

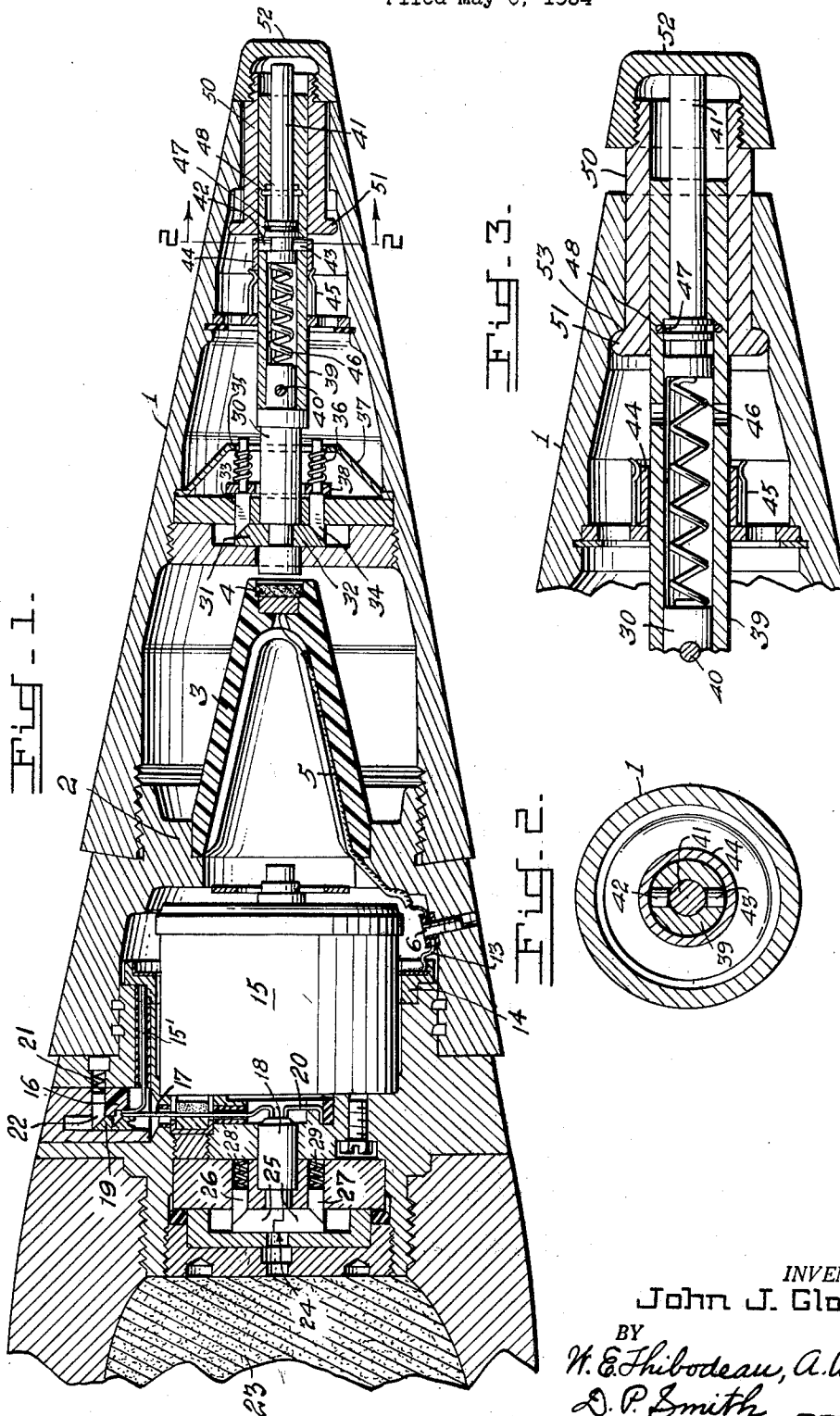
Dec. 30, 1969

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3,486,452

FUZE

Filed May 6, 1954



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3,486,452

FUZE

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Filed May 6, 1954, Ser. No. 428,149

Int. Cl. F42c 11/02

U.S. Cl. 102—70.2

8 Claims

This invention relates to fuzes for rotary projectiles and more particularly to fuzes for the destruction of ammunition to which they are applied.

A primary object of my invention is to provide a simple fuze for projectiles of the point detonating type which is very sensitive in operation, yet is completely safe to handle.

Another object of my invention is to provide a fuze for projectiles in which a detonator is exploded by energy from a piezoelectric crystal.

A further object of my invention is to provide a fuze having a plurality of safety devices all responsive to the same force to arm the fuze.

Other objects will be in part apparent and in part pointed out in the following specification.

The invention is carried out by the employment of a piezoelectric crystal which is positioned to be mechanically struck when the projectile engages a target. The output of the crystal is led through a suitable time delay mechanism to a detonator which is electrically responsive to explode a booster train to fire the shell.

