July 7, 1925. 1,545,139

N. GREENWELL

FUSE

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FIG. 1.

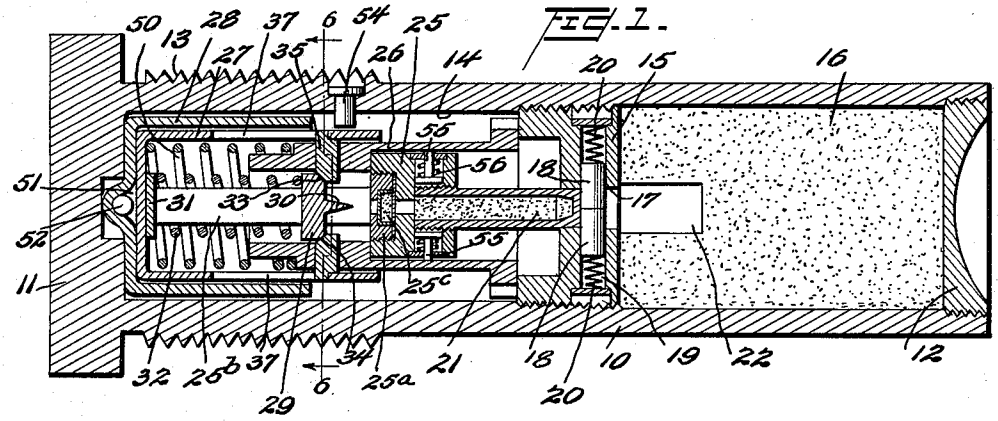


FIG. 2.

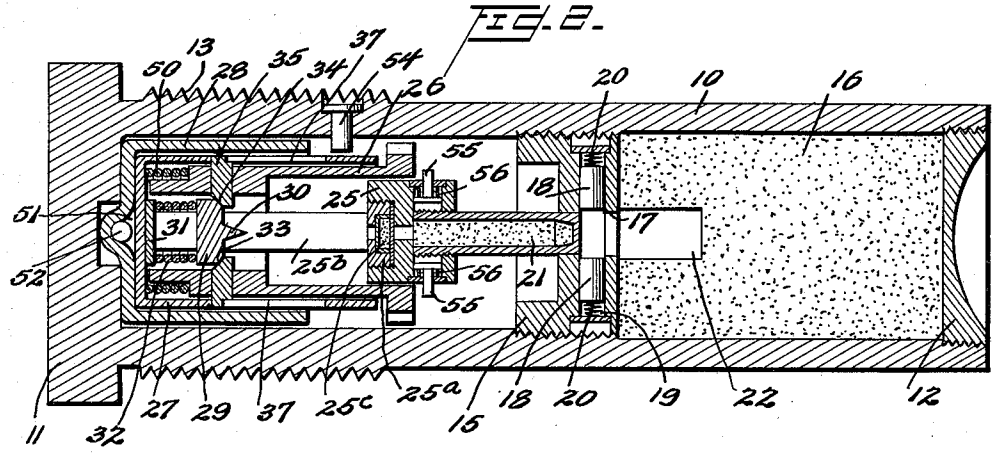
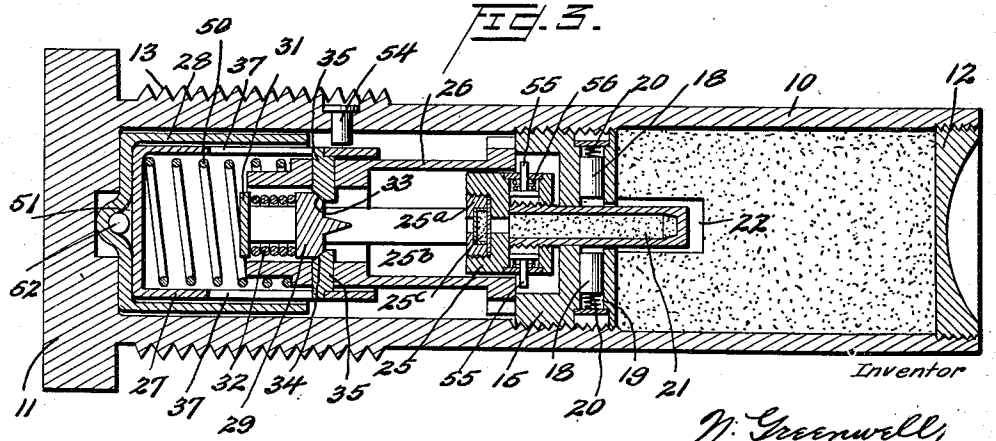


FIG. 3.



