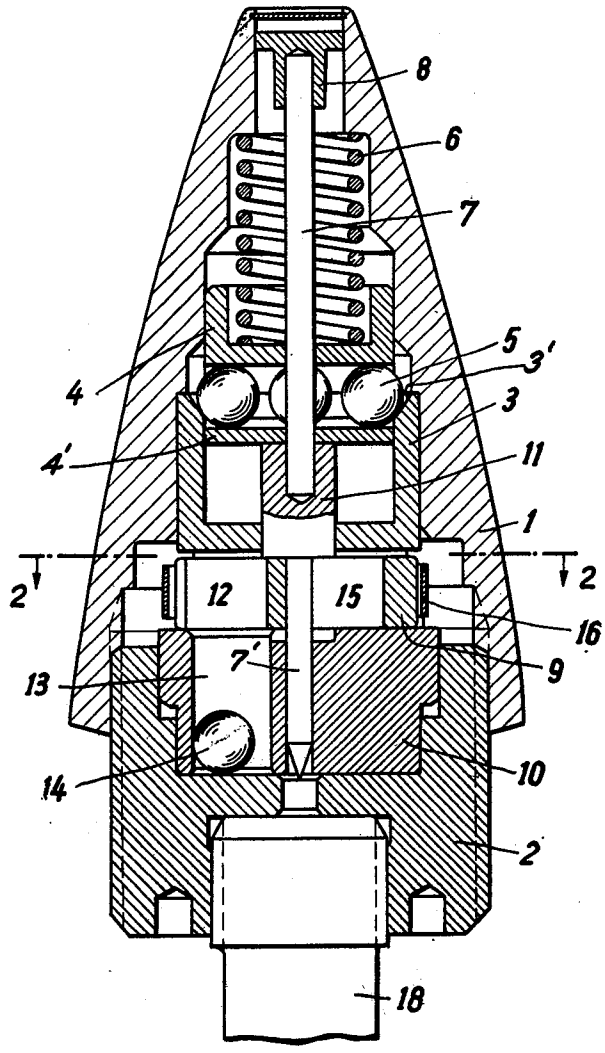
Dec. 3, 1963 F. SCHAADT 3,112,704

SELF-DESTROYING FUZE FOR A SPINNING PROJECTILE

Filed Dec. 23, 1960 3 Sheets-Sheet 1

Fig. 1



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Fig. 2

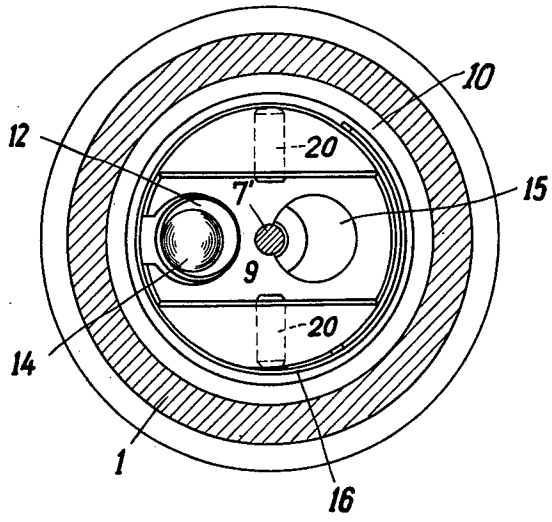
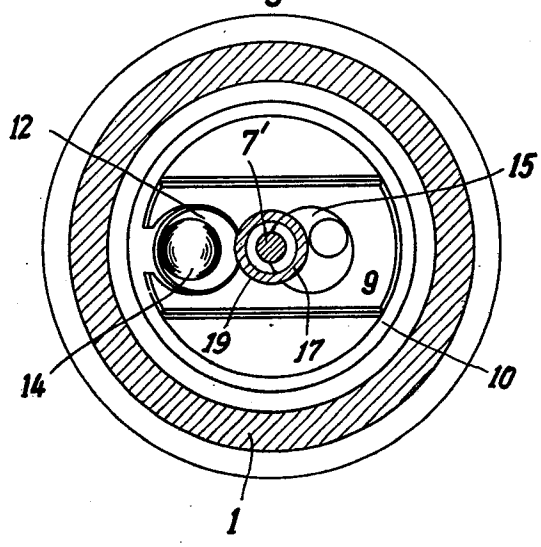


