Jan. 7, 1958 D. H. SHENK 2,818,812

FUSE

Filed Oct. 14, 1952 2 Sheets-Sheet 1

Fig. 1.

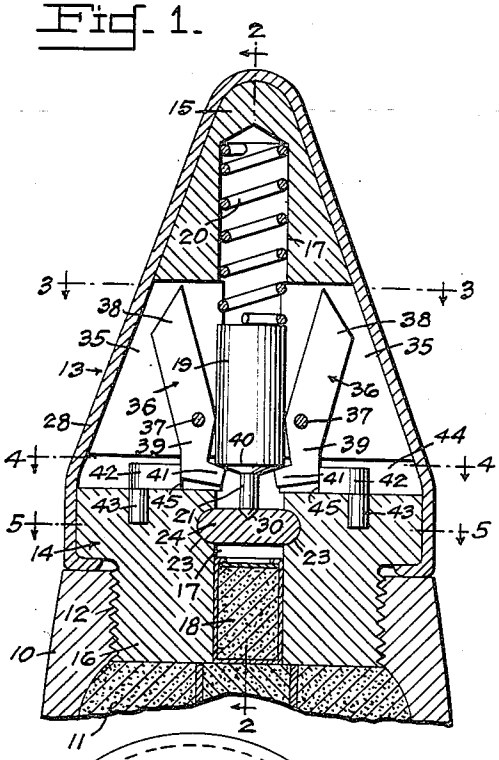



Fig. 2.

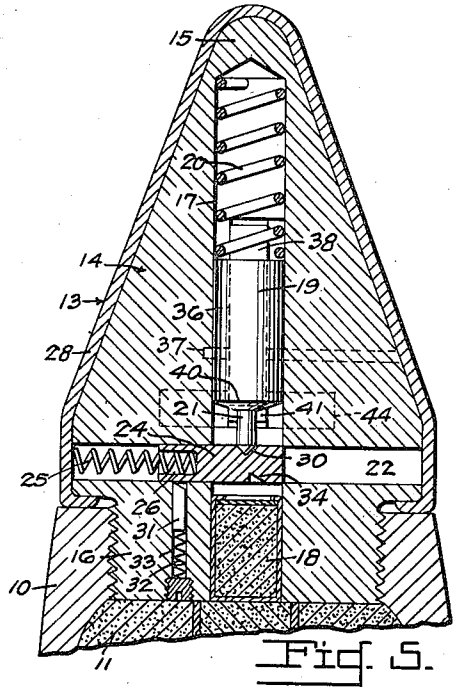



Fig. 5.

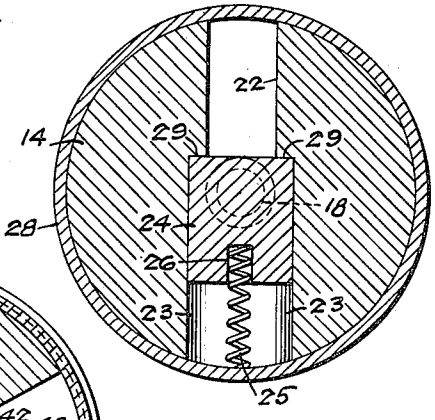



Fig. 3.

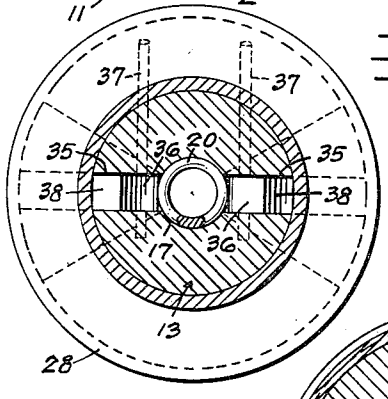
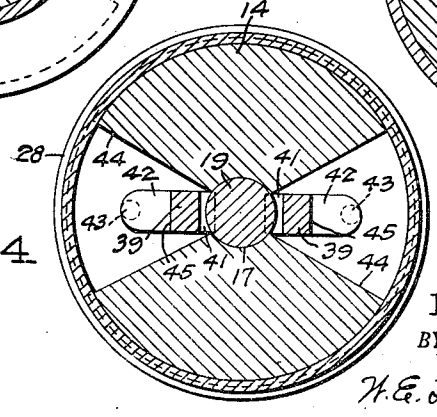



Fig. 4.