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FIG. 4.

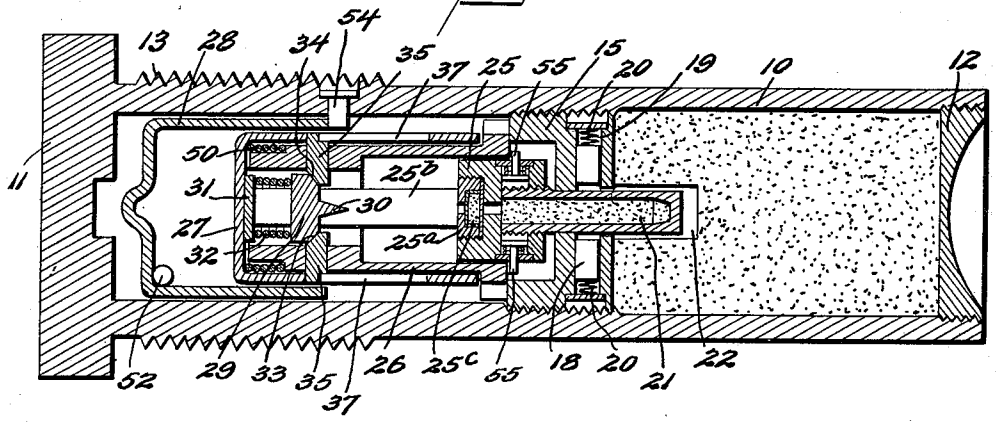


FIG. 5.

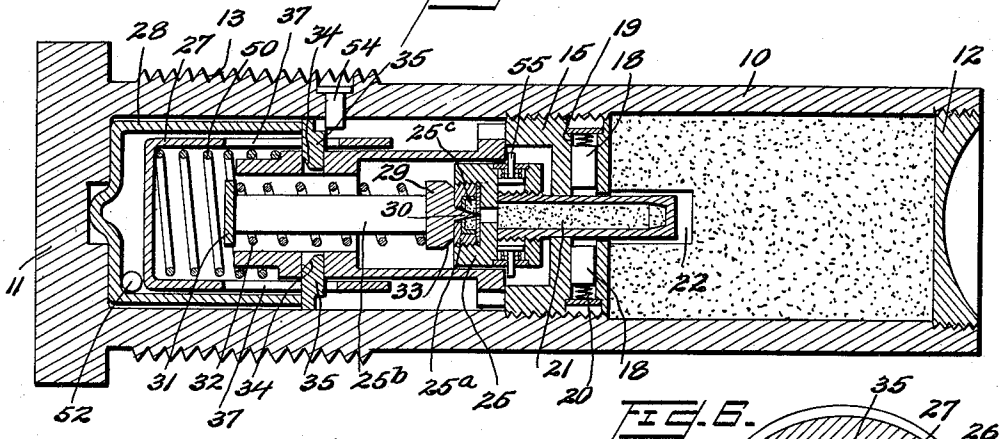


FIG. 6.

