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FUZE WITH DELAY FIRING AND IMPACT FIRING FEATURES

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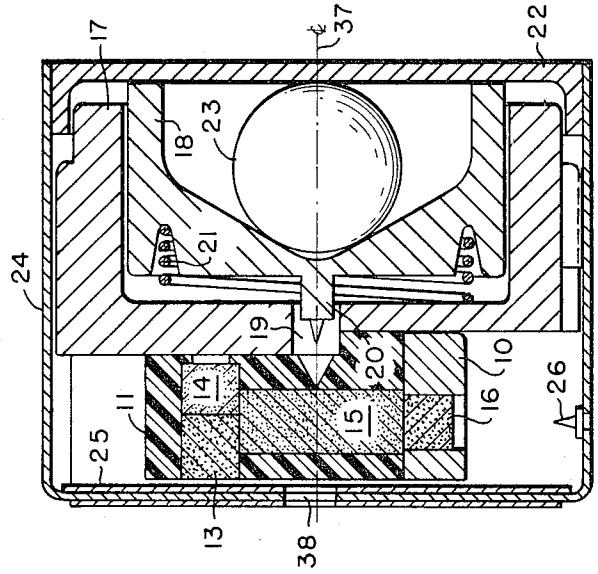

Fig. 2

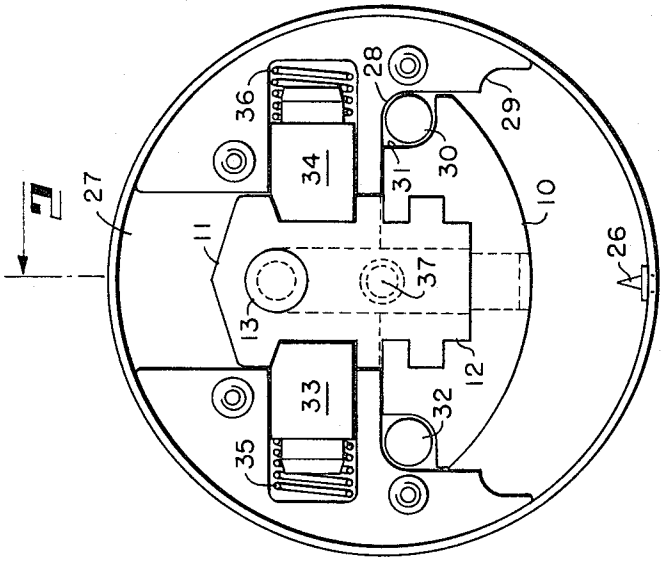

Fig. 1

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FUZE WITH DELAY FIRING AND IMPACT FIRING FEATURES

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ABSTRACT OF THE DISCLOSURE

This fuze is adapted to be installed in a spinning missile or bomblet. It provides for either delayed firing or impact firing. A weighted slider carries a first ignition train for delayed firing and a second ignition train for impact firing. In response to spin, the slider moves the first ignition train into contact with a first firing pin and sets up conditions for delayed firing. Additionally, it aligns the second ignition train with a second firing pin so that impact firing occurs in response to displacement of or relative to the second firing pin. Adjacent the second firing pin is a ball bearing. Transverse impact forces cause firing by moving the ball against the second firing pin. A spring is interposed between the second firing pin and the housing frame which secures the slider so that the second firing pin and ball move to cause firing on impact with the slider end of the fuze. The housing frame moves to cause firing in the event of axial impaut forces with the ball end of the fuze.

Field of the invention

The present invention relates to mechanical fuzes in ordnance and it provides a fuze which is of utility with pyrotechnic or explosive components and causes firing either on impact or after a predetermined delay.

The primary object of the invention is to provide a fuze with simple and sensitive initiating means which will cause firing and override the delay feature of the fuze if impact occurs before the expiration of the delay time.

