

[72] Inventor **George T. Boswell**
 Springfield, Va.
 [21] Appl. No. **823,223**
 [22] Filed **Feb. 28, 1968**
 Division of Ser. No. 647,355, June 20, 1967,
 Pat. No. 3,457,382
 [45] Patented **May 25, 1971**
 [73] Assignee **The Susquehanna Corporation**

2,949,783 8/1960 Butler..... 73/514
Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—Jerald J. Devitt
Attorney—Martha L. Ross

[54] **FUZE WITH IMPACT SWITCH**
 17 Claims, 11 Drawing Figs.

[52] U.S. Cl..... 102/75,
 102/85, 73/514

[51] Int. Cl..... F42c 1/08,
 F42c 9/10

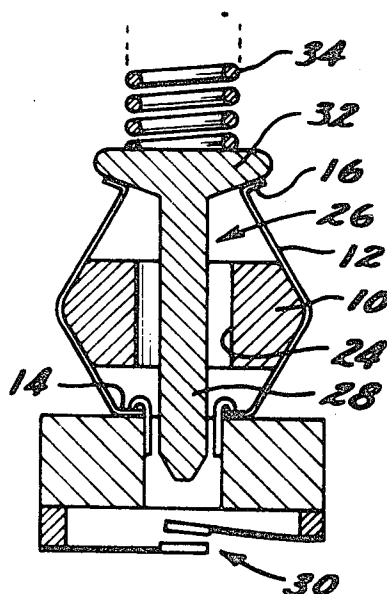
[50] Field of Search..... 102/75, 74,
 79, 85, 71, 72, 84; 73/514; 200/61.45

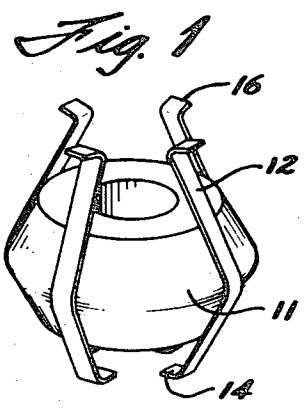
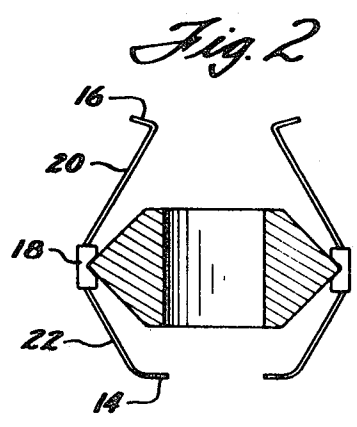
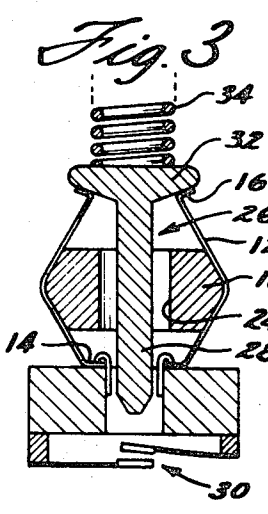
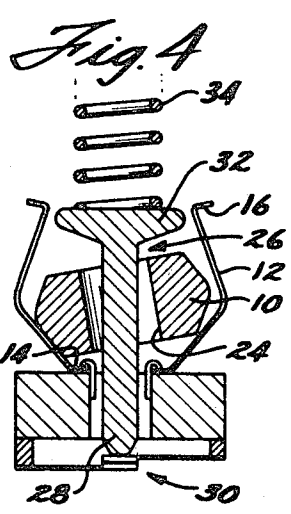
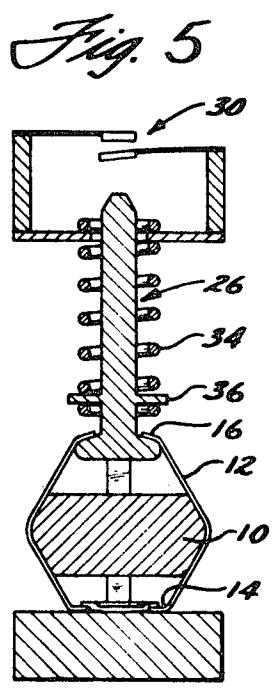
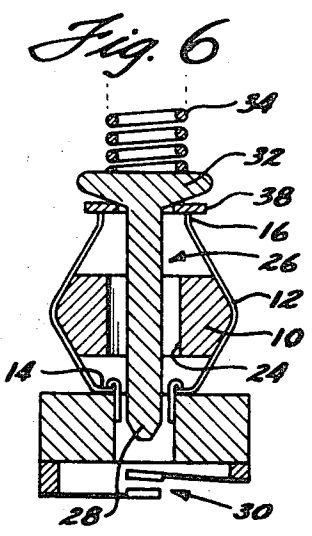
[56] **References Cited**