Fig. 4



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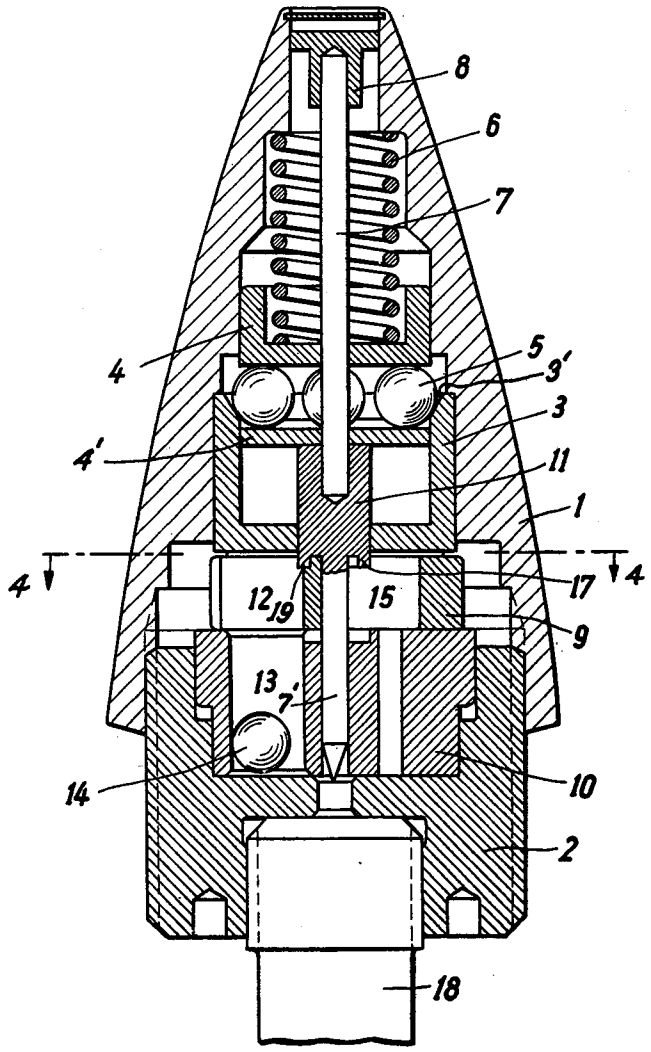
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SELF-DESTROYING FUZE FOR A SPINNING PROJECTILE

Filed Dec. 23, 1960 3 Sheets-Sheet 3

Fig. 3



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United States Patent Office 3,112,704 Patented Dec. 3, 1963

3,112,704

SELF-DESTROYING FUZE FOR A SPINNING PROJECTILE

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Filed Dec. 23, 1960, Ser. No. 77,865
5 Claims. (Cl. 102—71)

The invention relates to a self-destroying fuze for spinning projectiles more especially the invention relates to self-destroying fuzes having means whereby the detonation of the fuze is prevented until after a predetermined interval after the projectile has been fired from the gun barrel (this interval being known as the safety margin).

It is known to control the self-destroying fuze of spinning projectiles by centrifugal means for example radially movable centrifugal bodies such as balls, cylinders and the like, arranged inside the fuze so as to travel outwardly, under the action of the centrifugal forces occurring during the spinning of the projectile, the said balls or the like opposing the action of a spring adapted to displace the firing pin in the axial direction of the projectile to detonate the fuze. As the rotation of the projectile decreases the force of the striker pin spring overcomes that of the balls the striker pin is then forced against the detonator to explode the projectile. In these known constructions, the cocking or arming of the striker pin is effected by the action of the centrifugal forces and the drawback of this is than when the striker pin is cocked the projectile starts immediately to rotate on leaving the gun barrel and accordingly the safety margin is very small and thus if the projectile should strike an object a few metres after leaving the gun barrel it would be exposed with disastrous results to the gun crew.