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Fig. 6.

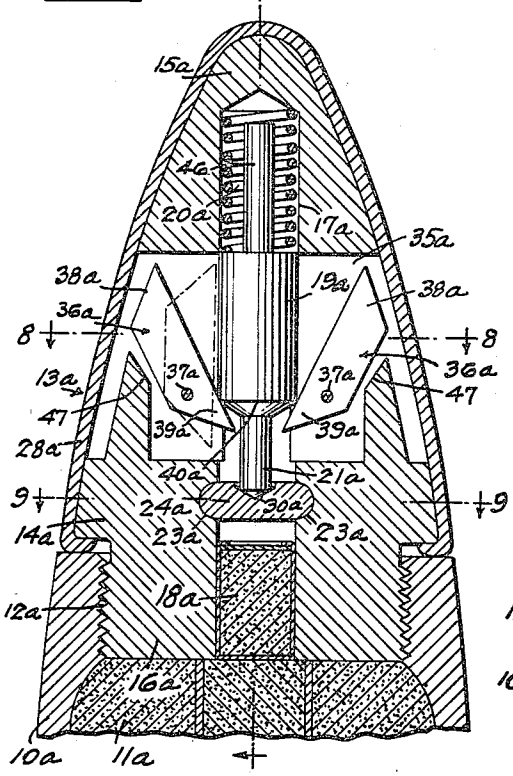



Fig. 7.

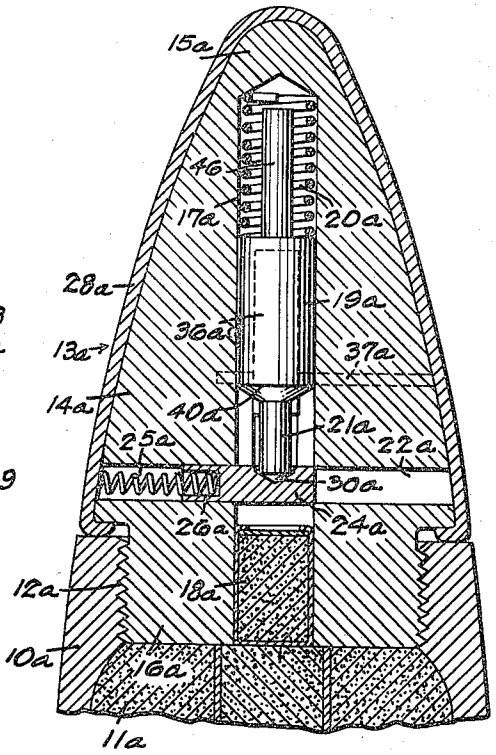



Fig. 8.

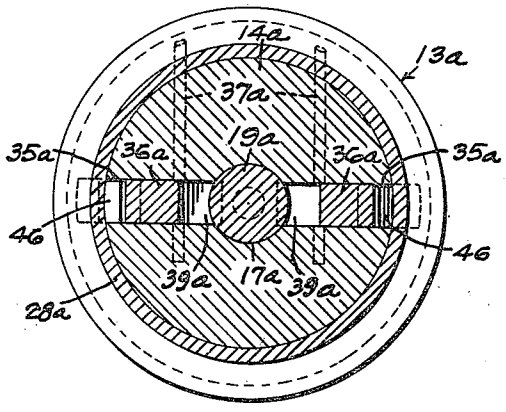
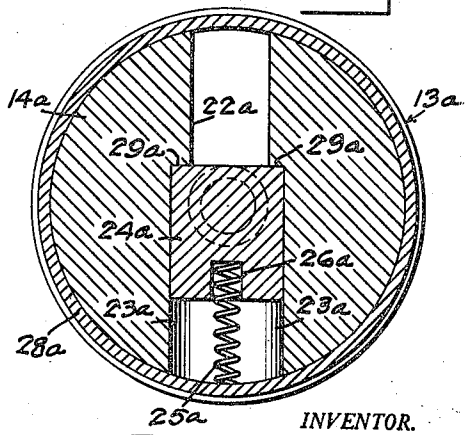



Fig. 9.