UNITED STATES PATENTS
 2,818,812 1/1958 Shenk..... 102/79

ABSTRACT: An impact weight is releasably engaged, supported, and caged by a plurality of springlike supports which also releasably engage a spring-loaded operator and hold it in the cocked position. The weight moves in response to impact or a predetermined level of vibration to dislodge the supports and allow the operator to be driven home by the spring.

In the fuze, a safety slide locks the supports until removed by the action of an explosive or mechanical delay mechanism. Once the supports are unlocked the weight is free to move upon impact, then dislodging the supports and allowing the operator to strike a detonator to fire the weapon. Should there be little or no impact, the delay train causes the operator to be released after a predetermined interval notwithstanding the position of the supports.

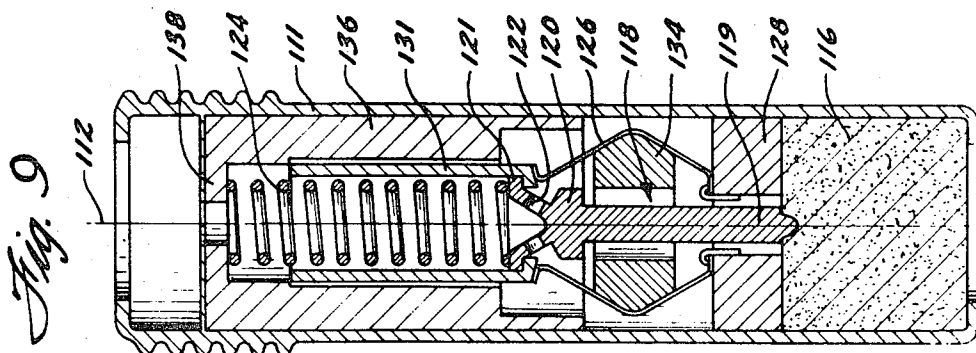
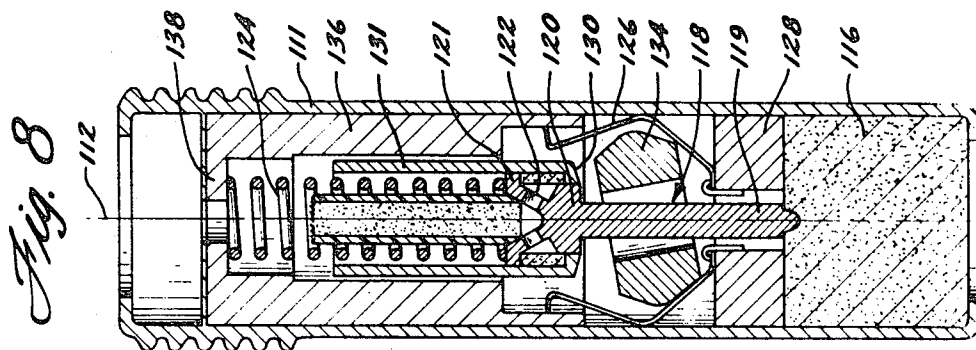
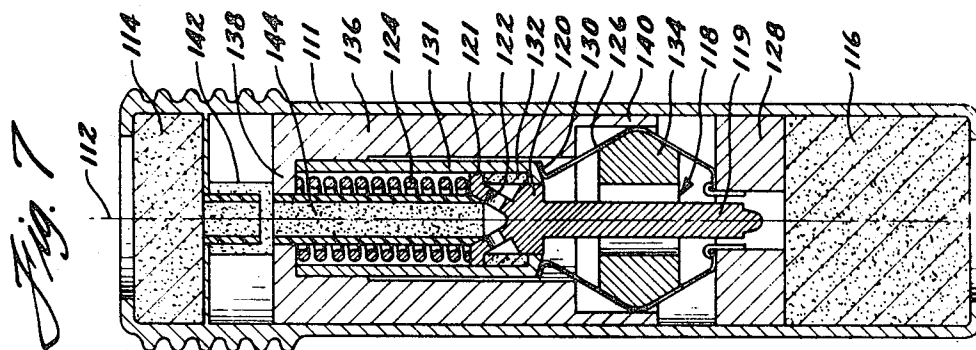




