July 14, 1925. 1,545,866

P. D. VAN ESSEN

INSTANTANEOUS IMPACT FUSE FOR HIGH EXPLOSIVE SHELLS

Filed Sept. 30, 1924

Fig. 1.

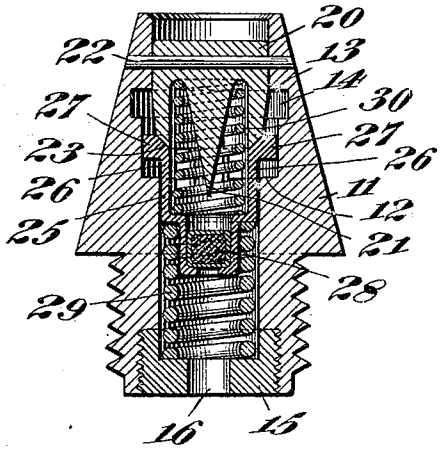


Fig. 2.

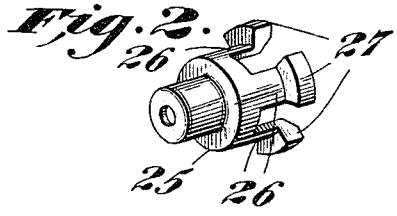


Fig. 3.

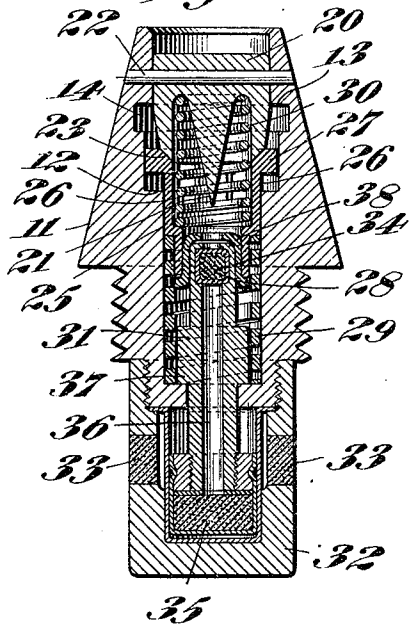


Fig. 4.

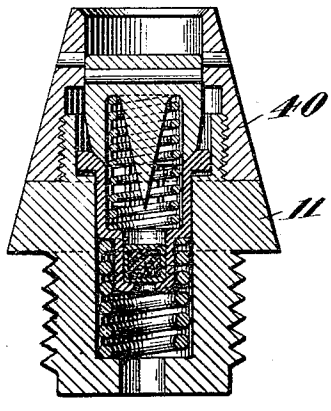
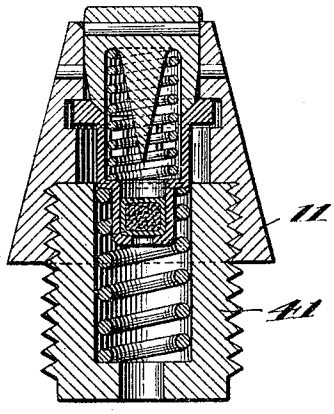


Fig. 5.



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UNITED STATES PATENT OFFICE.

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INSTANTANEOUS IMPACT FUSE FOR HIGH-EXPLOSIVE SHELLS.

Application filed September 30, 1924. Serial No. 740,690.

To all whom it may concern:

Be it known that I, PIETER DANIEL VAN ESSEN, a subject of the Queen of the Netherlands, residing at The Hague, Netherlands, having invented new and useful Improvements in Instantaneous Impact Fuses for High-Explosive Shells, of which the following is a specification.

My invention relates to impact fuses for high explosive projectiles, designed to be fired from ordnance. In modern warfare the heavy wastage of ammunition requires a supply of fuses simple in design and manufacture. Such fuses used in conjunction with high explosive projectiles must have a high degree of safety during handling and transportation, and also during their passage through the bore of a gun after the firing of the propellent charge. Owing to the use of "camouflage" and other means for concealing the position of the gun battery, it is also highly desirable to guard against the detonation of the shell in the event of its accidental impact at close range with said means of concealment. Furthermore these several requirements must be met without detracting from the sensitiveness of the fuse on impact with the objective.

