Sept. 21, 1926. 1,600,303

A. ADELMAN ET AL

COMBINATION FUSE

Filed July 28, 1925 2 Sheets-Sheet 1

Fig. 1.

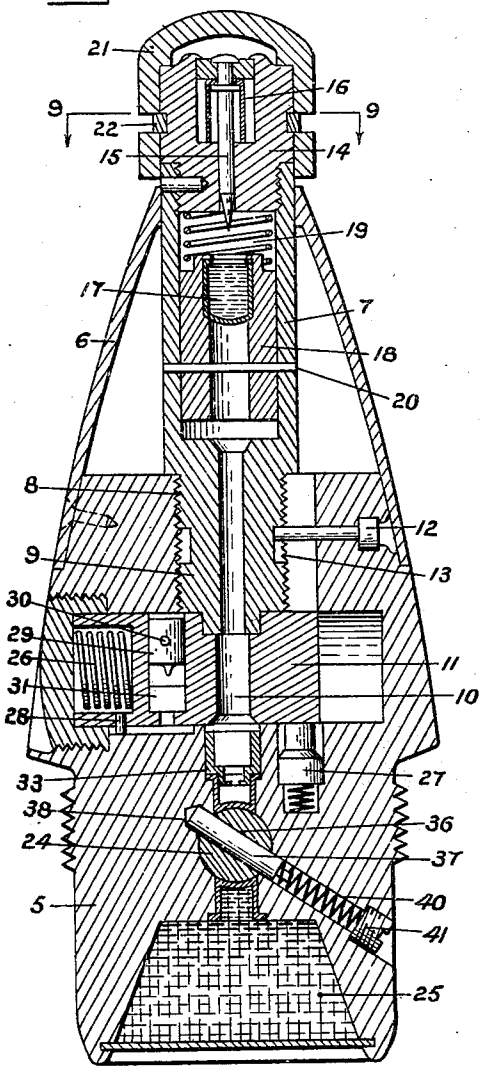


Fig. 2.

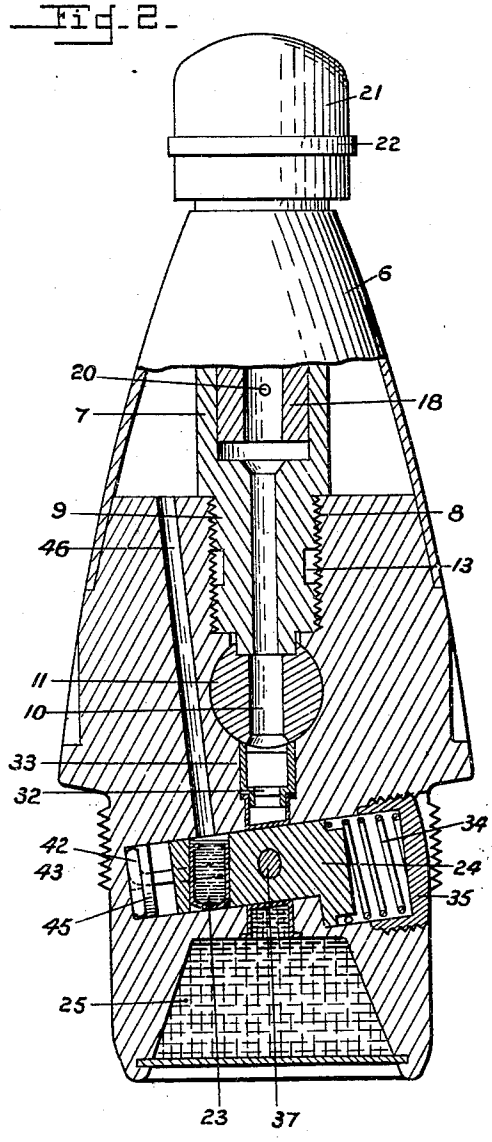
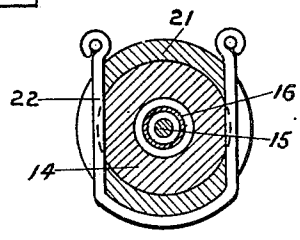


Fig. 3.