The invention accordingly comprises the elements and combinations of elements and arrangement of parts hereinafter described and the scope of the invention is indicated in the appended claims.

I have shown a preferred embodiment of my invention in the accompanying drawing in which:

FIGURE 1 is a longitudinal elevation in section showing the internal arrangement of my invention.

FIGURE 2 is a cross section taken on lines 2—2 of FIGURE 1 and looking in the direction of the arrows.

FIGURE 3 is a fragmentary elevation in section showing an enlarged detail of the invention.

Referring now to FIGURE 1 there is shown at numeral 1 a tapered fuze body, such body being of external ogive form and through which is formed a central axis opening. Starting more or less centrally the opening has a shoulder 2 defining a portion of reduced diameter and serving to receive an insulator 3 of general frusto-conical form and carrying a piezoelectric crystal 4 at the apex thereof. A conductor 5 runs from the rear crystal terminal to an insulated binding post 6 on the fuze body. The other side of the crystal is adapted to be grounded when struck by the impact assembly as will later be more fully explained. A wiper 13 is in electrical contact with the lead terminating at the binding post at one end thereof and engages a slip ring 14 adapted to be turned by a clock mechanism 15 at the other end. Since clock mechanisms to delay the firing of an explosive are well known, no attempt has been made to illustrate the details of the structure shown, however it will be understood that the slip ring 14 rotates at a predetermined rate and after the expiration of a known time a connection is made to conductor 15' which terminates in insulated block 16. A second conductor 17 connects to electrically responsive detonator 18 at one end thereof and is in metallic engagement with conductor 15' at the insulator block. A slidable metal plug 19 is normally in engagement with the exposed junction between conductors 15' and 17, and as will be readily seen, connects such junction to the fuze body, or ground, and thereby effectively short circuits the detonator, which goes to ground by conductor 20. A spring 21

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urges against detent plow 22 which has a beveled face bearing against a mating beveled face on plug 19 substantially as shown.

A booster charge 23 is received rearwardly of the fuze and forms part of the explosive train to burst the pay load of the projectile. Interposed in cavity 24 leading between the detonator 18 and the booster charge 23 is a normally closed gate assembly consisting of two interlocking pins 25 slidable in radial ports and held in the closed position by detent members 26 and 27 which are urged rearwardly by compression springs 28 and 29.

Disposed forward of the beforementioned shoulder 2 is a crystal impact assembly consisting of shaft 30 normally held with one end in spaced relation with crystal 4 by pins 31 and 32 radially slidable in ports and held in position by detent members 33 and 34 which are, in turn, urged to rearward position by compression springs 35 and 36 interposed between spider 37 and collar 38. The other end of shaft 30 is received within sleeve 39 and is pinned thereto for motion therewith by rivet 40. A second shaft 41 is slidably received in sleeve 39 and is normally secured thereto by detent plugs 42 and 43 which are restrained in the normal position by sleeve 44 slidably embracing sleeve 39 and movable rearwardly under set back to be seized and held by resilient fingers 45.

A compression spring 46 resiliently urges between the respective ends of the several shafts for a purpose that will presently be explained. A spring ring 47 is seated in a kerf formed in shaft 41 and rides forward when the shaft is freed and moved by spring 46 to lock into kerf 48 formed in sleeve 39. A bushing 50 is slidably fitted around the forward part of sleeve 39 and is provided with an outwardly flaring head 51 to seat against a step 53 formed in the fuse body. The bushing 50 is threadedly fitted into a cap 52 which is adapted to be impacted against and carried forward by motion of shaft 41 substantially as shown in FIGURE 3.

OPERATION

When the projectile is discharged from the gun the set back force moves sleeve 44 rearwardly to be seized and held by resilient fingers 45 as will be seen in FIGURE 3. The set back force also aids the compression springs in forcing detent members 33, 34, 22, 26 and 27 tightly against their several radially movable elements. When the set back force drops to zero, sleeve 44, normally holding plugs 42 and 43 in locked position on shaft 41 (see FIGS. 1 and 2) moves rearwardly to free them and then centrifugal force causes detent plugs 42 and 43 to fly radially outward, and since shaft 41 is now free to move, compression spring 46 forces it, together with bushing 50 and cap 52 to the forward position shown in FIGURE 3 wherein head 51 rests against step 53 and split ring 47 is seated in kerf 48. The impact assembly consisting of shafts 30 and 41 and sleeve 39 are now locked together for motion as an entity. Simultaneously, centrifugal force moves pins 31 and 32 radially outward in their ports and the assembly is free to move longitudinally in the fuse body.

Slidable metal plug 19 moves outwardly thereby removing the short circuit from the detonator 18 and interlocking pins 25 are displaced outwardly to open port 24 between the detonator and booster charge 23.

