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W. L. LUKENS

FUSE

Filed March 14, 1923

2 Sheets-Sheet 2

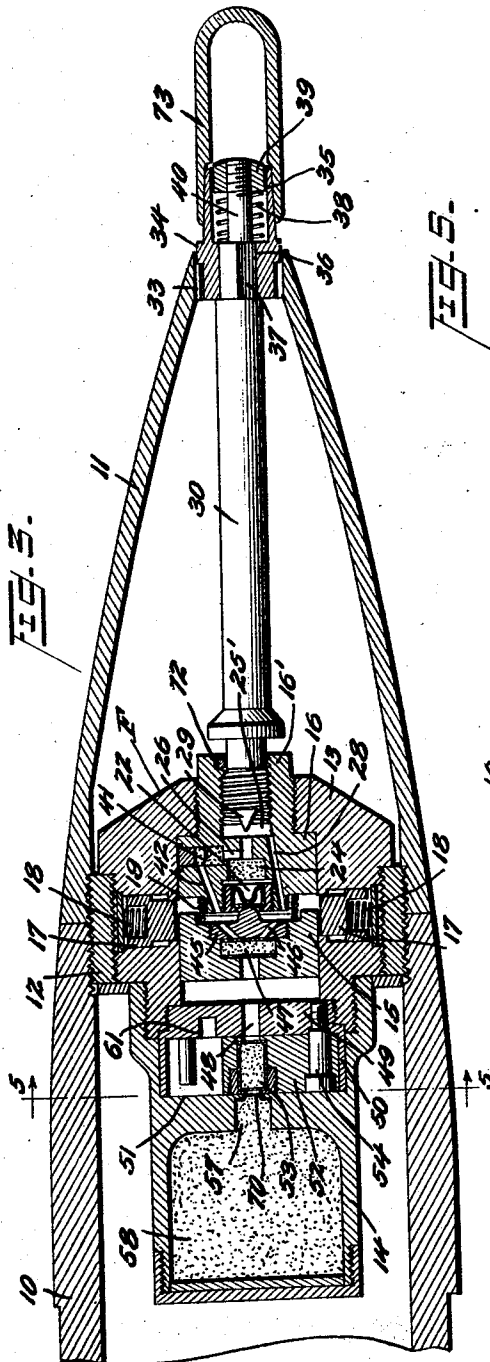


FIG. 3.

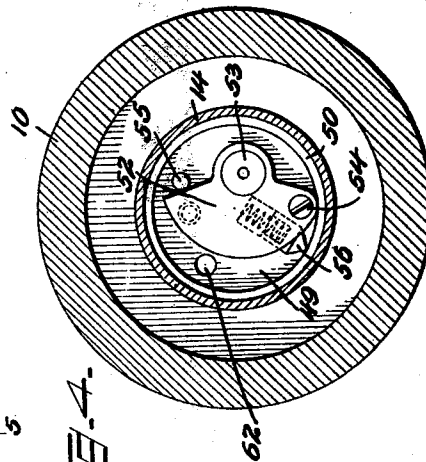
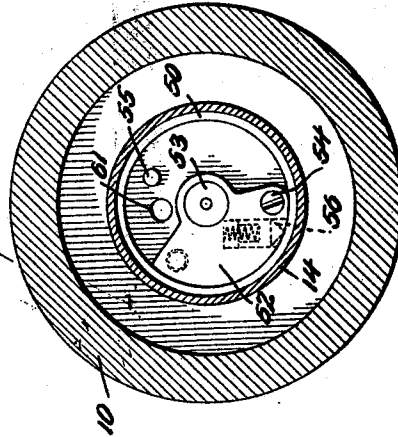


FIG. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM L. LUKENS, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, A CORPORATION OF PENNSYLVANIA.

FUSE.

Application filed March 14, 1923. Serial No. 625,076.

To all whom it may concern:

Be it known that I, WILLIAM L. LUKENS, a citizen of the United States, and residing at Bethlehem, Northampton County, State of Pennsylvania, have invented certain new and useful Improvements in Fuses, of which the following is a specification.

The present invention relates to artillery ammunition and particularly to explosive projectiles having point detonating fuses of the adjustable type.