Inventor

Arthur Adelman - J.K. Crain

Frederick Hawkes - H.G. Towner

By W.N. Roach.

Attorney

Sept. 21, 1926. 1,600,303

A. ADELMAN ET AL

COMBINATION FUSE

Filed July 28, 1925 2 Sheets-Sheet 2

Fig. 3.

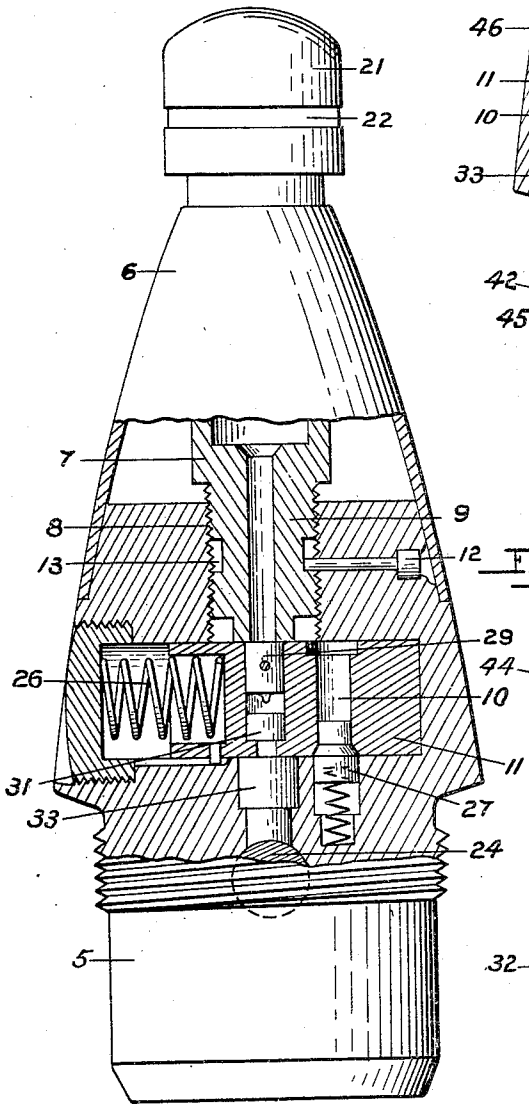


Fig. 4.

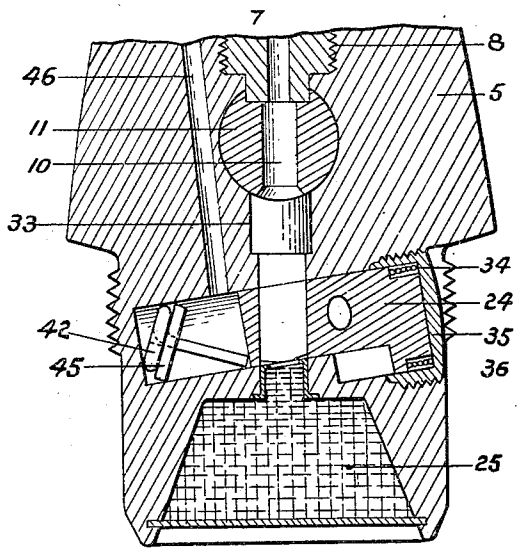


Fig. 5.

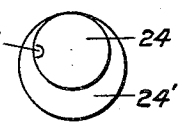


Fig. 6.

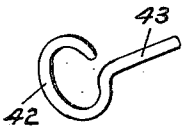


Fig. 8.

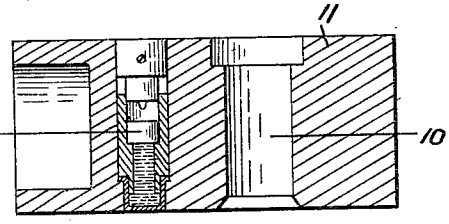
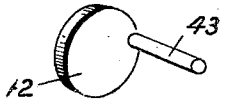


Fig. 7.