When the timing mechanism 15 has completed its cycle the fuze is fully armed and upon impact with a target, shaft 30 is driven rearwardly impacting against crystal 4 thereby at once imparting a mechanical stress thereto and grounding the same, whereby electrical energy flows through lead 5, contact 13, lead 15', lead 17, detonator 18 and lead 20 to ground and the detonator explodes. The flash from the detonator passes through port 24 to fire the booster charge and in turn the projectile pay load.

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I claim:

1. In a point detonating fuze for a rotatable projectile a body having an axial passage from front to rear, an explosive train mounted therein and comprising a detonator explodable upon passage of electrical energy therethrough, means to short circuit said detonator in fuze disarmed position, a piezoelectric crystal in said passage, a circuit to supply electrical energy to the said detonator and connected to said crystal, timing means forming a part of said circuit to close said circuit after a predetermined time interval, and means normally spaced from said crystal and adapted to impact against said crystal to ground the same upon engagement of said fuze with a target.

2. In a point detonating fuze for a rotatable projectile a body having an axial passage from front to rear, an explosive train mounted therein and comprising a detonator explodable upon passage of electrical energy therethrough, means to short circuit said detonator in fuze disarmed position, said last mentioned means responsive to projectile spin to remove the short circuit to arm the fuze, a piezoelectric crystal in said passage, a circuit connecting the said crystal with the said detonator, timing means forming a part of said circuit and adapted to close the same after a predetermined interval, and means normally spaced from said crystal and adapted to impact thereagainst to ground the same upon engagement of the said fuze with a target.

3. In a point detonating fuze for a rotatable projectile a body having an axial passage from front to rear, an explosive train mounted therein and comprising a detonator explodable upon passage of electrical energy therethrough, means to short circuit said detonator in fuze disarmed position, said last mentioned means responsive to projectile spin to remove the short circuit to arm the fuze, a piezoelectric crystal in said passage, a circuit connecting said crystal with the said detonator, timing means forming a part of said circuit and adapted to close the same after a predetermined interval, means normally spaced from said crystal and adapted to impact thereagainst upon engagement of the said fuze with a target, and detent means arranged to engage the last named means to maintain the same in fixed position in fuze disarmed condition.

4. The invention according to claim 3 wherein the said detent means comprises a plurality of pins seated in said normally spaced means and responsive to centrifugal force to move radially in the said passage.

5. The invention according to claim 4 including a plurality of members normally interposed in said powder train to obstruct the same and responsive to fuze spin to move radially in said passage.

6. In a point detonating fuze for a rotatable projectile a body having an axial passage from front to rear, a detonator in said passage and explodable upon passage therethrough of electrical energy, an explosive train formed in part at least by said detonator, means responsive to centrifugal force to short circuit said detonator, a piezoelectric crystal in said passage, a circuit connecting said crystal and said detonator, timing means forming a part of the said circuit, and an impact assembly in the

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front of said axial passage responsive to fuze engagement with a target to strike and ground the said crystal, said assembly comprising two pins longitudinally arranged in said passage, a compression spring between the said pins and a detent in the forward of the said two pins removable during fuze flight to permit the said spring to urge the said forward pin outward beyond the front of said body.

7. In a fuze for use in a rotatable projectile having an axial passage extending from front to rear, a piezoelectric crystal, a detonator in said passage and arranged to explode upon passage of electrical energy therethrough from said crystal and means to impact against said crystal comprising a first shaft disposed in spaced relation to said crystal, a second shaft having a pair of axially spaced annular collars integral on its rearward portion aligned with said first shaft and spaced therefrom, a compression spring urging between said first and second shafts, a first elongated sleeve extending at least between said first and second shafts and surrounding said compression spring, a plurality of detent pins piercing said first sleeve and received in said second shaft, a second sleeve embracing said first sleeve and said detent pins and movable under the urging of set back force of said projectile to release said pins from said second shaft, a kerf formed in said first sleeve adjacent an end of said second shaft, a spring ring normally seated between said collars and embracing said second shaft whereby upon cessation of said set back force said compression spring forces said second shaft to extend beyond said fuze and engage said spring ring in said kerf in said first sleeve whereby said first and second shafts and said first sleeve are locked for motion together.

8. In a point detonating fuze for a rotatable projectile a body having an axial passage from front to rear, an explosive train comprising a detonator explodable upon the passage of electrical energy therethrough, means to short circuit said detonator said means responsive to projectile rotation to remove said short circuit, a piezoelectric crystal in said passage, a circuit to connect said crystal with said detonator, timing means forming a part of said circuit, means normally spaced from said crystal adapted to impact thereagainst upon target engagement and detent means received in said last named means to maintain the said normal spacing in fuze disarmed condition.

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U.S. Cl. X.R.

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