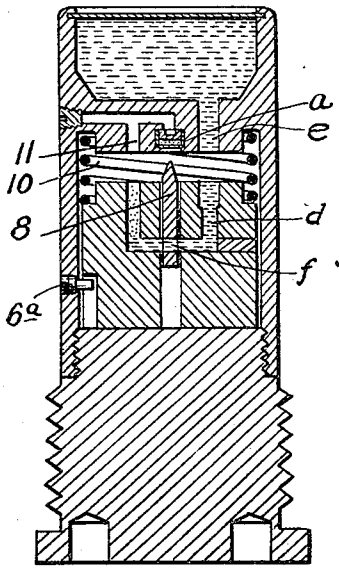


FIG.4.

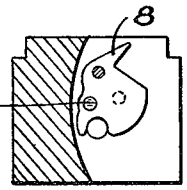
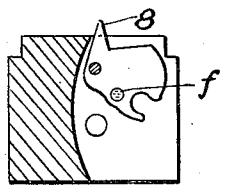


FIG.5.



WITNESSES

J. Herbert Bradley.

Francis J. Donasson.

INVENTOR

John B. Semple

by Christy and Christy

his attorneys

UNITED STATES PATENT OFFICE.

JOHN B. SEMPLE, OF SEWICKLEY, PENNSYLVANIA.

DETONATOR-FUSE.

1,336,391. Specification of Letters Patent. Patented Apr. 6, 1920.

Application filed December 31, 1918. Serial No. 269,083.

To all whom it may concern:

Be it known that I, JOHN B. SEMPLE, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Detonator-Fuses, of which improvements the following is a specification.

My invention relates to detonating fuses for shells, and its objects are simplicity of structure and economy of space.

In Letters Patent of the United States Nos. 1,172,636 and 1,172,637, granted me February 22, 1916, I have shown and described, in alternate specific forms, a detonating fuse for a high-explosive projectile including in its structure a percussion cap, a detonator, and a body of high explosive; a flashway leads from percussion cap to detonator, and a path of detonation transmission leads from detonator to the body of high explosive; in the path of detonation transmission last mentioned is arranged an interrupter which, prior to the firing of the projectile, prevents transmission of the detonating impulse, but which in consequence of firing moves to make continuous the theretofore interrupted path, that the detonation impulse may at the intended time pass to the body of high explosive.

In the detonating fuse of these earlier patents mentioned the percussion cap is fired by the relative movement of two members, comonly spoken of as the hammer member (or "plunger") and the anvil member—a relative movement due to inertia, when the projectile after being fired makes impact. The path of detonation transmission extends through a block of metal of considerable thickness and this path is made continuous while the projectile is in flight by the movement of a centrifugal bolt along a runway in the block of metal referred to.

In the fuse of my present invention the same movement of parts by which the firing of the percussion cap is accomplished accomplishes also the making continuous of the path of detonation transmission. In consequence, the structure is simplified (and that is in itself a matter of advantage), and dimensions may be diminished. This is advantageous not merely because there is saving in weight and in cost, but, more important by far, because there is saving in space, so that the fuse structure occupies a minimum space and the permissible size of the burster charge is correspondingingly increased. This is of particular importance in small shells.

In an application for Letters Patent of the United States filed August 2, 1918, Serial No. 248,022 (now held allowable), I have described and claimed a detonator charge so constituted that, in comparison with other detonators, it may be made of very small bulk. I prefer to employ in the fuse of my present invention such a detonator; thus the structure is reduced to the smallest dimensions thus far attained in this art.

Figures 1, 2, and 3 of the accompanying drawings show in medial longitudinal section three alternate specific embodiments of my present invention. Figs. 4 and 5 are sectional views of parts of the fuse of Fig. 3, the plane of section being at right angles to that of Fig. 3 and the relatively movable parts being shown in the two figures in their alternate positions.

Referring first to Fig. 1, the detonating fuse there shown is a base fuse, superficially of familiar appearance. Within the stock 1, in a suitable bore for longitudinal traverse, is arranged a two-part telescopic plunger 2, 3. Before the projectile is fired this plunger in the extended position shown occupies the entire length of the bore. When the projectile is fired the forwardly arranged part 3, which is a split collar, sets back by inertia, expands, and telescopes rearwardly upon the part 2; and thereafter the collapsed members, locked together by friction, function as a unit. When the projectile strikes and its speed is arrested this collapsed and now unitary plunger drives forward by inertia and effects the firing of the percussion cap.

The detonator and the path of transmission are shown at *d e e* and it will be seen that they are contained partly in member 2, partly in 3, and partly in the immovable portion of the structure. Normally, as shown in Fig. 1 communication is interrupted between *d* and *e;* when, on firing, member 3 sets back communication is established from *d* to *e*, but at the same time a break opens in the line of communication *e, e*. This break is closed only on impact, when the collapsed plunger drives forward to fire the percussion cap, and then for the first time detonation communication is complete from detonator to burster charge.

It should be explained that the material

which fills the duct prepared to receive it, and which constitutes the path of detonation transmission *e*, *e*, has this capacity: a detonating impulse traversing it will jump across short breaks in continuity; using the usual material, the impulse will jump across an air space as great as half the diameter of the bore. It follows from this that, while the setting-back of member 3 already described will ordinarily open a break in continuity of the path *e*, *e* wider than can be jumped, the subsequent driving forward of the unified parts 2, 3 will to all intents and purposes reëstablish continuity, even though the two portions *e*, *e* should not come into actual and immediate contact. They will at least come so closely together that the detonation impulse will jump the interval.

The proper establishment of communication is dependent, as will be observed, on the proper alinement of the movable parts, and to this end a pin-and-slot engagement is shown at 6 between members 2 and 3, and again at 9 between member 3 and the stationary portion of the structure.