My invention has for an object a sensitive impact fuse of simple design whereby the requirements of safety in handling and firing are adequately met. A further object of my invention is to provide a fuse which will remain inoperative after its departure from the gun, for a predetermined portion of its trajectory.

In the drawings accompanying this specification I show in Fig. 1 a section of my fuse with the component parts thereof in their inoperative or safe position as they exist before firing from the gun.

In Fig. 2 I show a detail in perspective of an essential component of my fuse.

In Fig. 3 I show a modification of my fuse in section, to illustrate its application to a fuse of the type having a cap and main detonator combination, with a detonator safety device.

In Fig. 4 I show a section of the fuse with its component parts in position after shock of discharge.

In Fig. 5 I show another section with these parts in their firing position.

I also show in Figs. 4 and 5 modifications in the construction of the fuse body.

In Fig. 1, I show a fuse body (11) adapted to be screwed into the nose of a projectile. The body is bored axially to contain the several components of the fuse and is internally profiled so as to provide abutments (12) and (13) and an annular groove (14), and closed rearwardly by a closing plug (15), said plug having a central flash hole (16).

A needle plunger (20) having a needle point (21) is held in position by a shearing wire (22) which passes through the fuse body and the needle plunger. This needle plunger has its rear edge (23) bevelled. A hollow sleeve or cage (25), having forwardly four spring vanes (26) terminating in toe pieces (27) and the inner edges of said toe pieces bevelled to correspond with the bevelled edge (23) of the needle plunger, affords a seat to the needle plunger. These four vanes (26) are under slight compression when the cage is entered into the bore of the fuse body, hence when the cage is in a forward position with its toe pieces contiguous with the annular groove (14), the vanes are able to spring outwards to their normal position so that the toe pieces can shoulder slightly on the rear edge of the groove (14) and prevent any return of the cage to its rearward position. In the design shown in Figs. 1 and 2, the cage (25) also serves as a holder for the detonating cap or primer (28) having a rearwardly reduced portion serving as a recess for said primer. The cage is held forwardly against the edge (23) of the needle plunger (20) by a substantially strong compression spring (29) shouldering rearwardly on the closing plug (15). The needle plunger being held in position by the shearing wire, the spring (29) is designed so as to be under substantial compression when assembled in the fuse. A comparatively light compression spring (30) is interposed between the needle plunger and the cage, as shown in the drawing; this spring is also under compression in the assembled position of the fuse.

The operation of my fuse is as follows. On the shock of gun discharge, the needle plunger (20) sets back, shearing the wire (22). The cage (25) also sets back until the

toe pieces shoulder on the abutment (12) of the fuse body, causing the further compression of the spring (29). These movable components of the fuse are maintained in their rearward position as long as the acceleration of the projectile is effected, that is to say throughout its travel in the gun. As soon as acceleration has ceased the spring (29) tends to react and project said components forwardly, but this forward movement is prevented by the air pressure imposed on the needle plunger (20) by the velocity of the projectile. It is, however, evident that depending on the strength of the spring, a point in the trajectory will be reached where the reaction of the spring overcomes the air pressure due to the remaining velocity of the projectile, and will thereupon project the cage (25) and the needle plunger (20) to a forward position determined by the shouldering of the toe pieces (27) on the abutment (13) of the fuse body. In this forward position, the toe pieces being contiguous with the annular groove (14) are no longer confined by the walls of the fuse body and are able to expand slightly into the groove to their normal position. This engagement with the groove is sufficient to prevent any subsequent rearward movement of the cage on impact of the needle plunger, with the objective. The tension of the light spring (30) being still substantially less than the air pressure due to the remaining velocity of the projectile, the needle plunger is prevented from further forward movement.

On impact with the objective the needle plunger is driven rearwardly in relation to the fuse body, in such a manner as to effect a further outward displacement of the toe pieces (27) in the groove (14) and bring the needle point (21) in violent contact with the primer (28), the resulting flash passing rearwardly to the projectile charge through the flash hole (16) in the closing plug.

If the projectile fails to explode through causes unforseen, or if it sets up in the gun, the light spring (30) ejects the needle plunger (20) from the fuse body, the fuse being thereby rendered ineffective and harmless. By a suitable selection in tension of the compression spring (29) it is also evident that the fuse can be caused to arm only after a predetermined point in the trajectory has been reached, accidental impact prior to that point will not effect the firing of the fuse.