Inventor
GEORGE T. BOSWELL

By *Frank P. Presta*

Attorney



Inventor
GEORGE T. BOSWELL

By *Frank P. Presto*

Attorney

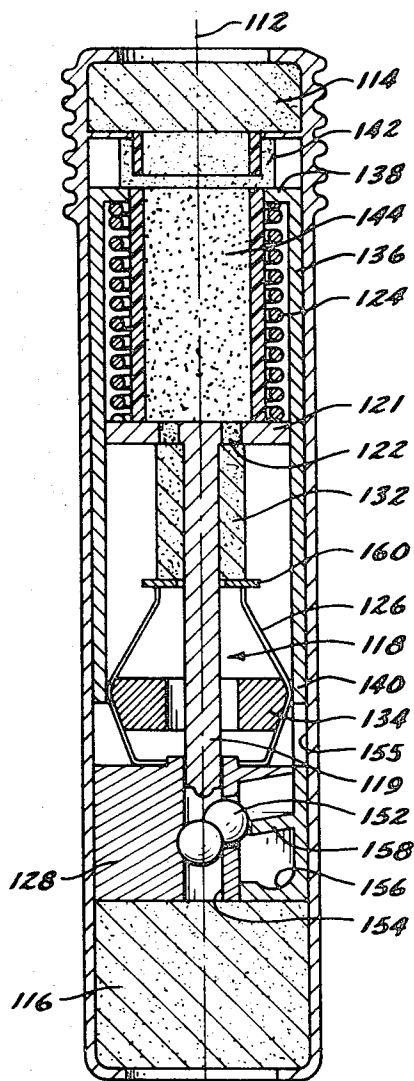


Fig. 10

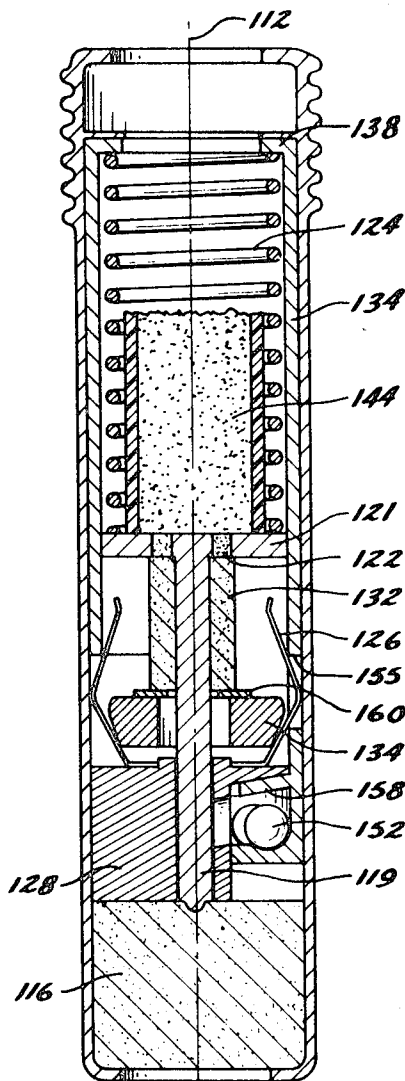


Fig. 11

Inventor
GEORGE T. BOSWELL

By Frank P. Presta

Attorney

FUZE WITH IMPACT SWITCH

This is a division of application Ser. No. 647,355, filed June 20, 1967, now U.S. Pat. No. 3,457,382, issued July 22, 1969.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

