

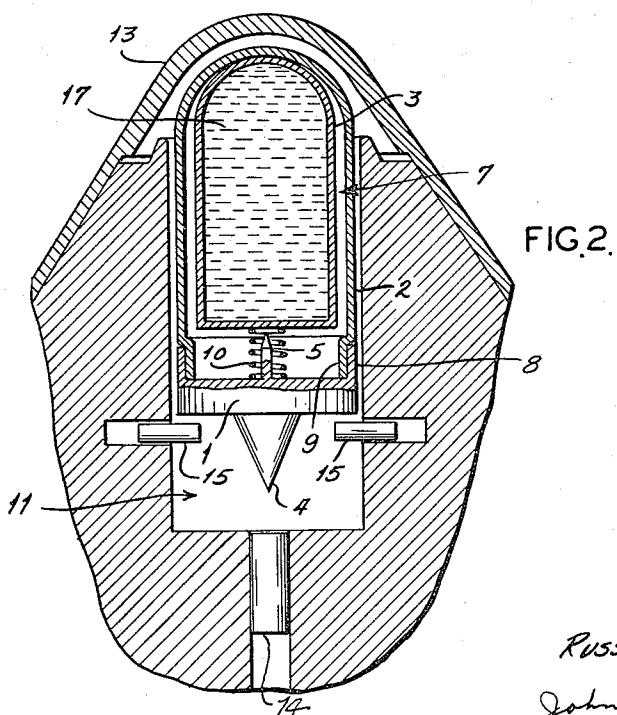
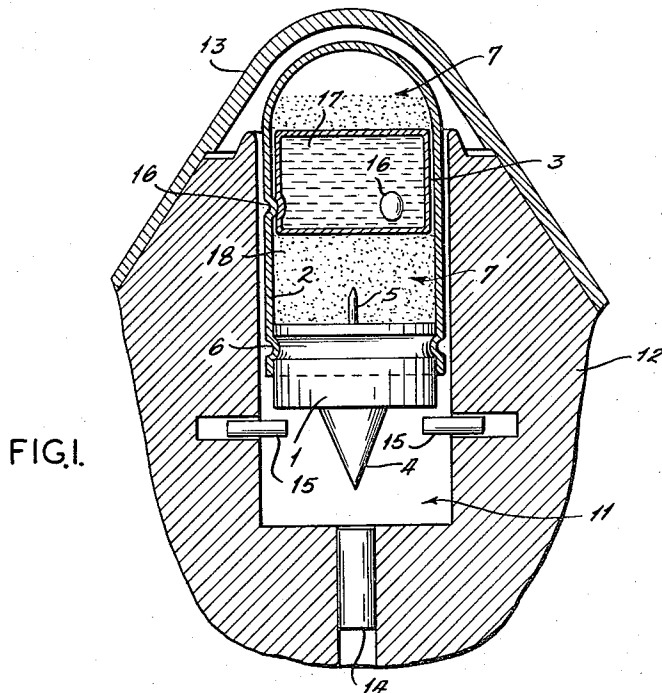
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PROJECTILE FUZE

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PROJECTILE FUZE

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This invention relates to projectile fuzes and more particularly to such fuzes provided with means for self-destruction of the fuze and projectile at a desired time interval after the projectile has been fired.

The ordinary type of projectile fuze is designed so that it will be initiated upon impact and in addition a number of such fuzes are provided with various types of devices to insure self-destruction of the fuze and projectile in the event that it fails to contact the target. This self-destruction feature is particularly important in projectiles used in air-to-air weapons for if the fuzes of such projectiles are not provided with some means for exploding the shell in the air they will explode upon contact with the ground, possibly in friendly territory. Although various types of self-destruction devices for fuzes have been heretofore employed, all of them have been of a very intricate nature and dependent upon precision mechanisms and exceedingly close tolerances. Such devices have generally depended upon centrifugal force and spin decay of the projectile, upon complex clocking mechanisms, or external propellers. Other such devices have relied upon the air pressure generated by the travel of the projectile or upon differentials between such pressures and the pressure in a sealed aneroidal container. While various types of such self-destruction elements function satisfactorily they leave much to be desired in ease of manufacture, economy and capability to function in a foolproof manner under all conditions.

It is therefore an object of this invention to provide a self-destruction projectile fuze that overcomes the disadvantages of the prior art. Another object of this invention is to provide a novel projectile fuze having self-destroying means that become operable upon set-back. Another object of this invention is to provide a novel means for the automatic destruction of a projectile at a desired time interval after it has been fired.