Inventor

Arthur Adelmen - J.K. Crain

Frederick Hawkes - H.G. Towner

By W.N. Roach

Attorney

Patented Sept. 21, 1926. 1,600,303

UNITED STATES PATENT OFFICE.

ARTHUR ADELMAN, OF CHESANING, MICHIGAN; JAMES K. CRAIN, OF THE UNITED STATES ARMY; FREDERICK HAWKES, OF TAKOMA PARK, MARYLAND; AND HAROLD G. TOWNER, OF NEW HAVEN, CONNECTICUT.

COMBINATION FUSE.

Application filed July 23, 1925. Serial No. 46,650.

(GRANTED UNDER THE ACT OF MARCH 3, 1883; 22 STAT. L. 625.)

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment to us of any royalty thereon, in accordance with the act of March 3, 1883.

The subject of this invention is a combination fuse.

The type of fuse employed on projectiles for functioning their bursting charges is controlled by a consideration of the nature of the target and the particular effect desired. To facilitate fabrication and distribution combination fuses have been devised which may be selectively adjusted in the field to function under varying conditions.

The most practical fuses of this class generally embody an involved structure including an eccentric firing pin and requiring a large fuse body chambered, and thereby correspondingly weakened, to accommodate the various elements of the firing mechanisms. The delay mechanism which, in the better practice, is employed for heavy impact, to obtain demolition by penetration before explosion, is subject to become disarranged, by reason of deformation of the fuse, as a result of the heavy impact.

The principal object of this invention, then, is to provide a compact combination fuse, in which the firing mechanisms, for securing varying actions, are positioned axially of the fuse, when set for functioning, so as to insure positive functioning even on heavy impact.

Other objects and advantages of equal importance are: to provide a novel primary firing mechanism mounted in a stem which controls the positioning of a transversely movable bolt carrying a delay firing pin adapted to be functioned by the force of detonation of the primary firing mechanism; to securely lock the bolt in set position so that it will not be displaced on impact; to provide a bore safety slide carrying a detonator interposed between the firing mechanisms and the booster; and, to to provide means for preventing return of the slide when it has assumed the armed position during flight of the projectile.

To these and other ends, our invention consists in the construction, arrangement, and combination of elements, described hereinafter and pointed out in the claims forming a part of this specification.

A practical embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Fig. 1 is a longitudinal sectional view through a fuse constructed in accordance with the invention, the parts being arranged to afford instantaneous action;

Fig. 2 is a similar view taken at right angles to Fig. 1;

Fig. 3 is a partial sectional view on the plane of Fig. 1, showing the parts arranged for delay action;

Fig. 4 is a fragmentary sectional view on the plane of Fig. 2, showing the slide in armed position;

Fig. 5 is an end view of the slide in unarmed position;

Fig. 6 is a detail view of the slide locking member;

Fig. 7 is a detail view of a different form of slide locking member;

Fig. 8 is a sectional view of a modified bolt carrying the complete delay firing mechanism; and

Fig. 9 is a sectional view on the line 9—9 of Fig. 1.

Referring to the drawings by numerals of reference:

In a practical embodiment of a preferred form of the invention, there is provided a fuse body 5, to which may be secured on its forward end a cap or shell 6. Inserted through the shell is a hollow stem 7 whose inner end is threaded as at 8 for axial attachment to the fuse body. The extremity of this portion of the stem is further reduced, as at 9, to form a key receivable into a passage 10 in a bolt 11 mounted transversely in the body for slidable movement. A stop pin 12, fixed in the body, is disposed in an annular groove 13, in the threaded portion 8 of the stem, to determine proper positioning of the keyed end 9 of the stem with respect to the bolt, the key being inserted in the aperture 10, as illustrated in Figure 1, when desired to set the fuse for instantaneous action, or withdrawn there-

from as seen in Figure 3 when setting the fuse for delay action.