In the application filed Sept. 20, 1922 in the name of William L. Lukens, John A. Taylor and Robert R. Carey, Ser. No. 589,435 is disclosed and claimed a novel and convenient fuse for use with projectiles which fuse while enclosed within the walls of the projectile is adapted to be adjusted from without so that the projectile may be caused to burst either immediately upon impact of the projectile upon the target, a short interval of time after the projectile strikes the target or a short interval of time before the body of the projectile has reached the target.

The object of the present invention is to provide a fuse constructed substantially along the lines of the fuse disclosed in the prior application referred to but having improvements incorporated therein which render it more advantageous in certain respects.

In the following description and in the accompanying drawings one form of the invention is disclosed by way of example, but it will be understood that the invention may have various forms and is not limited to that form herein disclosed.

In the drawings:

Fig. 1 is an axial longitudinal section through portion of a projectile having the improved fuse incorporated therein, the movable parts of the fuse being illustrated in the positions which they occupy before the projectile is fired, the fuse being adjusted for delayed detonation;

Fig. 2 is a view similar to Figure 1 showing the parts in the positions which they occupy immediately after the projectile has struck its target;

Fig. 3 is a view similar to Figure 2 but showing the fuse arranged to explode the projectile immediately upon impact of an anticipator attached thereto whereby the explosion of the projectile is produced before contact of its walls with the target;

Fig. 4 is a section on line 4—4 of Figure 55 1;

Fig. 5 is a section on line 5—5 of Figure 3.

The projectile body is indicated at 10, the ogival nose at 11 and an adapter at 12 by means of which the body and nose of the projectile are secured together and the fuse secured in its proper position. The fuse is indicated generally at F and comprises essentially a head portion 13 and a body portion 14 having threaded engagement with each other and being in axial alignment. The outer cylindrical surface of the head 13 of the fuse has threaded engagement with the adapter 12 and this head portion is provided with an axial cylindrical opening therethrough in which is slidably contained the cylindrical firing pin carrier 15 and in the forward end of which is positioned the primer carrier 16 having a reduced forwardly extending portion 16' which has threaded engagement with head 13 of the fuse. The firing pin carrier 15 is normally locked in the position shown in Figure 1 by centrifugal bolts 17 which are urged inwardly by springs 18. The creep spring 19 is interposed between block 15 and the primer carrier 16 and opposes forward movement or creeping of the firing pin carrier when the bolts 17 have been withdrawn.

The primer is indicated at 22 and is disposed in an axial recess in the rear end of the carrier block 16 and in position to be struck by the firing pin 23 secured to the carrier block 15. A small chamber 24 in advance of and communicating with the cavity containing the primer contains flash powder, and leading forwardly from chamber 24 is a duct 25 having a branch 26. Duct 25 opens into a chamber 25' and a conduit 28 leads rearwardly from this chamber to the rear face of the block 16. Normally a valve 29 is so adjusted that the conduit 25 is not in communication with chamber 25'.

Valve 29 is a rearwardly extending conical projection on a spindle 30, the inner end of which has threaded engagement with the correspondingly threaded inner wall of an axial recess in the primer carrying member 16. Spindle 30 is arranged axially within the nose and extends forwardly and through an axial aperture in the point of the nose. The axial aperture is provided with slots 33

and slidably fitting within these slots are lugs 34 of an adjusting nut 35. Nut 35 has a squared aperture 36 and fits closely around the squared shank 37 of spindle 30. The adjusting nut 35 is maintained in the position in which it is illustrated in Figure 1 by means of a spring 38, the inner end of which presses on the adjusting nut and the outer end of which abuts against a spring retaining nut 39 secured on the end of a short spindle 40 projecting from the larger spindle 30.

The branch duct 26 leading from the axial duct 25 in the primer carrier communicates with a chamber 41 containing a delay powder pellet, from which chamber a duct 42 leads rearwardly to the rear face of the block 16.