This invention relates generally to fuzes with impact switches, and more specifically to double-acting fuzes which will cause the ordnance item to be fired either by the action of an impact switch or, in the event there is no impact or insufficient impact, cause them to be detonated automatically after the expiration of a predetermined time. The fuze is described herein as being for use in handgrenades, but it could equally well be applied to such other ordnance items as gun-thrown ammunition, rockets, and torpedoes. In addition, the impact switch can be used in any environment other than that of fuzes, in which it is desired to sense and respond to impact or vibration.

2. Description of the Prior Art

The two most important requirements in the design of a fuze for any ordnance item are safety and reliability. In the case of the former, the prior art shows many approaches, with the most accepted being that of mechanically locking the firing pin until the expiration of a certain amount of time or the happening of a certain event, so that it is highly unlikely that the fuze can fire while the ordnance item is still in close proximity to the user. The second problem, that of reliability, has been much more difficult to solve, especially in the case of a double-acting, time-impact fuze. As evidenced by the prior art, the result of designing a double-acting fuze has been a complicated mechanism which is expensive to manufacture and is subject to a high rate of failure in the field. These fuzes usually embody a sensitive percussion device consisting of a detonator and a striking member in telescopic relation to each other, together with some sort of intercepting mechanical safety device to prevent premature contact of these parts. At first blush this system might seem to be the most simple and reliable. However, such a system does not lend itself well to responding to impact in any direction. In order to achieve omnidirectional impact explosion characteristics, this telescopic firing pin mechanism must be mounted so that it will always point in the direction of impact or in such a manner as to be driven home no matter what the direction of impact. The most exemplary showing of this concept is that of U.S. Pat. No. 2,763,212, Selective Time Impact Fuze for Hand Grenades, issued Sept. 18, 1956 to J. F. McCaslin. Another interesting concept is set forth in U.S. Pat. No. 2,714,353 issued Aug. 2, 1955 to H. W. Greer. A third concept now being utilized in the art is that of a completely electrically operated fuze, having a battery activated by some happening after launch to arm an electric igniter which will fire on impact or upon cycling of some electrical means such as the full charging of a capacitor. All three of the concepts above recited, plus the many others advanced in the art, purport to advance as their main considerations safety and reliability. However, in all of them it has been difficult to reconcile the two. For example, U.S. Pat. No. 2,763,202 and the electrical devices are extremely safe fuzes but are made so at the expense of a very complicated mechanism, while in the concept advanced by U.S. Pat. No. 2,714,353, the mechanism is made simple at the expense of safety.

SUMMARY OF THE INVENTION

This invention provides a novel impact switch and a fuze which is both safe and reliable and which contains a minimum number of parts. It consists, in its most basic form, of a casing having a primer at one end and a detonator at the other end. Adjacent to the detonator is a spring-loaded operator which is held away from the detonator by an impact-responsive switch. The switch consists of a plurality of supports engaging a spring-loaded operator. In addition to engaging the operator and holding it in its biased condition away from the detonator, these support members also cage and support within their en-

velope a movable impact weight, which will by its inertial movement upon impact of the fuze dislodge at least one of the support members from its proper position, so unbalancing the equilibrium of the mechanism as to allow the other support members to be dislodged by the force of the spring behind the operator. The time fuze operates in lieu of impact, by means of a delay element which is motivated by launching the item containing the fuze. Upon the expiration of a predetermined time, this element ignites a combustible spacer, the burnout of which permits the spring to drive the operator home notwithstanding the position of the support members. A safety cage surrounds the support members and holds them in place even in the face of impact, until a combustible spacer safety element is consumed after being ignited by the delay train in its initial stages of operation.