Secured in the mouth of the hollow stem 7 is an apertured striker head 14 in which is placed a firing pin 15 normally held in inoperative position by an inverted cup-shaped retainer 16 which is adapted to be crushed on impact to allow the firing pin to be driven in towards the primer detonator 17 carried by an apertured plunger 18 in the hollow stem 7. The plunger is normally maintained in spaced relation to the firing pin by means of a spring 19 confined between it and the striker head 14 and also by a safety pin 20, extending transversely through the stem and plunger. This pin 20 may be of sufficient strength to either be sheared to free the plunger on set back in the gun or on impact. In the former case, the fuse will function in ricochet action when the front end of the fuse is not crushed, the plunger being free to move forward under its inertia so that the detonator 17 may be set off by the firing pin 15. As an additional safety factor during transportation and storage, a protecting cap 21 for the firing pin is placed over the striker head 14 and held in place by a spring clip 22.

When the fuse is set for instantaneous action as shown in Figures 1, 2 and 4, the force of the explosion in the primer detonator 17 passes unrestricted through the passage 10 in the bolt to function a second detonator 23 carried in a slide 24 mounted in the fuse body above a booster charge 25. However, when desired to set the fuse for delay action, shown in Figure 3, the stem is unthreaded until clear of the bolt 11 which is then free to be moved by its spring 26 until brought to rest against the fuse body where it is locked by a plunger 27 which engages in the passage 10. During this movement it is guided by the pin 28 working in a groove in the body. Mounted in the bolt so as to be axially aligned in the fuse when the bolt is locked by the plunger 27 is a delay firing mechanism consisting of a firing pin 29 held inoperative in an aperture in the bolt by a safety wire 30 which spaces it from a primer 31 positioned therebeneath. The wire 30 is adapted to be sheared by the force of detonation of the primer detonator 17.

The flame from the primer 31 ignites a delay element 32 interposed between it and the second or lower detonator 23 in the slide 24. This delay element may be disposed in the bolt 11, as shown in Figure 8, or it may be located in the chamber 33, between the bolt and the slide. In the latter arrangement it does not interfere with the functioning of the fuse in the instantaneous setting as the charge in the primer detonator 17 of the plunger is made large enough so that the force of its explosion instantly consumes the delay element.

The slide 24 is a cylindrical member having an eccentric portion 24′ to prevent rotation and to insure axial alignment of the detonator 23 as the slide moves to armed position through the action of centrifugal force. The slide is preferably inclined with respect to the axis of the fuse so as to guard against its movement to armed position when in the bore of the gun while a spring 34 confined by a stop screw 35 is also provided to auxiliarily hold it in unarmed position.

The slide is primarily maintained unarmed position by a suitable locking device whose center of gravity is so placed that rotation of the projectile will only tend to lock it more firmly while it can only be moved to release the slide through the force of setback on acceleration or through this force plus centrifugal force during rotational flight of the projectile. The slide is formed with a slot 36 in which is a pin 37 of greater length than the diameter of the slide and normally projecting into a short slot 38 and a long slot 39 in the fuse body, the center of gravity of the pin being initially maintained on the side of the short slot 38 by a spring 40 seated against a screw plug 41. When assembled the pin 37 is inclined with respect to the longitudinal axis of the fuse so that on setback its center of gravity will be shifted to the opposite side of the axis of the fuse. The force of setback may initiate withdrawal of the pin whose movement is then completed through centrifugal force during rotation of the projectile or setback may completely effect withdrawal of the pin. By this arrangement the locking pin may be withdrawn before the projectile attains its full rotational speed at which time the slide commences to arm.