The firing pin carrier block 15 supports a disk 45 which disk is threaded thereto and which has the firing pin 23 integral therewith. Disk 45 is provided with apertures or conduits 46 leading inwardly and rearwardly and opening into an axial chamber 47 containing a magazine charge of flash powder. Chamber 47 has extending rearwardly therefrom an axial channel 48 which not only passes through the rear end of the firing pin carrier block 15 but also through a transverse bottom plug 49 threaded into the rear of the axial recess in head 13. Bottom plug 49 has a cylindrical flange 50 extending rearwardly therefrom, the outer wall of this flange fitting closely against the inner wall of a cavity in the forward end of base 14 of the fuse.

The cylindrical chamber within the flange 50 of the bottom plug and in advance of the circular face 51 of the fuse body, contains the shutter 52 which holds the detonating charge 53, as shown clearly in Figures 2, 3, 4 and 5. Referring particularly to Figures 4 and 5 it will be seen that the shutter 52 is pivoted to swing about a screw 54, between the side wall of the containing cavity and a stop pin 55. The shutter is generally segmental in shape and is normally held in the position in which it is shown in Figure 4 by means of a spring pressed plunger 56. In such position the fulminate detonating charge 53 is eccentric to the axis of the shell and not in a position to communicate with either the axial passage 48 leading forwardly to the flash powder charge 47 or with the axial passage 57 leading rearwardly to the chamber 58 which contains the booster charge of the fuse. Shutter 52 is held in this position by means of a plunger or inertia bolt 59 which is normally pressed forward by a spring 60 into an aperture 61 in the rear side of the bottom plug 49. The inertia bolt 59 is also adapted to enter an aperture 62 and to lock the detonator shutter in the position shown in Figure 5, in which position the fuse is armed.

Normally the fuse is adjusted for delay

action, as shown in Figure 1. Here, it will be seen, the valve 29 obstructs communication between conduit 25 and chamber 25'. When the projectile is fired it is of course caused to rotate and during flight the centrifugal bolts 17 will fly outwardly so that forward movement of the firing pin carrying block may occur upon impact. Initial acceleration of the projectile causes the inertia bolt 59 to move rearwardly against the action of spring 60 and to withdraw from recess 61. Rotation of the projectile then occurs while pin 59 is withdrawn and hence the shutter or detonator carrier 52 is free to be moved laterally by centrifugal action into the position in which it is illustrated in Figure 5. When this position is reached and acceleration has ceased, inertia bolt 59 moves forwardly into recess 62 and the shutter is thus locked in this new position with the fulminate charge 53 in position to be ignited by a flame from the flash powder charge 47.

Upon impact of the nose of the projectile on the target the firing pin carrying block 15 flies forwardly and the firing pin 23 fires the primer 22. Flame from the primer ignites the flash powder 24 and the flame from this flash powder in turn passes through branch conduit 26 and ignites the delay pellet 41. This pellet is of such composition that it burns relatively slowly and a short interval of time elapses before the flame passes through ducts 42 and 46 to the magazine flash powder charge 47 the ignition of which results in ignition of the fulminate detonator charge 53 and finally the booster charge 58. The passage 57 is provided with a gas check cup 70 and the chamber 71 in which the centrifugal shutter 52 is positioned, is of such strength that the fulminate detonating charge 53 may explode without causing detonation of the booster charge providing that the shutter is in the unarmed position, as shown in Figure 4.

To adjust the fuse for non-delay action upon impact of the shell and target, the operator grasps the adjusting nut 35 and pulls it forwardly against the action of spring 38 until lugs 34 disengage slots 33 whereupon the nut, and hence the spindle 30, may be rotated and the needle valve 29 moved forwardly. As a result conduit 25 is brought into direct communication with chamber 25' and duct 28 and the flame from the flash powder charge 24 may pass directly to the magazine flash powder charge 47, so that the projectile is exploded instantly instead of by delay action involving the burning of the delay pellet 41. A stop pin 72 may be provided to limit the outward movement of the spindle.