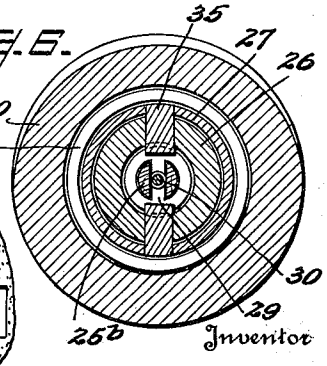
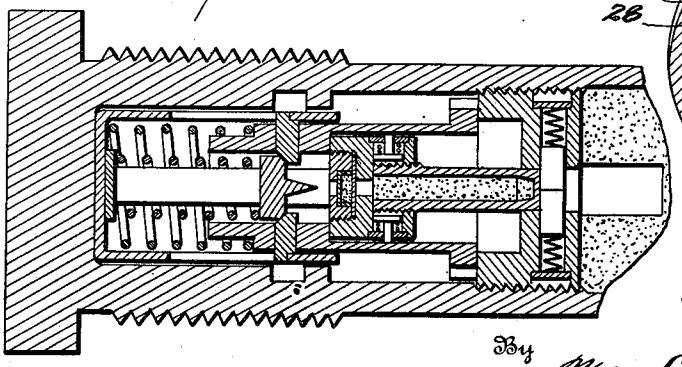


FIG. 7.



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UNITED STATES PATENT OFFICE.

NEVIL GREENWELL, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, A CORPORATION OF PENNSYLVANIA.

FUSE.

Application filed April 6, 1923. Serial No. 630,364.

To all whom it may concern:

Be it known that I, NEVIL GREENWELL, a citizen of the United States, and a resident of Bethlehem, county of Northampton, State of Pennsylvania, have invented certain new and useful Improvements in Fuses, of which the following is a specification.

The present invention relates to fuses for projectiles.

The maximum destructive effect of an explosive projectile used in warfare is produced when its explosion takes place after penetrating a protective shield of the enemy such as the armor plate of a warship, the protective shield of a mobile field gun, the wall of a fort, or any other device which has been erected to protect the personnel from injury. Time fuses of various types have been heretofore designed or suggested for the purpose of causing explosion of the projectile after the expiration of a certain length of time following impact. The time required for the fuse to function, where such fuses are employed, is fixed by the gunner before the projectile is fired and is entirely independent of the character of the target. It follows therefore that when the projectile meets light resistance the fuse will only function after it has passed a considerable distance beyond the target and oftentimes without serious destructive effect.

The object of the present invention is to provide a fuse, the time of operation of which depends entirely upon the character of the target. The gunner, before firing the projectile, need have no exact knowledge of the nature of the target, that is, of its thickness and strength, and the fuse is so designed and constructed that it automatically selects the proper instant to function, which instant will of course vary in accordance with the nature of the target which the projectile strikes. In case the target is penetrated by the projectile, the fuse will function immediately after passing therethrough. In case of an impenetrable target the fuse will function after the forward motion of the projectile has been completely arrested and when the projectile has penetrated the same to the limit of its capacity, so that its explosion results in a maximum mining effect.

The invention may have various embodiments and may be employed in either a nose detonating fuse or base detonating fuse.

In the accompanying drawings, a base detonating fuse constructed in accordance with the invention is disclosed, but it will be appreciated by those skilled in the art that it may be not only embodied in a nose detonating fuse if desired, but also that the design and arrangement of the component elements of the invention may be considerably modified without departing from its spirit and scope.

In the drawings:—

Figure 1 is an illustration in longitudinal axial section of the invention incorporated in a fuse of the base detonating type, the parts being shown in the positions which they occupy before the projectile to which the fuse is secured is fired from a gun.

Figure 2 is a similar view showing the parts in the positions which they occupy during acceleration of the projectile.

In Figure 3, which is a similar view, the parts are shown in the positions which they occupy during the flight of the projectile.

Figure 4 is a similar view but showing the positions of the parts upon impact.

Figure 5 is also a longitudinal axial section showing the parts in firing position.

Figure 6 is a section on line 6—6 of Figure 1.

Figure 7 is an axial section through a fuse which is modified so as to function immediately upon impact of the projectile with the target.