In order to insure retention of the slide 24 in the armed position during the interval between impact and functioning of the secondary detonator, there is provided a locking member, conveniently positioned at one end of the slide, and consisting of an annular base 42 having an eccentric stud or finger 43 which is disposed in a longitudinal slot 44 in the slide when the slide is in unarmed position. As the slide moves in one direction to armed position under the action of centrifugal force, the locking member 42—43 is maintained, through the same influence, in its normal assembled position at the end of the passage provided for the slide. When disengaged by virtue of their relative movement in opposite directions, the finger 43 is free to be displaced with respect to the slot due to its unequally distributed weight as affected by the rotation of the projectile and the curve of the trajectory. By forming the base 42 of smaller diameter than the passage of the slide and locating the slot or groove on any but the forward or impact side of the slide displacement of the

finger with respect to the slot may be more positively assured. In order to prevent the locking member from being carried with the slide as the latter arms, additional weight may be given this member by means of a washer 45. A passage 46 in the fuse body establishes a safety vent for the secondary detonator 23 when the slide is in the unarmed position.

The fuse is assembled for issue with the parts arranged in the instantaneous setting as illustrated in Figures 1 and 2, the key 9 of the stem being disposed in the passage 10 of the bolt 11. To change this setting for delay action it is only necessary to unthread the stem 7 until the key 9 clears the bolt whence the bolt may be moved by its spring to align the delay firing mechanism axially of the fuse in which position it is locked by the plunger 27 which enters the aperture 10 of the bolt. In either method of functioning, the firing mechanism is located axially of the fuse thereby enabling the fuse to be of compact and convenient form and preventing disarrangement and consequent non-functioning of the delay mechanism by reason of deformation of the fuse on impact.

It will be noted that in the delay setting the auxiliary firing pin 29 is spaced but a very short distance from the key 9 of the stem 7 so that even should the safety wire 30 be sheared on impact by the inertia of the firing pin 29 the pin will still be held in operative position. Normally, however, the safety wire will not be sheared except by force of the detonation of the primer detonator 17.

The stem 7 might equally well restrain movement of the bolt by engaging the inner face of the bolt which would be shortened accordingly.

While in the foregoing there has been illustrated and described such combination and arrangement of elements as constitute the preferred embodiment of our invention, it is nevertheless desired to emphasize the fact that interpretation of the invention should only be conclusive when made in the light of the subjoined claims.

We claim:—

1. A combination fuse including a body, a hollow stem threaded in one end of the body and having a key on its inner end, means in the body for limiting adjusting movement of the stem with respect to the body, a striker head secured to the stem, a firing pin collapsibly supported in the head, an apertured plunger and plunger spring in the stem, a primer detonator in the plunger, a shear pin passing through the plunger and stem, a bolt mounted transversely in the body and having a passage normally positioned axially of the fuse to receive the key on the stem a delay firing pin in the bolt, a wire for holding it in place adapted to be sheared by the force of explosion of the primer detonator, a primer in the bolt, a spring for moving the bolt to align the delay firing mechanism axially of the fuse when the stem has been moved clear of the bolt, a plunger pin in the body adapted to enter the passage in the bolt when the bolt is released, a transversely mounted centrifugal slide in the body, a detonator in the slide, means for holding the slide in unarmed and armed position, and a delay element interposed between the slide and bolt.

2. A combination fuse including a body, a hollow stem threaded in one end of the body and having a key on its inner end, means in the body for limiting adjusting movement of the stem with respect to the body, a striker head secured to the stem, a firing pin supported in the head, an apertured plunger and plunger spring in the stem, a primer detonator in the plunger, a bolt mounted transversely in the body and having a passage normally positioned axially of the fuse to receive the key on the stem, a delay firing pin in the bolt, a wire for holding it in place adapted to be sheared by the force of explosion of the primer detonator, a primer in the bolt, a spring for moving the bolt to align the delay firing mechanism axially of the fuse when the stem has been moved clear of the bolt, a plunger pin in the body adapted to enter the passage in the bolt when the bolt is released, a transversely mounted centrifugal slide in the body, a detonator in the slide, and a delay element interposed between the slide and bolt.