To cause the projectile to burst before striking the target, the spindle 30 is advanced as before by means of the adjusting

nut 35 so that there is unobstructed communication between flash powder 24 and the magazine charge 47 and in addition the anticipator pin or sleeve 73 is fitted on to the end of the nut 35. The end of this anticipator striking the target arrests the forward movement of the projectile and causes the firing pin carrying block to move forwardly so that the firing pin strikes the primer and the instantaneous explosion of the projectile thereby results while the body of the projectile is as yet some distance from the target. Anticipators of various lengths may be carried in quantities with the ammunition, and may be affixed whenever it is found desirable.

While I have shown the primer carrying block 16 as having threaded engagement with the nose portion 13 of the fuse it is obvious that this block may be formed integral with the nose of the fuse if desired. It is found more convenient to manufacture the fuse with the primer carrier formed separately and rigidly connected thereto as illustrated. The rounded nose of the firing pin enables it to fire the primer without puncturing the metallic container in which the priming substance is held. There is then no back flow of gas or flame from the primer, upon firing, directly into the ducts 46. In the application previously referred to the spindle is shown to be connected to a primer carrying block which is slidably mounted in the fuse. In accordance with the present invention the spindle is connected to a non-movable portion of the fuse and the projectile thus equipped has increased simplicity, cheapness and safety.

One skilled in the art will readily appreciate the advantages of the invention and will also realize that the design and arrangement of the component elements of the invention may be changed without departing from its spirit and scope.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. In a projectile, the combination with a body of a hollow ogival head secured to said body, said head having an aperture therein, a fuse enclosed within said head and secured to said body, said fuse being adjustable for different speeds of action, and a control member which is normally rigid with respect to the projectile, engaging the fuse and projecting through said aperture beyond the exterior contour of the projectile so that said member may be manually operated to control the action of the fuse.

2. In a projectile, the combination with a body of a hollow ogival head secured to the body, said head having an aperture therein, a fuse enclosed within said head and secured to the body, said fuse being adjustable for different speeds of action, a control member

which is normally rigid with respect to the projectile threaded to the fuse and projecting through the aperture beyond the contour of the projectile so that said member may be manually rotated to effect a longitudinal movement thereof to control the action of the fuse, and a locking means engaging the control member and said head to normally prevent rotation of said member.

3. In a projectile, the combination with a body of a hollow ogival head secured to the body, said head having an aperture therein, a fuse enclosed within the head and secured to the body, said fuse being adjustable for different speeds of action, a control member normally rigid with respect to the projectile body threaded to the fuse and projecting through said aperture beyond the contour of the projectile so that said member may be manually rotated to effect longitudinal movement thereof to control the action of the fuse, a locking means interposed between the control member and the projectile normally preventing rotation of said member, and an anticipator device detachably mounted on the locking means.

4. In a projectile, the combination with a body of a hollow ogival head secured to the body, said head having an aperture therein, a fuse enclosed within said head and secured to the body, said fuse being adjustable for different speeds of action, a member threaded to a fixed portion of the fuse for controlling the action thereof and projecting through said aperture beyond the contour of the projectile, and a locking means interposed between said member and the projectile to normally prevent relative rotation of the member with respect to the projectile.

5. In a projectile, the combination with a body of a hollow ogival head secured to the body, said head having an aperture therein, a fuse enclosed within said head and threaded to the body, said fuse being adjustable for different speeds of action, an anticipator device threaded in the fuse and projecting through said aperture beyond the contour of the projectile so that said device may be manipulated to control the action of the fuse, and a locking means to prevent relative movement between the anticipator device and the projectile during the entire flight of the latter.

6. In a projectile, the combination with a body of a hollow ogival head secured to the body, a fuse enclosed within said head threaded to the body, an anticipator device normally rigid with respect to said body and threaded in said fuse and projecting through said aperture beyond the contour of the projectile, and a locking device engaging the anticipator device and said head, said locking device being releasable so that

the anticipator device may be manipulated to control the action of the fuse.

7. In a projectile, the combination with a body of a hollow ogival head secured to the
5 body, said head having an axial aperture therein, a fuse enclosed within the head and rigidly secured to the body, said fuse being adjustable for different speeds of action,

and a member controlling the action of the fuse rigidly secured with respect to the
10 projectile and projecting through said aperture beyond the contour of the projectile.

In testimony whereof I hereunto affix my signature.

WILLIAM L. LUKENS.