The fuse body 10 is cylindrical or tubular, having its rear end closed by the base portion 11 and its forward end closed by the plug 12, the outer surface being provided with screw threads 13 adapted to engage the correspondingly formed threads within an aperture in the base of the projectile. The fuse mechanism is contained within the rear portion of the cylindrical axial recess 14, a diaphragm 15 dividing this recess or chamber substantially into two equal portions, the forward portion holding the booster charge 16. This diaphragm 15 is in the form of a circular disk having a central aperture 17 which is normally closed by centrifugal bolts 18 slidably held in transverse chambers 19 in disk 15 and normally urged toward the center of the same and into contact with each other by springs 20. During flight of the projectile, and due to the centrifugal force produced by the rotation of the same these bolts are thrown outwardly, compressing springs 20, so that the detona-

tor pellet 21 may be thrust by the fuse mechanism through disk 15 and into the axial cavity 22 which is formed in the booster charge.

Arranged axially in the chamber in rear of disk 15 is a cylindrical carrier block 25 slidably contained in a cylindrical inner sleeve 26, and also two additional sleeve-like members 27 and 28 hereinafter called the "intermediate" and "outer" sleeves respectively. To the carrier block 25 is threaded the detonator pellet container 21 previously referred to and also a disk-like primer holder 25^a from which extends axially toward the rear of the fuse a spindle 25^b which is slotted axially as shown in Figure 6. The primer is indicated at 25^c, the firing hammer at 29, and the firing pin at 30, the firing hammer and primer being hereinafter designated "the firing elements". The firing hammer comprises an annular ring extending around the spindle 25^b and having a diametrical bridge portion extending through the slot in the spindle to which portion the firing pin 30 is secured.

To the rear end of spindle 25^b is secured a disk 31 and between this disk and the firing hammer and encircling the spindle, is positioned a spring 32, which performs the functions of a firing spring, propelling the firing hammer toward the primer at the instant of firing. The forward outer edge of the firing hammer has a bevelled seating surface 33 which normally rests against correspondingly bevelled surfaces 34 on the radially arranged hammer locking bolts 35. These bolts are slidably contained in radial apertures in the inner sleeve 26 and normally block the forward movement of the firing hammer. This hammer can only move forward when these bolts are moved outwardly to clear the same, and the outward movement of the bolts is normally prevented by the intermediate sleeve 27. This sleeve is provided with diametrically opposed slots 37 into which the outer ends of the locking bolts extend, the outer ends of these bolts being notched however to receive the portions of the intermediate sleeve which constitute the forward margins of slots 37, as shown in Figure 1.

A coiled spring 50 is positioned between the rear end of sleeve 26 and the closed end of the intermediate sleeve 27 and normally tends to thrust these two members in opposite directions so that the intermediate sleeve, together with the outer sleeve 28 will normally press against the rear end of the fuse body, and the sleeve 26 is normally pressed against the rear face of the disk or partition 15.

The outer sleeve 28 has a recess 51 (preferably eccentric to the axis of the fuse) in which is positioned a small metallic ball 52, this ball being held therein so long as the intermediate sleeve 27 is pressed tightly against the outer sleeve. The outer sleeve may have a slight relative movement axially of the fuse body, its forward movement being limited however by a pin 54. The carrier 25 is provided with centrifugal locking bolts 55 which are normally pressed inwardly by springs 56, as shown in Figure 1, but which are adapted to fly outwardly while the projectile is in flight, under the influence of centrifugal forces, and when the inner sleeve has moved rearward relatively to the carrier, as shown in Figure 2.

During transportation, and at all times before the projectile is fired, the fuse parts occupy the positions in which they are shown in Figure 1, as previously pointed out, the firing hammer being held against forward movement by the hammer locking bolts 35 which are in turn held against outward movement by the intermediate sleeve 27. Upon firing, and while the projectile is receiving its acceleration, the parts are as illustrated in Figure 2, the sleeve 26 having moved rearwardly relatively to the other parts of the fuse due to its inertia, the springs 32 and 50 being compressed, and the locking bolts 55 having moved outwardly immediately upon the rearward movement of the sleeve. The centrifugal force due to the rotation of the shell being continuous during flight, the locking bolts will remain extended, and also bolts 18 will remain in their outer positions as shown in Figure 2. However upon the cessation of acceleration, the spring 50 expands and moves the sleeve 26 forwardly to the position in which it is illustrated in Figure 3, that is, to its original position. The firing spring 32 however remans compressed since the locking bolts 55 are engaged by the forward end of the inner sleeve and the carrier block together with the spindle and detonator pellet container 21 are moved forwardly by spring 50 simultaneously with the inner sleeve. During this rearward movement of the sleeve the hammer locking bolts 35 have of course disengaged the intermediate locking sleeve 27, but before they have had opportunity to fly outwardly their outer ends have engaged the inner surface of the outer locking sleeve 28 so that such outward movement is positively prevented.