The invention aims to overcome this drawback by providing means to ensure a substantial safety margin before the mechanism is cocked or armed. The said means also ensures that the projectile can be safely transported. This is achieved by providing a slide block for the axial movement of the striker pin in the securing or safety position, said slider being pressed against the shank of the striker pin by the centrifugal force on rotation of the projectile and its centre of gravity being altered by the action of a ball whereby the slide is displaced laterally by the centrifugal force so as to free the firing pin for the axial movement. During the acceleration of the projectile on firing, the ball is retained by the forces of inertia and rests on the bottom of a bore in a slide-supporting body disposed behind the slide, the wall of said bore being advantageously inclined outwardly through a small angle with respect to the axis of the striker pin. The supporting body advantageously consists of plastic, but may also be made of any other suitable material.

According to one embodiment, the slide may be surrouned by a band spring securing it in the locking position and expandible radially outwards by centrifugal force so as to release said slide.

According to another embodiment, in which there is no spring, the firing pin has projections which engage in corresponding recesses in the slide, in the locking position of the slide.

Details of the invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a longitudinal section of a fuze of a projectile according to one embodiment of the invention;

FIGURE 2 is a cross-section on line 2—2 of FIGURE 1 in the direction of the arrows;

FIGURE 3 is a longitudinal section of fuze of a projectile according to a second embodiment of the invention; and

FIGURE 4 is a cross-section on line 4—4 of FIGURE 3 in the direction of the arrows.

In the accompanying drawings, equivalent parts are designated by the same reference numerals.

The fuze, illustrated in the drawings is composed of two main structural groups, namely the group containing the self-destroying system and the group containing the safety-margin device.

The self-destroying system is located in the screw cap 1, while the safety-margin device is housed in the fuze body 2.

The self-destroying system comprises a sleeve 3 having a conical bearing surface 3', a ball carrier consisting of an upper part 4 and a lower part 4' with balls 5 and a spring 6. A pin 7 is provided connected to a guide head 8 which is mounted in the nose of the cap 1.

The safety-margin device comprises a slide 9 surrounding an extension of the firing or striker pin 7', and a slide-supporting body 10 disposed behind said slide and mounted in the fuze body 2.

The striker pin 7' has an abutment or shoulder 11 which rests against the slide 9 in the locking position. The slide 9 has a through bore 12 the axis of which extends parallel to the longitudinal axis of the fuze and to the longitudinal axis of the pin 7. Behind said bore 12 there is located in the slide-supporting body 10 a guideway 13 which as shown comprises a through bore in which is located a ball 14. The wall of the guideway or bore 13 is inclined outwardly by a small amount with respect to the longitudinal axis of the fuze.

To permit the slide 9 to shift radially with respect to the striker pin 7', it has a bore 15 which affords the necessary space for this radial movement.

In the embodiment illustrated in FIGURES 1 and 2 the slide 9 is surrounded by a band spring 16 which holds two pins 20 in a position locking the slide 9 to the slide-supporting body 10.

In the embodiment illustrated in FIGURES 3 and 4 no spring such as 16, is provided. Instead, the abutment or shoulder 11 of the striker pin 7' has projections 17 on its side facing the slide, said projections engaging in corresponding recesses 19 in the slide 9 in the locking position of the slide.

The embodiment according to FIGURES 1 and 2 operates in the following manner:

Under the action of the acceleration which occurs as the projectile is fired and travels inside the gun barrel, i.e., as long as the forces of inertia operate, all the axially movable parts of the fuze remain blocked in the position illustrated, that is in the locking position. The centrifugal forces occurring as a result of the incipient rotation of the projectile, however cause an expansion of the band spring 16, and at the same time cause the pins 20 to move radially outwardly and to release the slide 9. The slide 9 is caused to exert a pressure against the striker pin 7', whereby the slide is held in engagement under the shoulder 11 and the securing action is maintained. On cessation of the acceleration of translation and the full speed of rotation being reached at the mouth of the gun barrel, forces of inertia no longer act on the parts of the fuze, but centrifugal forces come into full play. In consequence, the band spring 16 expands still more and the ball 5 of the self-destroying system tend to fly radially outward and to press the upper part 4 of the ball carrier against the pre-tensioned spring 6. At the same time, the ball 14 begins to roll upwardly in the bore 13 in the body 10. The time the ball 14 takes to reach the upper end of the bore 13 is determined by the angle of inclination of the bore and its axial length. The ball 14 eventually enters the bore 12 in the slide 9 and effects a displacement of the centre of gravity of the slide and ball through 180° in the direction of the side where the ball inlet is located. Under the action of centrifugal force, the slide 9 and ball 14 are displaced radially outwards out of engagement with

the abutment 11 of the striker pin 7', whereby the locking of the striker pin 7' is terminated.

If the projectile hits the target, the pin 7 and the striker pin 7' is driven into the detonator 18. If the target is missed, the speed of the projectile decreases steadily owing to air friction and after a predetermined distance, the limit of speed at which the self-destruction occurs is reached. The centrifugal force acting on the balls 5 has now become so small that it is no longer sufficient to balance the force of the spring 6. The latter is able to expand and exert pressure on the parts 4, 4', 5 and 11, to drive the striker pin 7' into the detonator 18. In this way, the self-destruction of the fuze is effected.

In the embodiment according to FIGURES 3 and 4 the initial operation will be substantially as described above in connection with FIGURES 1 and 2. In this case however in order to release the locking action of the striker pin the projections 17 on the striker-pin have to be pushed out of the recesses 19 in the slide 9. This is done by the pin 7 and the striker pin 7' being lifted, when the full speed of rotation is reached, by the action of the outwardly flying balls 5 in opposition to the pressure of the spring 6 which results in the raising of the ball carrier 4, 4' since said ball carrier is fixedly connected to the pin 7.

During the initial stages of the lifting of the pin 7 by the outwardly flying balls 5, the slide 9 engages the shank of the striker pin 7' and acts as a guide to keep it central whereby the sliding of the projections 17 out of the recesses 19 in the slide 9 is facilitated.

The slide supporting body member 10 may be made of synthetic plastic.

I claim:

1. A fuze for spinning projectiles comprising in combination a detonator, a fuze casing, a striker pin axially slidably guided in said fuze casing, a pin arranged axially and connected to said striker pin and being slidably guided into said fuze casing for a movement to and fro relative to said detonator, a sleeve disposed concentrically around said pin, said sleeve having in a direction opposite to said detonator a conical surface directed outwardly, a plurality of first balls arranged around said second-mentioned pin above said conical surface and resting on said conical surface before the firing of the projectile, a cage for said balls to hold them in position, a spring abutting at one end in said fuze casing and the other end against said cage on its side opposite to said detonator, said cage being guided in said fuze casing and in said sleeve for movement to and fro relative to said detonator caused by running outwardly of said balls along said conical surface of said sleeve under centrifugal force against the force of said spring, a single slide member guided in said fuze casing for a movement transversely to said striker pin, said slide member having an axial perforation therein fitting substantially half around said striker pin, said striker pin extending through said perforation of said slide member, an abutment arranged between said striker pin and said second-mentioned pin and connected to said striker pin, said abutment having a cross sectional area overlapping said perforation of said slide member and said abutment rests with its underside on said slide member, said slide member having a second axial perforation extending transversely from said first-mentioned perforation, said second perforation having a cross sectional area larger than the cross sectional area of said abutment so that said abutment can pass through when said slide member is moving transversely with its first-mentioned perforation away from said striker pin, said slide member having a hole therein at least open towards said detonator and disposed diametrically to said second-mentioned perforation, said slide member having a center of gravity arranged radially out of the axis of said first-mentioned perforation in a direction toward said second-mentioned perforation so that under centrifugal force said slide member will be urged transversely towards said striker pin, a second ball disposed before firing of the projectile in said fuze casing between said detonator and said slide member, a guide way for said second-mentioned ball directed toward said hole in said slide member, said guide way being disposed substantially axially but slightly inclined outwardly toward said hole of said slide member so that by centrifugal force said second-mentioned ball is forced to move toward said slide member and to enter said hole of said slide member, said slide member and said second-mentioned ball being designed so that by entering of said second-mentioned ball into said hole the center of gravity of said slide member changes across the axis of said first-mentioned perforation toward said hole causing by centrifugal force a transverse movement of said slide member away from said striker pin and bringing said second-mentioned perforation in a position for passing through of said abutment.