In order to obtain detonation of a high order in a high explosive projectile, it is desirable to use a substantially powerful detonator to build up a wave of detonation from the initial flash of the primer cap. The position of such a detonator in close proximity to the main projectile charge, is, however, a potential source of danger, because of the possibility of a premature firing of the detonator through some unforseen cause. It is therefore customary to provide a safety device, whereby such premature detonation will not be communicated to the projectile charge.

In Fig. 3 I have shown a modified construction of my fuse, intended for use with a powerful detonator, and wherein a detonator safety device is provided. The operating principles of this modification are identical with those I have already described, but the detonating component is in this modification separate from the cage until after firing in the gun, when the shock of discharge effects the permanent attachment of the cage and the detonating component. The forward movement of the combined components under the reaction of the spring also serves to render ineffective the detonator safety device I have provided.

In Fig. 3 the same reference numbers are used to indicate the components that are common to both designs. In this modification I prefer to make the compression spring (29) of rectangular cross section. I also show the cage (25) open rearwardly and separate from the detonating component (31). The fuse body (11) has an extension piece (32) attached to it in any suitable manner, and is adapted to contain the main detonator. In the forward portion of the extension piece, radial powder channels (33) are provided, and are filled with a suitable explosive.

The detonating component (31) consists of a detonator holder (34) projecting rearwardly through the closing plug (15), and adapted to hold the primer cap (28), at its forward end, and the main detonator (35) at its rearward end; a communicating channel (36) being provided between the primer and the detonator. The detonator holder is further provided with a collar (37) which abuts on the internal shoulder of the fuse body (11). A stirrup spring (38) is interposed between the cage and the detonator holder, the stirrup ends of which project beyond the rear edge of the cage (25).

The set back of the cage causes the deformation of the stirrup ends, and the cage is jammed onto the detonator holder (34) and becomes permanently attached thereto. The reaction of the spring (29) which has also been further compressed by the "set back" of the cage effects the forward movement of the detonator holder integrally with the cage, in such a manner that the main detonator (35) is brought into close proximity with the powder channels (33) and propagation of a wave of detonation can be effected thereby. In the normal or rearward position of the detonator, when the latter is not contiguous to the powder channels,

propagation of detonation cannot be effected. The firing of the cap (28) by the needle point (21), on impact with the objective, is effected in a manner identical with that I have previously described.

To facilitate the assembly of the component parts of the fuse, the fuse body (11) may be constructed in two parts. For instance, in Fig. 4, I show a main fuse body (11) with a fuse cap (40) attached thereto by suitable threads. Similarly in Fig. 5 I show a sleeve (41) extending rearwardly of the fuse body (11).

It will be obvious to those skilled in the art that my invention is not limited to the forms I have shown, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a fuse for a projectile, the combination of a striker, a detonating member, a deformable spring spacing member between the striker and the detonating member, a fuse body opposing the deformation of the spacing member until the latter has been moved to a relatively forward position, and a compression spring shouldering on the spacing member to effect its forward movement as soon as the air pressure imposed upon the striker has been substantially reduced.

2. In a fuse for a projectile, the combination of a striker, a detonating member, a deformable spring spacing member between the striker and the detonating member, a fuse body opposing the deformation of the spacing member until the latter has been moved to a relatively forward position, a compression spring shouldering on the spacing member to effect its forward movement as soon as the air pressure imposed upon the striker has been substantially reduced, means securing the striker in the fuse body, said means releasable on shock of discharge, and a safety compression spring to eject the striker when so released in the event of a sudden retardation of the projectile.

3. In a fuse for a projectile, the combination of a striker, a detonating member, a deformable spring spacing member between the striker and the detonating member, a clutch rendered effective by the shock of discharge to permanently connect the spacing member to the detonating member, a fuse body opposing the deformation of the spacing member until the latter is in a forward position, a compression spring shouldering on the spacing member, to effect the forward movement of said spacing member and the detonating member connected thereto, as soon as the air pressure imposed on the striker has been substantially reduced, and means to communicate detonation to a projectile charge only when the detonating member is in said forward position.

In testimony whereof I hereunto affix my signature this twelfth day of September 1924.

PIETER DANIEL VAN ESSEN.