The manner in which these and other objects are accomplished by this invention will be fully understood when the following description thereof is read in connection with the drawing in which—

Figure 1 is a fragmentary view particularly in section illustrating a fuze made in accordance with this invention in position in a projectile; and

Figure 2 is a similar view illustrating another embodiment of this invention.

In accordance with this invention, generally stated, these and other objects are accomplished by providing a fuze containing a gas filled or gas producing capsule that is activated upon set-back when the projectile is fired in the gun, and after a desired time interval the gas builds up sufficient pressure to drive the firing pin into the detonator, thus destroying the shell. More specifically, these objects are accomplished by providing an impact detonating fuze comprising a forwardly located gas filled or gas producing capsule, a firing pin in the form of a cap for a cavity housing the capsule, and having a point extending forwardly so as to puncture the capsule when the inertia of the capsule forces it rearwardly upon set-back. Upon

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firing of the projectile, the forces of set-back cause the capsule to be punctured, and gas leakage or generation from the capsule into the surrounding container after a period of time blows the firing pin cap off the container and into the detonator. Thus, the firing pin of the present invention is provided with two oppositely disposed points, one of which is designed to contact the detonator and the other of which is designed to puncture the capsule upon set-back. Preferably, the firing pin serves as a bottom closure of a container which surrounds the capsule of compressed gas, but if this portion of the fuze is airtight the external container for the capsule can be eliminated.

Any type of relatively inert gas can be used as the motivating means for the self-destruction element of this invention. Thus, carbon dioxide, nitrogen, oxygen and any other commercially available inert compressed gas can be used in this capacity. Alternatively, the capsule can be filled with a material capable of producing gas upon penetration of the forward point of the firing pin. For example, the capsule can be filled with an acid such as hydrochloric and the cavity surrounding the capsule lined with a coating of zinc or the like. Likewise, the capsule can serve as a reservoir for an acid, such as hydrochloric or acetic surrounded by a solution of sodium bicarbonate or, if preferred, the sodium bicarbonate solution can surround a capsule of acid. Means must be provided to prevent penetration of the capsule prior to the time the projectile is fired from the gun. In order to prevent such premature penetration of the capsule it can be held in a position away from the forward firing pin by means of a spring or the like. Premature penetration of the capsule by the forward point of the firing pin can also be avoided by crimping or staking the capsule in a position remote from the firing pin. Also, in order to prevent detonation of the main charge of the projectile upon set-back, means which do not form a part of the present invention are provided to prevent the firing pin from impinging on the detonator.

In order that the invention may be further clarified and more fully understood, the following is a detail description of a preferred embodiment thereof.

As shown in Figure 1 of the drawing, the firing pin is a two-piece element, the lower portion 1 forming a base and closure for the cylindrical portion 2. In this embodiment a gas tight seal between the two portions of the firing pin is provided by crimping the cylindrical portion into the base portion as shown at 6. It will be readily appreciated however that the seal can also be effected by swaging and similar operations or by use of adhesives and sealants. The cylindrical portion of the firing pin serves as a reservoir for acid 18, such as acetic or hydrochloric in volume 7 and also as a container for a capsule 3 containing a solution of sodium bicarbonate 17 or the like. The base portion of the firing pin is provided with a rearwardly directed point 4 adapted for penetration of the detonator and an oppositely directed point 5 which penetrates the capsule 3 upon exertion of the set-back forces upon firing of the projectile. In this embodiment the capsule is maintained in a position remote from the forward point of the firing pin by three indentations 16 in the cylindrical portion of the firing pin. If desired, these indentations can be replaced by a circumferential crimp. This crimp or indentation permits normal handling of the projectile during manufacture and transportation, but the capsule is forced past the crimp by the forces exerted upon set-back and is perforated by the forward point of the firing pin.

Figure 2 of the drawing shows a firing pin in accordance with this invention in position in a typical projectile fuze. In this example the capsule 3 is charged with compressed gas 17, such as carbon dioxide, rather than a gas-

generating composition and is surrounded by air. The firing pin shown in this embodiment is of the same general configuration as the one shown in Figure 1 but it will be noted that the lower portion of the firing pin is provided with a flange 8 extending upwardly to receive the lower segment 9 of the cylindrical portion 2 of the firing pin. These two portions of the firing pin form a tight frictional fit which is gasproof but can be broken by the exertion of longitudinal pressure. This firing pin assembly also differs somewhat from that shown in Figure 1 in that the forward point 5 of the firing pin is surrounded by a helical spring 10. This spring is equivalent to the retaining indentations referred to in connection with the embodiment set forth in Figure 1 of the drawing. It will, however, be readily appreciated that any other device will be equally satisfactory to prevent premature contact between the capsule 3 and the point 5 of the firing pin.