2. A fuze for spinning projectiles comprising in combination a detonator, a fuze casing, a striker pin axially slidably guided in said fuze casing, a pin arranged axially and secured to said striker pin and being slidably guided into said fuze casing for movement to and fro relative to said detonator, a sleeve disposed concentrically around said pin, said sleeve having a conical surface directed outwardly in a direction opposite to said detonator, a plurality of balls arranged around said second-mentioned pin above said conical surface and resting on said conical surface before firing the projectile, a cage for said balls to hold them in position, said cage being secured to said second-mentioned pin, a spring abutting at one end in said fuze casing and the other end against said cage on its side opposite to said detonator, said cage being guided for movement to and fro of said detonator caused by running outwardly of said balls along said conical surface of said sleeve under centrifugal force against the force of said spring, a single slide member slidably guided in said fuze casing for movement transversely to said striker pin, said slide member having an axial perforation therein fitting substantially half around said striker pin, said striker pin extending through said first perforation of said slide member, an abutment arranged between said striker pin and said second-mentioned pin and connected to both pins, said abutment having a cross sectional area overlapping said perforation of said slide member and said abutment resting then with its underside on said slide member, said slide member having a second axial perforation extending transversely from said first-mentioned perforation, said second-mentioned perforation having a cross sectional area larger than the cross sectional area of said abutment so that said abutment can pass through when said slide member is moving transversely with its first-mentioned perforation away from said striker pin, said slide member having a hole therein extending in a substantially axial direction at least open towards said detonator and disposed diametrically to said second-mentioned perforation, said slide member having a center of gravity situated radially out of the axis of said first-mentioned perforation and toward said second-mentioned perforation so that under centrifugal force said slide member is pressed transversely toward said striker pin, a second ball disposed before firing of the projectile in said fuze casing between said detonator and said slide member, a guide way for said second-mentioned ball directed toward said hole in said slide member, said guide way being disposed substantially axially but slightly inclined relative to said hole of said slide member so that by centrifugal force said second-mentioned ball is forced to move toward said slide member and to enter said hole of said slide member, said slide member and said second-mentioned ball being designed so that by entering of said second-mentioned ball into said hole the center of gravity of said slide member changes across the axis of said first-mentioned perforation toward said hole causing by centrifugal force a transverse movement of said slide member

away from said striker pin and bringing said second-mentioned perforation in a position for passing through of said abutment.

3. A fuze for spinning projectiles comprising in combination a detonator, a fuze casing, a striker pin axially slidably guided in said fuze casing, a pin arranged axially and connected to said striker pin and being slidably guided into said fuze casing for movement to and fro, a sleeve disposed concentrically around said pin, said sleeve having a conical surface directed outwardly in a direction opposite to said detonator, a plurality of balls arranged around said second-mentioned pin above said conical surface and resting on said conical surface before firing the projectile, a cage for holding said balls, said cage being secured to said second-mentioned pin, a spring abutting at one end in said fuze casing and the other end against said cage on its side opposite to said detonator, said cage being guided for movement to and fro caused by running outwardly of said balls along said conical surface of said sleeve under centrifugal force against the force of said spring, a single slide member slidably guided in said fuze casing for movement transversely to said striker pin, an axial perforation of said slide member fitting substantially half around said striker pin, said striker pin extending through said perforation of said slide member, an abutment arranged between said striker pin and said second-mentioned pin and connected thereto, said abutment having a cross sectional area overlapping said perforation of said slide member and said abutment resting then with its underside on said slide member, said slide member having a second axial perforation extending transversely from said first-mentioned perforation, said second-mentioned perforation having a cross sectional area larger than the cross sectional area of said abutment so that said abutment can pass through when said slide member is moving transversely with its first-mentioned perforation away from said striker pin, said slide member having a groove around said first-mentioned perforation, projections on the underside of said abutment gripping in said groove of said slide member before firing the projectile and holding said slide member in a transverse direction, said slide member having a hole therein at least open towards said detonator and disposed diametrically to said second-mentioned perforation, said slide member having a center of gravity being situated radially out of the axis of said first-mentioned perforation toward said second perforation so that under centrifugal force said slide member is pressed transversely relative to said striker pin, a second ball disposed before firing of the projectile in said fuze casing between said detonator and said slide member, a guide way for said second-mentioned ball directed toward said hole in said slide member, said guide way being disposed substantially axially but slightly inclined outwardly to said hole of said slide member so that by centrifugal force said second ball is forced to move toward said slide member and to enter said hole of said slide member, said slide member and said second-mentioned ball being designed so that by entering of said second-mentioned ball into said hole the center of gravity of said slide member changes across the axis of said first-mentioned perforation toward said hole caused by centrifugal force and after lifting said projections of said abutment out of said groove of said slide member by running outwardly of said first-mentioned balls.