Other objects of the invention are to provide a fuze which is characterized by the following advantages:

(1) Insurance against arming except under conditions of spin;

(2) Firing of primers by inertia forces and not stored energy;

(3) The use of compression springs which are never more than partially compressed;

(4) A small number of moving parts;

(5) An assembly without critical clearances and tolerances;

(6) Adaptability to duplication by mass production methods;

(7) Ready alteration of arming characteristics by modification of springs;

(8) Fail-safe operation if the desired spin rate for arming is not attained;

(9) The achievement of safety by mechanical misalignment.

For a better understanding of the invention together with other and further objects, advantages and capabilities thereof, reference is made to the following description of the appended drawings, in which there is shown a preferred embodiment of fuze in accordance with the invention.

Description of the drawings

FIG. 1 is an end view through a fuze structure in accordance with the invention, the rear plate being removed; and FIG. 2 is a view, generally in section, as taken along section line 2—2 of FIG. 1 and looking in the direction of the arrows.

Detailed description of the invention

Referring now to the drawings, attention is first invited to the arming means or slider group **10**, **11**, which may be made of brass and plastic. The slider group comprises a brass weight member **10** and a plastic carrier member **11**, suitably mechanically joined as indicated at **12**. The carrier is transversely bored to provide a mounting for an igniter **13** and a stab primer **14**. These elements are referred to as the "second ignition train." It is displaced from point **20** of firing pin **18** when the fuze is in unarmed condition. The carrier and the weight **10** are bored, in a direction lateral to the central axis of the fuze, to provide a mounting for a pyrotechnic delay element **15** and a stab primer **16** (i.e., the "first ignition train"). Support for the operating parts of the fuze is provided by a housing frame **17** which is generally of well-shaped configuration to provide a large bore in which the firing pin **18** is mounted in pistonlike fashion. The housing **17** is centrally apertured at **19** and this aperture is in alignment with the point **20** of the firing pin. An impact spring **21** is disposed between the fuze housing **17** and an annular formation in the rear face of the firing pin member **18**. This pin member is of pistonlike formation and there projects from its rear face the firing pin point **20**.

Positioned between the concave frontal face of the firing pin and a front end plug **22** is a ball bearing **23**. The fuze housing **17** and the other parts are disposed within a cylindrical cover **24**, the rear face of which is underlaid by plate **25**. Both the rear face of **24** and plate **25** are centrally apertured at **38** to establish communication with the main pyrotechnic material charge (not shown) located rearwardly. The brass slider weight **10** and the plastic carrier member **11** are so formed as to slide within a track located between the top plate **25** and the rear face of the fuze housing. An additional firing pin **26** projects upwardly from the side of the cover **24**, at a position which is in axial alignment with the elements **15** and **16**. The pin **26** is referred to as the "first firing pin" and pin **18** as the "second firing pin."

Returning now to the track in which the carrier **11** and associated weight **10** slide, that track is formed with a portion **27** of approximately constant width, a portion of enlarged width which provides an arcuate shoulder **28** and a third portion of still greater width which provides an arcuate shoulder **29**. A locking pin **30** resides between shoulder **28** and a complementary shoulder **31** formed on weight **10**. It will be understood that a similar locking pin **32** is likewise recessed between similar complementary shoulders formed by the weight and the housing.

The carrier **11** and the fuze housing **17** are suitably bored to provide for the engagement, release and sliding movement of arming weights **33** and **34**. The weights **33** and **34** are normally biased into latching position by arming weight springs **35** and **36**.

Referring to FIGURE 1, the operation of the fuze is now described.

It is assumed that the fuze is used in conjunction with an air-dropped bomblet which rotates about a central axis **37**. It is also assumed that the specified spin rate is the minimum spin rate based upon the expected speeds and deployment methods to be used with the weapons system. Lower spin rates would cause non-function or fail-safe operation of the weapon. Finally, the axis **37** of the fuze is common to the spin axis of the bomblet.