3. A combination fuse including a body, a hollow stem threadable in the body and having a key on its inner end, a striker head on its outer end, a primary firing mechanism and detonator carried by the stem, a bolt mounted transversely in the body and having a passage normally positioned axially of the fuse when the key of the stem is inserted therein, a delay firing mechanism in the bolt adjacent said passage, means for moving the bolt when the stem is partially unthreaded to position the delay mechanism axially of the fuse, said delay mechanism adapted to be functioned by the detonation of the primary firing mechanism, a centrifugal slide in the body, a detonator in the slide, and a powder train interposed between the slide and bolt, said train adapted to be instantly consumed when directly subject to the action of the primary firing mechanism but affording a delay interval when ignited through the delay firing mechanism.

4. A combination fuse including a body, a hollow stem threadable in the body and having a striker head on its outer end, a primary firing mechanism and detonator carried by the stem, a bolt mounted transversely of

the body and having a passage normally positioned axially of the fuse when the inner end of the stem is inserted therein, a delay mechanism in the bolt adjacent said passage, means for moving the bolt when the stem is withdrawn from the passage to position the delay mechanism axially of the fuse, said delay mechanism including a firing pin adapted to be functioned by the detonation from the primary firing mechanism, a centrifugal slide in the body below the bolt and a relay element in said slide.

5. A combination fuse including a body, a hollow stem threadable in the body and having a striker head on its outer end, a primary firing mechanism and detonator carried by the stem, a bolt mounted transversely of the body and having a passage normally positioned axially of the fuse when the inner end of the stem is inserted therein, a delay mechanism in the bolt adjacent said passage, means for moving the bolt when the stem is withdrawn from the passage to position the delay mechanism axially of the fuse, said delay mechanism adapted to be functioned by the primary firing mechanism detonator, a centrifugal slide in the body below the bolt, and a relay element in said slide.

6. A combination fuse including a body, a hollow stem threadable in the body and having a striker head on its outer end, a primary firing mechanism and detonator carried by the stem, a bolt mounted transversely of the body and having a passage normally positioned axially of the fuse when the inner end of the stem is inserted therein, a delay mechanism in the bolt adjacent said passage, and means for moving the bolt when the stem is withdrawn from the passage to position the delay mechanism axially of the fuse.

7. A combination fuse including a body, a bolt mounted transversely in the body and having a passage, a delay firing mechanism in the bolt adjacent the passage, means for moving the bolt, a hollow stem threadable axially in the body and movable into and out of said passage whereby to hold or release the bolt, a primary firing mechanism carried by the stem adapted to produce instantaneous action when the stem engages the bolt and to function the delay mechanism when the stem is disengaged from the bolt, and means for locking the bolt in released position.

8. A combination fuse including a body, a bolt mounted transversely in the body and having a passage, a delay firing mechanism in the bolt adjacent the passage, means for moving the bolt, a hollow stem threadable axially in the body and movable into and out of said passage whereby to hold or release the bolt, and a primary firing mechanism carried by the stem adapted to produce instantaneous action when the stem engages the bolt and to function the delay mechanism when the stem is disengaged from the bolt.

9. A combination fuse including a body, a bolt mounted transversely in the body, a delay firing mechanism in the bolt, means for moving the bolt, a hollow stem threadable axially in the body and movable to engage and disengage the bolt, and a primary firing mechanism carried by the stem adapted to produce instantaneous action when the stem engages the bolt and to function the delay mechanism when the stem is disengaged from the bolt.

10. A combination fuse including a body, a bolt mounted transversely in the body, a delay firing mechanism in the bolt, means for moving the bolt, a hollow stem securable axially in the body and movable to engage and disengage the bolt, and a primary firing mechanism carried by the stem adapted to produce instantaneous action when the stem engages the bolt and to function the delay mechanism when the stem is disengaged from the bolt.

11. A combination fuse including a body, a movable member mounted transversely in the body, a secondary firing mechanism in said member, a movable member mounted axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to position the secondary firing mechanism out of axial alignment and in another position of adjustment to release the transverse member to position said mechanism in axial alignment, and a primary firing mechanism carried by the axial member and adapted for functioning the fuse by itself or through the mechanism in the transverse member.