4. A fuze for spinning projectiles comprising in combination a detonator, a fuze casing, a striker pin axially slidably guided in said fuze casing, a pin arranged axially and connected to said striker pin and being slidably guided into said fuze casing, a sleeve disposed concentrically around said pin, said sleeve having a conical surface directed outwardly in a direction opposite to said detonator, a plurality of balls arranged around said pin above said conical surface and resting on said conical surface before firing the projectile, a cage for said balls holding them therein, a spring abutting at one end in said fuze casing and the other end against said cage on its side opposite to said detonator, said cage being guided for a movement caused by running outwardly of said balls along said conical surface of said sleeve under centrifugal force against the force of said spring, a single slide member slidably guided in said fuze casing, said slide member having an axial perforation fitting substantially half around said striker pin, said striker pin extending through said perforation of said slide member, an abutment arranged between said striker pin and said second-mentioned pin and connected to said striker pin, said abutment having a cross sectional area overlapping said perforation of said slide member and said abutment resting then with its underside on said slide member, said slide member having a second axial perforation extending transversely from said first-mentioned perforation, said second-mentioned perforation having a cross sectional area larger than the cross sectional area of said abutment so that said abutment can pass through when said slide member is moving transversely with its first-mentioned perforation away from said striker pin, said slide member having a hole therein at least open towards said detonator and disposed diametrically to said second-mentioned perforation, said slide member having a center of gravity being situated radially out of the axis of said first-mentioned perforation toward said second-mentioned perforation so that under centrifugal force said slide member will be forced toward said striker pin, a second ball disposed before firing of the projectile in said fuze casing between said detonator and said slide member, a guide way for said second-mentioned ball directed toward said hole in said slide member, said guide way being disposed substantially axially but slightly inclined outwardly to said hole of said slide member so that by centrifugal force said second-mentioned ball is forced to move to enter said hole of said slide member, said slide member and said second-mentioned ball being designed so that by entering of said second-mentioned ball into said hole the center of gravity of said slide member changes across the axis of said first-mentioned perforation toward said hole causing by centrifugal force a transverse movement of said slide member away from said striker pin and bringing said second-mentioned perforation in a position so that said abutment can pass therethrough, a body disposed inside said fuze casing and guiding said slide member in transverse direction, said guide way for said second-mentioned ball being formed in said body, said cage resting on the upper side of said abutment transmitting the force of said spring to said abutment.

5. A fuze for spinning projectiles according to claim 4, in which said body guiding said slide member is composed of a plastic material.

References Cited in the file of this patent

UNITED STATES PATENTS

2,405,653	Honger	Aug. 13, 1946
2,650,541	Rosselet	Sept. 1, 1953
2,871,788	Guerne	Feb. 3, 1959
2,896,540	Voland	July 28, 1959

FOREIGN PATENTS

113,992	Sweden	May 2, 1945
1,087,643	France	Aug. 25, 1954