The cycle of fuze operation is as follows:

After deployment of the bomblet, when the fuze reaches the specified spin rate, the arming weights **33**, **34** move radially outwardly, being forced by the centrifugal force. With the arming weights displaced outwardly, the slider group **10**, **11**, moves into the armed position, as forced by the centrifugal force, aligning **13**, **14**, **19** and **20**. The

kinetic energy produced by the slider and weight **10**, **11** in the process of arming the fuze is used to impact **26** and fire the primer **16** and delay element **15**. With the slider and weight **10**, **11** in the fully armed position, the locking pins **30**, **32** are rolled radially outwardly by centrifugal force to lock the slider **10** in the armed position, placing the pins in shear between the slider and the fuze housing, i.e., for example between shoulders **31** and **29**. The delay element **15** burns the required time and in turn fires the igniter **13** which finally fires the flame material (not shown) located to the rear of aperture **38**. If impact occurs before the required delay time has elapsed, the firing mechanism **18**, **23**, **17** will initiate the primer **14** placed next to the igniter **13**.

The impact firing mechanism **18**, **23** is a simple ball cam mechanism used in conjunction with the housing **17**. This mechanism has three modes of operation;

(a) When impact is normal to the fuze axis, the inertia force of the ball **23** overcomes the firing pin spring **21** as the ball cams the firing pin point **20** into the primer **14**.

(b) When the impact occurs at the slider or rear end of the fuze, the inertia force of the firing pin **18** and ball **23** is used to overcome the spring **21** and fire the primer **14**.

(c) If impact occurs at the ball or front end, the inertia force of the housing **17** and slider assembly **10**, **11** will drive the primer **14** into the firing pin point **20**.

The net result is a firing mechanism which has three modes of operation.

The discussion of the specific embodiments assumes that the fuze is employed to ignite a pyrotechnic material. However, the fuze in accordance with the invention can likewise be used with high-explosive materials by using a delay detonator in place of the pyrotechnic delay element **15**, a stab detonator in place of the element **16** and a stab detonator in place of the elements **13** and **14**.

While there has been shown and described what is at present considered to be the preferred embodiment of the invention, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In a fuze adapted to be installed in a spinning missile, the combination of:

delay firing means comprising a first firing pin and a first ignition train including a delay element,

the first ignition train being normally spaced from said first firing pin,

impact firing means including a second firing pin and a second ignition train normally displaced from the second firing pin,

an arming means formed to carry both of said ignition trains,

said arming means being movable in response to spin to impact the first ignition train against the first firing pin to initiate firing after a predetermined time following the movement of the arming means,

said arming means aligning the second ignition train with the second firing pin whereby impact initiates firing at a time prior to the expiration of said delay.

2. The combination in accordance with claim **1** wherein the impact firing means comprises a housing member formed to provide mountings on which the arming means and the second firing pin move.

3. The combination in accordance with claim **2** in which the housing member is formed with an axial bore, in which the second firing pin moves, and a face on which the arming means moves, the arming means being a weighted slider and the second firing pin projecting axially through said housing member.

4. The combination in accordance with claim **3** and a compression spring disposed between the second firing pin and the housing.

5. In a fuze adapted to be installed in a spinning missile, the combination of:

a housing member formed to define an axially extending interior bore terminating in a wall having a central aperture;

a piston-like firing pin formed with a projection extending axially into said aperture and with a concave face;

a bearing reposing against said face;

a spring disposed between the housing and the firing pin and yieldable on impact to permit relative motion of the housing and firing of the fuze in response to inertia forces to cause said pin to project through said aperture;

arming means comprising a slider member and a weight secured together to slide transversely;

ignition means carried by the slider member and adapted to be positioned in alignment with said firing pin when the fuze is armed; and

means including another ignition means carried by the slider member and another firing pin disposed in alignment with said other ignition means for producing delayed firing in the absence of impact, the last-mentioned ignition means being disposed longitudinally of the slider and transversely of the axis of the fuze.

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