12. A combination fuse including a body, a movable member mounted transversely in the body, a delay mechanism in said member, a movable member mounted axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to position the delay mechanism out of axial alignment and in another position of adjustment to release the transverse member to position said mechanism in axial alignment, and a primary firing mechanism carried by the axial member and adapted for functioning the fuse by itself or through the mechanism in the transverse member.

13. A combination fuse including a body, a movable member mounted transversely in the body, a secondary firing mechanism in said member, a movable member mounted axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to position the secondary firing mechanism out of axial alignment and in another position

of adjustment to release the transverse member to position said mechanism in axial alignment, and a primary firing mechanism carried by the axial member.

14. A combination fuse including a body, a movable member mounted transversely in the body, a delay mechanism in said member, a movable member mounted axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to position the delay mechanism out of axial alignment and in another position of adjustment to release the transverse member to position said mechanism in axial alignment, and a primary firing mechanism carried by the axial member.

15. A combination fuse including a body, a movable member mounted transversely in the body, a secondary firing mechanism in said member, a movable member axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to inoperatively position the secondary firing mechanism and in another position of adjustment to release the transverse member to operatively position said mechanism, and a primary firing mechanism carried by the axial member and adapted for functioning the fuse by itself or through the mechanism in the transverse member.

16. A combination fuse including a body, a movable member mounted transversely in the body, a delay mechanism in said member, a movable member axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to inoperatively position the delay mechanism and in another position of adjustment to release the transverse member to operatively position said mechanism, and a primary firing mechanism carried by the axial member and adapted for functioning the fuse by itself or through mechanism in the transverse member.

17. A combination fuse including a body, a movable member mounted transversely in the body, a secondary firing mechanism in said member, a movable member axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to inoperatively position the secondary firing mechanism and in another position of adjustment to release the transverse member to operatively position said mechanism, and a primary firing mechanism carried by the axial member.

18. A combination fuse including a body, a movable member mounted transversely in the body, a delay mechanism in said member, a movable member axially in the body and adapted in one position of adjustment to restrain movement of the transverse member whereby to inoperatively position the delay mechanism and in another position of adjustment to release the transverse member to operatively position said mechanism, and a primary firing mechanism carried by the axial member.

19. A fuse including a body, a movable member mounted transversely in the body, a firing mechanism in said member, and a movable member axially in the body adapted in one position of adjustment to restrain movement of the transverse member whereby to inoperatively position the firing mechanism carried thereby and in another position of adjustment to release the transverse member to operatively position its firing mechanism.

20. A combination fuse including a body, a movable member mounted transversely in the body, a delay mechanism in said member, a hollow stem threadable in the body and movable to engage or disengage the transverse member whereby said delay mechanism may be held in inoperative or operative position, said stem formed with an annular groove, a pin carried by the body and disposed in the groove to limit movement of the stem, and a primary firing mechanism carried by the stem and adapted for functioning the fuse by itself or through the mechanism in the transverse member.

21. A combination fuse including a body, a movable member mounted transversely in the body, a secondary firing mechanism in said member, a hollow stem threadable in the body and movable to engage or disengage the transverse member whereby said secondary firing mechanism may be held in inoperative or operative position, said stem formed with an annular groove, a pin carried by the body and disposed in the groove to limit movement of the stem, and a primary firing mechanism carried by the stem.

22. A combination fuse including a primary firing means, a carrier therefor, a delay action means, and an instantaneous action means, said three firing means normally out of alignment, the carrier adjustable to bring the delay action means into alignment with the primary firing means, and the instantaneous means brought into alignment automatically by the forces set up upon discharge of a projectile carrying the fuse from a gun.

ARTHUR ADELMAN.
JAMES K. CRAIN.
FREDERICK HAWKES.
HAROLD G. TOWNER.