THE DRAWINGS

FIG. 1 is a perspective view of the impact weight and supports;
FIG. 2 is a side elevation, in cross section, of an alternative arrangement of the impact weight of FIG. 1;
FIG. 3 is a side elevation, in cross section, of a complete impact switch before operating;
FIG. 4 is a side elevation, in cross section, of the switch of FIG. 3 after operating;
FIG. 5 is a side elevation, in cross section, of an alternative embodiment of the impact switch of FIG. 3;
FIG. 6 is a side elevation, in cross section, of an alternative embodiment of the impact switch;
FIG. 7 is a side elevation, in cross section, of a fuze utilizing the impact switch of FIG. 3;
FIG. 8 is the fuze of FIG. 7 after firing by impact;
FIG. 9 is the fuze of FIG. 7 after firing by time delay;
FIG. 10 is an alternative embodiment of the fuze utilizing the impact switch of FIG. 6; and
FIG. 11 is the fuze of FIG. 10 after firing by impact.

DESCRIPTION OF THE IMPACT SWITCH

A basic component of the fuze hereinafter described is an impact-sensing switch of novel design. This impact switch responds to impact in any direction to release a spring-loaded operator to actuate a detonator, close electrical contacts, or perform like operations. As shown in FIG. 1, the impact switch consists, in its most basic form, of an impact-responsive weight 11 which is engaged, supported, and caged by a plurality of supports 12 which can be of configuration somewhat like leaf springs. These supports 12 are shaped in the center section to engage weight 10 and are adapted to be mounted at 14 on the casing of the switch and to engage the operator at 16. An alternative configuration is illustrated in FIG. 2, wherein weight 10 is engaged by inserts 18 which together with spring members 20 and 22 form the supports for the weight and the operator. As in FIG. 1, each of the supports has a mounting portion 14 and a portion 16 which engages the operator.

FIG. 3 shows all the parts necessary for an operating switch. Impact weight 10 is provided with a passage 24 through the center and through this passage an operator 26 protrudes. Operator 26 has a stem portion 28 which extends through passage 24 and is adapted to contact means such as an electrical switch 30 upon release, and a head portion 32 which is releasably engaged by portions 16 of support elements 12. Operator 26 is biased toward the switch 30 by means such as a compression spring 34, but is prevented from moving under the influence of this bias so long as supports 12 engage the head portion 32 of operator 26. FIG. 4 shows position of the various elements after the switch has operated. Weight 10 responds to impact of the switch, or a predetermined amount of vibration, to dislodge one or more of supports 12 from beneath the head 32 of operator 26, thus allowing the supporting system to collapse and operator to be driven into the switch by the force of spring 34.

The concept expressed in FIGS. 1 through 4 can also be manifested into another arrangement of components, as is shown in FIG. 5. In this showing, the arrangement of weight 10 and supports 12 is identical to that described above except that the portion 16 of supports 12 are so designed as to engage and hold an operator 26 which is oriented in the opposite direction to that shown in the FIGS. 3 and 4. In FIG. 5 operator 26 further includes an annular collar 36 which is engaged by a tension spring 34 which is trying to pull it away from the engagement of elements 12. The operation is almost identical to that of the switch previously described, except that upon sensing of impact or vibration by weight 10 portions 16 of the supports disengage from around surface of head 32 thus allowing the tension spring to pull operator 26 away to strike the switch means 30.

Another variation on the basic design is shown in FIG. 6 wherein, in addition to the components described in the other FIGS., a loosely mounted annular ring or washer 38 is provided around the stem of operator 26. Portions 16 of supports 12 engage this washer 38 which, in turn, is in engagement with the lower surface of head portion 32 of operator 26. Again, a compression spring 34 provides the motive force to drive operator 26 into switch contacts 30. In this embodiment, reaction of weight 10 causes supports 12 to be dislodged from under the tiltable washer which then causes the other remaining supports to collapse, freeing operator 26 so that it may be driven by spring 34. The advantage offered by this embodiment is that the supports do not engage inclined surfaces and thus the balance of the support system, i.e., the force needed to dislodge the supports, can be more precisely predicted and established.