Upon impact of the projectile upon the target the intermediate and outer sleeves are moved forwardly, due to their inertia, as shown in Figure 4, spring 50 being again compressed by the intermediate sleeve. The forward movement of the outer sleeve is limited by pin 54 as previously pointed out. Relative movement of the intermediate and outer sleeves allows the ball 52 to escape

from the recess 51 and into the position in which it is illustrated in Figure 4. As soon as the retardation due to impact has ceased, due either to the projectile clearing the target or to its being completely stopped thereby, the spring 50 immediately thrusts the intermediate sleeve rearwardly. The rear end of this sleeve strikes the ball 52 and causes rearward movement of the outer sleeve. The interposition of the ball between the intermediate and outer sleeve however results in relative axial movement of these members and this relative movement frees the outer ends of hammer locking bolts 35, as shown in Figure 5. The hammer is urged forwardly by the firing spring and its inclined or bevelled faces act as cams upon the inner ends of the hammer locking bolts, thrusting them outwardly, so that the hammer is free to move forwardly, the firing pin piercing the primer, as shown in Figure 5. The flame from the primer is immediately conducted to the detonator pellet which has of course entered the chamber containing the booster charge and hence detonation of the detonator pellet, booster charge and projectile results. This detonation, it will be observed, has occurred at the instant when retardation of the projectile has ceased, and in case the projectile has pierced the armor of a vessel it will explode immediately inside and will effect a maximum destruction. In case the target encountered is impenetrable the fuse will function when the projectile has come to rest and hence a maximum mining effect will be realized.

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

1. The combination with a fuse body, a carrier block axially arranged in said body and provided with a primer, and a firing pin in line with the primer, of a sleeve, a bolt supported by said sleeve and adapted to prevent the firing pin from prematurely contacting with the primer, a spring for impelling the firing pin, a second spring for impelling the sleeve, and means for releasing the firing pin from the bolt operable only after impact and after retardation due to impact has ceased.

2. In a fuse of the character described, the combination with a firing pin and primer, a sleeve surrounding the firing pin and carrying a bolt adapted to engage said pin and hold it out of contact with the primer, a spring impelling said sleeve forwardly, a second spring for impelling the firing pin into contact with the primer, said springs being compressed by set back of the sleeve on firing, and means operable to free the firing pin from the bolt upon impact followed by stoppage or further free travel of the projectile.

3. In a fuse for projectiles, the combination of a fuse body, a carrier block, a primer seated in said block, a member extending from said block and having a spring abutment at the extended end, a firing pin slidably mounted on said member, a spring interposed between the firing pin and said abutment, a movable part engaging the firing pin and adapted to compress said spring by set back on firing the projectile, and means to release the spring, said latter means being operable only after impact with a target and after retardation has ceased.

4. In a fuse for projectiles, the combination of a fuse body, a carrier block, a primer seated in said block, a movable firing pin in line with the primer, a spring for impelling the firing pin, an abutment for said spring, a sleeve surrounding the firing pin, a bolt carried by said sleeve and normally engaging the firing pin to hold the same out of contact with the primer, said sleeve and bolt being movable and adapted to move the firing pin back and compress its spring by set back on firing the projectile, a second spring tending to impel the said sleeve forward, means whereby the sleeve in its forward movement carries the firing pin with it, and means for releasing the firing pin from the bolt operable only after impact with a target and after retardation has ceased.