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# FUSE

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Application October 14, 1952, Serial No. 314,757

4 Claims. (Cl. 102—79)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to improvement in fuses.

An object of the invention is to provide a fuse which cannot be detonated in its unarmed position.

Another object of the invention is to provide a fuse which is bore safe.

Another object of the invention is to provide a fuse which will be safe to handle at the end of its flight if the control arms fail to function.

A further object of the invention is to provide a fuse designed for point or graze detonation.

A still further object of the invention is to provide a fuse which will detonate at the end of its flight regardless of whether it strikes a target or not.

A still further object of the invention is to provide a fuse having delayed firing means.

A still further object of the invention is to provide a fuse which is simple in construction and requires a minimum of machining.

Other objects and advantages will be apparent from the following detailed description and the accompanying drawings, in which:

Figure 1 is a central longitudinal section of a portion of a projectile equipped with a fuse illustrating the present invention;

Figure 2 is a longitudinal section of the line 2—2 of Figure 1;

Figure 3 is a transverse section on the line 3—3 of Figure 1;

Figure 4 is a transverse section on the line 4—4 of Figure 1;

Figure 5 is a transverse section on the line 5—5 of Figure 1;

Figure 6 is a central longitudinal section of a projectile equipped with a fuse illustrating a slightly modified form of the present invention;

Figure 7 is a longitudinal section on the line 7—7 of Figure 6;

Figure 8 is a transverse section on the line 8—8 of Figure 6;

Figure 9 is a transverse section on the line 9—9 of Figure 6.

In the drawings, wherein for the purpose of illustration, is shown two forms of the invention, the reference characters **10** and **10***a* indicate any form of rotating projectile having a bursting charge **11** and **11***a* respectively.

Referring now to Figures 1 through 5. Secured to the projectile by any preferred means, such as screw threads **12**, is a fuse **13**. A body portion **14** is cast or machined to provide a tip **15** and a base **16**. Extending axially through the body portion from the base **16** to a point near the tip **15** is a bore **17**, for receiving a detonator or primer **18** in the inner end thereof.



The outer end of the bore slidably receives a firing pin **19** and its propelling spring **20**. The inner end **21** of the firing pin is reduced in diameter for striking the detonator **18**.

Intermediate the inner end **21** of the firing pin and the detonator **18** a transverse slot **22** is formed. The side walls of the slot are grooved to form guideways **23** for a barrier member **24** shaped on its edges to slidably fit the guideways. A light spring **25** is seated at its inner end in a socket **26** in the barrier member and at its outer end bears against the wall of a windshield **28**. The windshield envelops the fuse body portion for the usual purpose.

The barrier member is normally urged inwardly against shoulders **29** which form the ends of guideways **23** to properly center the barrier member. A seat or indentation **30** is formed in the forward face of the barrier member in axial alignment with the reduced end **21** of the firing pin. Normally the firing pin point **21** rests in the seat **30** and retains the barrier in safe position.

In rotational flight the barrier member will be held against movement by the firing pin until such time as it is released as will be hereinafter disclosed. The barrier member **24** will move outwardly compressing its spring **25** and uncovering the bore **17**. A detent **31**, square in cross-section and urged forwardly by a spring **32**, is slidably received in a slot **33** in the base **16** of the body portion. A notch **34** formed in the rearward face of the barrier is positioned to receive the detent and hold the barrier retracted.