Referring now to Fig. 2, the fuse there shown will be seen to be a point fuse, firing on contact. Normally—that is to say, until the time of firing—the plunger is held in remote, inoperative position by a "French ribbon" 9, interposed between a flange on the plunger and the fuse stock. This French ribbon is a spiral of flexible material (ordinarily metal) coiled about the body of the plunger; as the projectile flies, rotating as it flies, this ribbon in response to centrifugal force uncoils and comes away, leaving the plunger armed—that is to say, free of restraint and ready to act. Thereafter, during the further flight, a spring 10 holds the plunger inactive; but when the projectile strikes on its point the plunger, protruding as it does at the point of the projectile, is driven back against the weak tension of the spring and the cap *a* impinging on the pin 8 is fired.

The path of detonation transmission *d*, *e* is arranged, partly in the plunger, partly in the immovable part of the structure. Normally, as shown in the drawing, this path is discontinuous, and it will be understood that it becomes continuous only on contact and by the movement of parts which effects also the firing of the percussion cap. A pin-and-slot engagement indicated at 6^a holds the movable part alined in the stationary part.

Fig. 3 shows again a base fuse, firing on impact; the plunger carries the firing-pin 8, and carries it normally in unarmed position (*cf.* Fig. 4). In response to centrifugal force due to the rotation of the projectile the firing-pin is first released and then brought to armed position (*cf.* Fig. 5). Thereafter on impact the plunger drives forward, and the extended pin impinges upon and fires the percussion cap. Spring 10 serves to hold the plunger retracted until under the heavy strain of impact its tension is overcome and the plunger drives forward.

The path of detonation transmission may conveniently be arranged in part in the body of the swinging firing pin 8 (at *f*) and in that case the path becomes continuous through the firing-pin only when the firing-pin moves to armed position. Furthermore, as is shown in Fig. 3, a gap in the path of detonation transmission is maintained so long as the plunger remains in the retracted inactive position shown; it is only on impact and on the driving forward of the plunger to fire the percussion-cap that this gap is closed and the path of detonation complete from detonator to burster charge. As in the cases already described alinement of the moving plunger within the fuse is insured by the pin-and-slot engagement indicated at 6^a.

What has been said above in connection with the form shown in Fig. 1 about the substantial continuity of the path of detonation transmission at the time of detonation applies in substance to the form shown in Fig. 3.

Comparing the three figures, it will be observed that the invention may be applied, either to a base fuse (Figs. 1 and 3) or to a point fuse (Fig. 2); that firing-pin and percussion cap may be arranged as preferred, the plunger may carry the cap (Figs. 1 and 2) or it may carry the firing-pin (Fig. 3), and to either arrangement my invention is applicable. And in this connection I call attention to the flash-way 11 (Fig. 3) formed in the fuse body, through which the flash from the cap may pass to impinge on the detonator borne in the plunger, In each case it will however be observed that the detonator is borne by the plunger; that normally it is isolated from the burster-charge; that it is contained in a chamber adapted to relieve the stress of accidental premature explosion of the detonator. And finally it will be observed that in each case the path of detonation transmission is completed on, and only on, the cap-firing traverse of the plunger. This in the case of the fuse of Figs. 1 and 3, occurs on impact, when the sudden arrest of speed of the flying projectile causing the plunger to drive forward under inertia; it occurs in the case of Fig. 2 when the projectile strikes on its point and the protruding plunger is driven inward.

I claim as my invention:

1. In a detonating fuse a cap-firing plunger functioning on impact and a path of detonation transmission preliminarily incomplete and completed only by the traverse

of said plunger on impact, substantially as described.

2. In a detonating fuse a cap-firing plunger and a path of detonation transmission completed on the cap-firing traverse of said plunger.

3. In a detonating fuse for shells a cap-firing plunger consisting of a plurality of parts brought to relative positions of operation by forces released on explosion of the propelling charge, and a path of detonation transmission extending through said parts and made continuous when said parts are brought to the relative positions defined above.

4. In a detonating fuse for shells the combination of a stock, a cap-firing plunger movable within the stock said plunger consisting of a plurality of parts brought to relative positions of operation by forces released on explosion of the propelling charge and movable as an entity to effect cap-firing, and a path of detonation transmission formed in said parts and in said stock and made continuous through the plunger parts when said parts are brought to the relative positions defined above, and made continuous from plunger to stock by the cap-firing traverse of said plunger.

5. In a detonating fuse for shells a cap-firing plunger movable in a runway, centrifugally moving means for preparing the plunger for service, and a path of detonation transmission made continuous by the cap-firing movement of the plunger in its runway.

6. In a detonating fuse for shells, a stock, a cap-firing plunger movable in said stock, centrifugally removable means for holding said plunger in safety position, and a path of detonation-transmission made continuous on the cap-firing traverse of said plunger.

7. In a detonating fuse for shells a cap-firing plunger functioning on contact and a path of detonation transmission normally discontinuous and made continuous on the functioning of said plunger.

8. In a detonating fuse for shells a cap-firing plunger armed by inertia through the operation of forces released on the explosion of the propelling charge and a path of detonation transmission made continuous on the cap-firing traverse of said plunger.

9. In a detonating fuse the combination of a stock, a plunger having cap-firing traverse in said stock, a detonator, a path of detonation transmission formed in part in said plunger and in part in said stock, said path preliminarily discontinuous and made continuous on the cap-firing traverse of said plunger.

In testimony whereof I have hereunto set my hand.

JOHN B. SEMPLE.

Witnesses:
BAYARD H. CHRISTY,
FRANCIS J. TOMASSON.