5. In a fuse for projectiles, the combination of a carrier block, a primer mounted in the carrier block, a firing pin, a spring for the firing pin, an abutment for the spring, means connecting the abutment with the carrier block, a sleeve surrounding the carrier block and firing pin and movable relatively thereto, means on the sleeve for engaging the firing pin whereby set back of the sleeve on firing a projectile will compress the firing pin spring, and means on the carrier block for engaging the sleeve in its set back position to hold the spring under tension.

6. In a fuse for projectiles, the combination of a carrier block, a primer mounted in the carrier block, a firing pin, a spring for the firing pin, an abutment for the spring, means connecting the abutment with the carrier block, a sleeve surrounding the carrier block and firing pin and movable relatively thereto, means on the sleeve for engaging the firing pin whereby set back of the sleeve on firing a projectile will compress the firing pin spring, means on the carrier block for engaging the sleeve in its set back position to hold the spring under tension, the said carrier block being movable axially in the fuse, and a second spring for impelling the carrier block, sleeve and firing pin forward and maintaining them in their forward position during flight, the firing pin spring remaining under tension.

7. In a fuse mechanism, the combination with a fuse body of a carrier block, a primer supported on said block, a firing pin in line with the primer, a spring for impelling the firing pin, an abutment for the spring, means connecting said abutment with the carrier block, an inner sleeve surrounding said firing pin and carrier block, a bolt carried by said inner sleeve and adapted to engage the firing pin, an intermediate sleeve having a slot therein and adapted to normally retain said bolt in contact with the firing pin, an outer sleeve also adapted to retain said bolt in contact with the firing pin, and means operable only after impact of a projectile on a target to hold said intermediate and outer sleeves in such relation that the bolt may automatically move away from the firing pin and release the latter.

8. In a fuse for projectiles, the combination of a fuse body, an exploding element, a firing pin movable toward said element, locking means to normally prevent said movement, a control means for said locking means comprising a pair of sleeve members normally held in fixed relation to each other, and adapted to move relatively to each other upon impact of the projectile with an obstacle, and means operable upon impact to obstruct the return of said sleeve members to their normal relative position, whereby the firing pin is released.

9. In a fuse for projectiles, the combination of a fuse body, an exploding element, a firing pin movable toward said element, a locking means to normally prevent said movement, a control means for said locking means comprising a sleeve member having an end wall, a second sleeve member having an end wall dished to form a recess, a spring constraining said sleeve members rearwardly, the action of which is overcome by the inertia of said members upon impact, a fixed stop positioned in the fuse body to limit the forward movement of the second sleeve member, and a member normally disposed in said recess and which assumes a position between the end walls of the sleeves upon impact and impedes the return of the first sleeve member to its normal position at the cessation of retardation due to impact, whereby the locking means is released.

10. In a fuse for projectiles, the combination with a firing means adapted to be energized upon the initial acceleration of the projectile, of locking means for maintaining said firing means inactive during the flight of the projectile comprising a locking bolt, a sleeve member normally engaging said bolt to prevent outward movement thereof and the release of the firing means, a second sleeve surrounding the first mentioned sleeve and normally disengaged from the locking bolt, a spring constraining said sleeves to their normal positions, the action of which is overcome by the inertia of said sleeve members upon impact of the projectile so that the first sleeve member will disengage the locking bolt and the second sleeve will engage the locking bolt to prevent outward movement thereof and release of the firing means during the period of retardation due to impact, and means operable at impact to obstruct the return of the first mentioned sleeve member to its normal position after cessation of retardation due to impact, whereby the locking bolt moves outwardly and the firing means is released.

11. In a fuse for projectiles, the combination, with a firing mechanism adapted to be armed upon the initial acceleration of the projectile, of a locking means adapted to maintain said firing mechanism in its armed condition during the flight of the projectile and release said mechanism upon cessation of retardation due to impact comprising a movable locking member, a pair of inertia members alternately engaging said locking member during the flight of the projectile to prevent the outward movement thereof and the release of the firing mechanism, and means operable after impact to prevent engagement of either of said inertia members with the locking member, whereby the latter moves outwardly and releases the firing mechanism.

In testimony whereof I hereunto affix my signature.

NEVIL GREENWELL.