In practice the use of a very light spring **25** is contemplated and therefore the detent **31** may be found unnecessary. In which event on impact the residual forces in the barrier **24** will hold it retracted long enough for the firing pin to snap into the detonator **18**.

Radial slots **35** are formed in the body portion to receive control arms **36**. While two arms are shown in the model illustrated, three or more may be used if desired. Each control arm is mounted to oscillate in its radial slot on a pivot pin **37**, secured in the body portion. As the control arms are identical a description of one will suffice for both.

The control arm **36** has a weighted end **38** which is outwardly disposed with respect to the axis of the fuse body and to its other end **39**, and forwardly with respect to its pivot pin, for reasons which will be more fully explained. The inner end of the firing pin **19** has formed thereon a shoulder **40** which is normally engaged by an inturned toe **41** formed on the short rearward end **39** of the control arm.

A latch **42** provided with a pivot element **43** is rotatably received in a bore in the body portion. Adjacent the latch and the short end of the control arm the body portion is cut out to provide a recess **44** into which the latch may turn. The free end of the latch is formed with a flat face **45** which engages the abutting face of the short end **39** of the control arm whereby movement of the latch is restrained until sufficient spin is generated to move the offset end **38** of control arm outwardly.

The operation of the invention is as follows:

In unarmed condition the spring loaded firing pin **19** is restrained by the barrier member **24** which normally closes the bore **17**. The end **21** of the firing pin engages the seat **30** and renders the fuse safe.

As herein before stated the center of gravity of each control arm **36** is located forwardly of its pivot axis and in the position of the arms shown upon Figure 1 is radially and outwardly offset from the longitudinal planes through the axes of the respective shafts **37**, so that centrifugal force and the forces of set-back both tend to hold the firing pin safe, that is, in the position of Figure 1, when fired.

When the ends **38** of the control arms move outwardly, consequently the inner ends **39** are moved inwardly and the firing pin point is cammed forwardly away from the barrier member. Continued and increased rotational forces cause the ends **38** of the control arms to move farther outward until the latches **42** are free and rotate under centrifugal force, out of contact with the short ends **39** of the control arms. The barrier member **24** also moves outwardly under centrifugal force of the spinning projectile and is held in outward armed position when detent **31** snaps into recess **34**. Thus, in flight, the firing pin is restrained only by the toe **41** of the control arm.

On point impact the sudden deceleration causes the ends **38** of the control arms to move forwardly and inwardly to release the firing pin but the firing pin also moves forwardly from inertia forces causing a delay in firing. The slight delay occasioned by the forward movement of the firing pin allows the projectile to penetrate a short distance into the target before detonation occurs.

When graze impact occurs the resulting deceleration pivots the control arms sufficiently to release the firing pin and almost instantaneous detonation occurs, thus causing some damage when the impact is too obtuse for penetration of the target.

In case no target is hit, the decay of spin plus the inertia drag forward on the control arms enables the conical end of pin **19**, under the thrust of spring **20**, to cam the rearward ends of the arms outwardly until the pin is released and driven into the primer to detonate the charge.

Figures 6 through 9 illustrate a modified form of the invention wherein like parts are designated by like reference characters with the addition of the suffix *a*.

Secured to the projectile by any preferred means, such as screw threads **12***a*, is a fuse **13***a*. A body portion **14***a* is cast or machined to provide a tip **15***a* and a base **16***a*. Extending axially through the body portion from the base **16***a* to a point near the tip **15***a* is a bore **17***a*, for receiving a detonator or primer **18***a* in the inner end thereof.

The outer end of the bore slidably receives a firing pin **19***a* and its propelling spring **20***a*. The inner end **21***a* of the firing pin is reduced in diameter for striking the detonator **18***a*.

Intermediate the inner end **21***a* of the firing pin and the detonator **18***a* a transverse slot **22***a* is formed. The side walls of the slot are grooved to form guideways **23***a* for a barrier member **24***a* shaped on its edges to slidably fit the guideways. A light spring **25***a* is seated at its inner end in a socket **26***a* in the barrier member and at its outer end bears against the wall of a windshield **28***a*.