In this figure the firing pin assembly is positioned in the longitudinal axial bore 11 of a fuze body 12 and the cap of the fuze is shown at 13. Premature penetration of point 4 of the firing pin into the detonator 14 is prevented by the protruding centrifugally responsive dogs which are illustrated diagrammatically at 15. These dogs do not form a part of the present invention and any other suitable means can be provided to prevent the rearward motion of the firing pin assembly prior to impact upon the objective of the projectile.

Operation

As shown in Figure 2 the fuze assembly is in condition to be fired from a gun. When the propellant charge of the projectile is fired the set-back forces overcome the inertia of the gas filled capsule 3, thus depressing the restraining spring 10 and permitting the forward point 5 of the firing pin to penetrate the base of the capsule. This causes the gas contained within this capsule to escape into the cylindrical portion 2 of the firing pin assembly. Rearward travel of the entire firing pin assembly upon set-back is prevented by dogs 15 or by any other equivalent retarding means that are retracted by centrifugal force while the projectile is in flight. After such restraining means have been retracted from the bore 11, the base of the firing pin is then in a position to be driven into the detonator upon the application of force which can be derived either upon impact of the projectile with the target or by the gas pressure released due to the perforation of the capsule 3. In the event that the projectile does not meet the target, the gas escaping from the capsule into the chamber 7 gradually increases the pressure therein and finally reaches a level sufficiently high to break the seal between the base 1 of the firing pin and the cylindrical portion 2. When this seal is broken the cylindrical portion of the firing pin is held relatively stationary by the surrounding elements of the fuze and the major portion of the force from the compressed gas is exerted on base portion 1 of the firing pin which is then driven downwardly into the detonator, initiating the charge and destroying the entire projectile.

The time interval between the firing of the projectile and the initiation of the self-destructing means of this invention is determined by the initial pressure in the capsule, the size of the hole formed in the base thereof and

the strength of the seal between the two component parts of the firing pin assembly. As shown in the drawings, it is preferred that the forwardly disposed penetrating point of the firing pin have a uniform diameter throughout its length so that the size of the penetration of the capsule is uniform regardless of the magnitude of the forces exerted upon set-back. It will be appreciated however that this point can be of a tapered or stepped configuration and that in such instances the size of the perforation in the capsule will be dependent at least to a degree upon the forces exerted upon set-back. Thus, the time interval between the firing of the gun and the actuation of the self-destructing means of this invention can be shortened by providing a higher initial pressure in the capsule 3, by increasing the diameter of the forwardly directed penetrating point of the firing pin or by reducing the strength of the bond between the two segments of the firing pin. Conversely, this time interval can be lengthened by reducing the gas pressure in the capsule, by utilizing a penetrating pin of smaller diameter, or by providing a relatively strong bond between the segments of the firing pin assembly. By coordinating these variables any desired time interval can be obtained.

While the preferred embodiment of the invention has been described, it is evident that various modifications are possible without departing from the scope of the invention as expressed in the following claims.

What is claimed is:

1. A projectile fuze of the impact or self-destructing type comprising a detonator, a fuze body having a longitudinal bore in general alignment with the detonator, a firing pin in said bore, means for preventing impact of the firing pin on the detonator upon set-back, said firing pin having two separable portions, the forward portion of the firing pin being a cylindrical member closed at its forward end and containing a capsule of compressed gas relatively free to move therein and the other portion of the firing pin being a disc closing the posterior end of the cylindrical member and having a pair of oppositely disposed points, one adapted to penetrate the capsule upon set-back and the other adapted to penetrate the detonator.

2. A projectile fuze of the impact or self-destructing type comprising a detonator, a fuze body having a longitudinal bore in general alignment with the detonator, a firing pin in said bore, means for preventing impact of the firing pin on the detonator upon set-back, said firing pin having two separable portions, the forward portion of the firing pin being a cylindrical member closed at its forward end and containing a gas producing capsule relatively free to move therein and the other portion of the firing pin being a disc closing the posterior end of the cylindrical member and having a pair of oppositely disposed points, one adapted to penetrate the capsule upon set-back and the other adapted to penetrate the detonator.

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