The barrier member is normally urged inwardly against shoulders **29***a* which form the ends of guideways **23***a* to properly center the barrier member. A seat or indentation **30***a* is formed in the forward face of the barrier member in axial alignment with the reduced end **21***a* of the firing pin. Normally the firing pin point rests in the seat **30***a* and retains the barrier in safe position.

In rotational flight the barrier member will be held against movement by the firing pin until such time as it is released as will be hereinafter disclosed. The barrier member **24***a* will move outwardly under centrifugal force, thus compressing its spring **25***a* and uncovering the bore **17***a*.

Radial slots **35***a* are formed in the body portion to receive control arms **36***a*. Each control arm is mounted to oscillate in its radial slot on a pivot pin **37***a*, secured in the body portion. As the control arms are identical a description of one will suffice.

In this form of the invention, as is indicated by dotted lines upon Figure 6, the control arm **36***a*, in a normal or unarmed condition, is free to oscillate about its pivot pin within the limitations of a shoulder **40***a* on the firing pin and the body portion of the firing pin **19***a*. Consequently one or more of the control arms will be in contact with the shoulder **40***a*, regardless of the position of the fuse, more certain with a multiplicity of control arms.



The control arm has a weighted end **38***a* which is disposed forwardly of its pivot pin and outwardly of the rotating axis of the fuse body, for reasons which have been set forth.

At its inner end **39***a*, the control arm is disposed rearwardly of its pivot pin and inwardly thereof for engaging the shoulder **40***a* of the firing pin.

At the height of acceleration in the barrel, the outward movement of the control arms is limited by stops **47**.

The firing pin is formed with a reduced extension **46** extending a predetermined distance forwardly in the bore **17***a*, and adapted to limit the forward movement of the firing pin on impact to control the time of delayed firing.

The operation of the modified form of the invention is as follows:

In unarmed condition the spring loaded firing pin **19***a* is restrained by the barrier member **24***a* which normally closes the bore **17***a*. The end **21***a* of the firing pin engages the seat **30***a* and renders the fuse safe.

In this modification of the invention the control arms **36***a* are not restrained by latches **42** as shown in Figure 1. The control arms assume a position in contact with the shoulder **40***a* of the firing pin on set-back, due to their weight distribution as hereinbefore stated. The barrier member cannot be retracted until sufficient centrifugal force has been generated in flight, to cause the control arms to cam the firing pin into release position.

As the high rate of spin of the projectile during flight moves the weighted ends of the control arms outwardly the firing pin spring is further compressed and held until the fuse contacts a target.

On impact with a target the control arms move inwardly and the firing pin moves forwardly to cause delayed firing in the same manner as set forth in the previous description of the first form of the invention.

The operation of this form of the invention on graze impact and on decay of spin is also identical with that of the first form.

While I have disclosed two forms of the present invention presently preferred by me, various changes and modifications will occur to those skilled in the art after a study of the present disclosure. Hence the disclosure is to be taken in an illustrative rather than a limiting sense; and it is my desire and intention to reserve all modifications falling within the scope of the subjoined claims.

Having now fully disclosed the invention, what I claim and desire to secure by Letters Patent is:

1. In a fuse of the type described, a fuse body having a first longitudinal axis of symmetry and a bore coaxial with said axis, there being a slot in said body transversely of and intersecting said bore between the ends thereof, a firing pin slidably fitting said bore, a barrier member slidably fitting said slot and movable in response to centrifugal force from a first position obstructing said bore to a second position free of said bore, first spring means urging said member into first position, second spring means urging said firing pin rearwardly into position engaging a recess in said member when in first position to hold the same against movement, a control arm pivoted intermediate its ends within said body for movement about a second axis normal to and laterally offset from said longitudinal axis, the centroid of said arm being forward and radially outward of said second axis, a latch member pivotally mounted on an axis parallel with the said first longitudinal axis normally engaging the rear end of said control arm and responsive to centrifugal force to remove from said normal engagement to free the said control arm for said movement about said second axis whereby upon such

movement the rearward end thereof engages said pin and moves the same forwardly to release said barrier member.

2. In a fuse of the type described a fuse body having a first longitudinal axis of symmetry and a bore coaxial with said axis, there being a slot in said body transversely of and intersecting said bore between the ends thereof, a firing pin slidably fitting said bore, a barrier member slidably fitting said slot and movable in response to centrifugal force from a first position obstructing said bore to a second position free of said bore, first spring means urging said member into first position, second spring means urging said firing pin rearwardly into position engaging a recess in said member when in first position to hold the same against movement, a plurality of control arms within said body and equiangularly spaced about said first longitudinal axis, each said control arm pivoted intermediate its ends for movement about a second axis normal to and laterally offset from said first longitudinal axis, the centroid of each said arm being forward and radially outward of said second axis, a plurality of latch members within said body, one for each said control arm, and pivotally mounted on an axis parallel with the said first longitudinal axis, each said member normally engaging its respective control arm and responsive to centrifugal force to remove from said normal engagement to free the said control arms for said movement whereby the rearward end thereof engages said pin and moves the same forwardly to release said barrier member.

3. In a fuze of the type described a fuze body having a first longitudinal axis of symmetry and a bore coaxial with said axis, a detonator seated in the rear end of said bore, a firing pin slidably fitted in said bore and spaced from the forward end thereof in normal safe position, there being a slot in said body transversely of and intersecting said bore between the rearward end of said firing pin and said detonator, a barrier member having a seat formed in its forward face for receiving the rearward end of said firing pin and being slidably fitted in said slot and movable in response to centrifugal force from a first position closing said bore to a second position opening said bore, first spring means urging said member into first position, second spring means in the forward end of said coaxial bore urging said firing pin rearwardly into position engaging said seat holding said member in first position, a plurality of centrifugally operated control arms within said body and equiangularly spaced about said first longitudinal axis, each said control arm pivoted intermediate its ends for movement about a second axis normal to and laterally offset from said first longitudinal axis, the mass center of each said arm being forward and radially outward of said second axis, a plurality of latch members within said body, one for each said control arm, and pivotally mounted on a third axis parallel with said first longitudinal axis, each said member normally engaging its respective control arm and responsive to centrifugal force pivots about said third axis from said normal engagement to free said control arms for said movement whereby the rearward end thereof moves said pin forwardly to release said barrier member.



4. In a fuze of the type described a fuze body having a first longitudinal axis of symmetry and a bore coaxial with said axis the forward end thereof being closed to provide a delay action chamber, a firing pin slidably fitted in said bore and spaced from the forward end thereof in normal safe position, a detonator seated in the rear end of said bore, there being a slot in said body transversely of and intersecting said bore between the rearward end of said firing pin and said detonator, a barrier member having a seat formed in its forward face for receiving the rearward end of said firing pin in normal safe position, said member being slidably fitted in said slot and movable in response to centrifugal force from a first safe position closing said bore to a second position opening said bore, first spring means urging said member into first safe position, second spring means in said delay action chamber urging said firing pin rearwardly into position engaging said seat to lock said member in first safe position, a plurality of centrifugally operated control arms within said body and equiangularly spaced about said first longitudinal axis, each said control arm pivoted intermediate its ends for movement about a second axis normal to and laterally offset from said first longitudinal axis, the mass center of each said arm being forward and radially outward of said second axis, a plurality of latch members within said body, one for each said control arm, and pivotally mounted on a third axis parallel with said first longitudinal axis, each said member normally engaging its respective control arm and responsive to centrifugal force to pivot about said third axis from said normal engagement to free said control arms for said movement whereby the rearward end thereof moves said pin forwardly to release said barrier member for outward movement under the influence of centrifugal force, and forces said pin into said delay action chamber against the bias of said second spring, said second spring being capable of further compression in said chamber on impact to effect a delay firing period.


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