The switch described above provides a simple means for sensing impact in any direction or for sensing the achievement of a predetermined amplitude of vibration. Therefore, the switch becomes particularly useful when combined with an ordnance item which is intended to explode upon impact. As the description progresses, it is seen that this switch lends itself very well to combinations with various types of arming mechanisms, both explosive and mechanical, as well as many types of mechanical safing methods. Although described throughout the remainder of this specification as installed in a grenade fuze, obviously the switch has many more applications and the invention should not be considered as being restricted to this particular environment.

DESCRIPTION OF THE FUZE

The basic design of the fuze is shown in FIG. 1. Although the fuze casing is of cylindrical configuration and the elements of the assembly are arranged along the axis of said cylinder, this is not to be construed to mean that the construction is limited to the configuration shown here. The concept may, with equal ease, be applied to other designs and arrangements of component parts.

For purposes of best illustration, the fuze consists of a cylindrical casing 111 having a longitudinal axis 112 hereinafter called the support axis. A primer 114 is positioned at one end of the cylinder, and a detonator 116 is positioned at the other end thereof. Primer 114 is fired by any conventional means such as a pin or a trigger of conventional design, which is not shown and does not form a part of the instant invention. The firing of primer 114 beings the chain of events which results in the firing of detonator 116, in communication with the main explosive charge of the ordnance item, not shown. Detonator 116 is exploded by the action of the impact-sensing switch described in FIGS. 1-6, the action of which is manifested in operator 118, which comprises a firing pin 119, a head 120 and an annular upward projecting flange 121. Flange 121 contains a series of flame passages 122, the purpose for which will be explained below. Operator 118 is positioned along the axis 112 in juxtaposition to detonator 116 and is biased toward detonator 116 by means such as a compression spring 124. Acting against the spring to hold operator 118 away from

detonator 116 are a plurality of supports 126, which may be in the form of leaf springs and which are spaced from the detonator 116 and mounted on an annular spacer 128. Supports 126 do not act directly on head portion 120 of operator 118, nor are they attached thereto, but engage the lower lip 130 of an impact piston 131 which is concentrically positioned about operator 118. Impact piston 131 does not engage the head portion 120 but acts on flange 122 through interposed cylindrical combustible spacer 132. The purpose and operation of this combustible spacer will be explained below. Held by supports 126 and, in fact, caged thereby, is an impact weight 134. Weight 134 has a hollow center through which the firing pin 119 of operator 118 passes. The design of the outer surface of impact weight 134 is such that it is complementary to the design of the support 126. Weight 134 is free to move in any direction.

Concentrically positioned about impact piston 131 and restraining compression spring 124, is a safety cage 136. This element comprises a shoulder 138 upon which compression spring 124 acts, and a skirt portion 140 which is designed to engage and cage the removable supports 126 and weight 134 against outward movement. Safety cage 136 is movable between a first position in which skirt 140 engages and locks the firing pin and a second position, toward which it is biased by spring 124, in which the support elements are free to move radially outwardly. This position is illustrated in FIG. 8. Movement to this second position is initially precluded by a combustible spacer 142, the operation of which will hereinafter be explained.

The final element essential to the fuze is a pyrotechnic delay element 144 which is positioned along axis 112 inside the concentrically positioned safety cage, impact piston and compression spring. This element is a delay train, the upper portion of which is ignited by primer 114. Pyrotechnic element 144 is also in communication with combustible spacer 142 and, after a predetermined length of burning, ignites it. In addition, pyrotechnic element 144 ignites combustible spacer 132 upon the end of the burning of the delay train, through flame passage ports 122 in the flange portion 121 of operator 118.

OPERATION OF THE FUZE

This fuze is designed to operate in two modes, in response to impact and in response to the expiration of a predetermined time. In addition, the fuze incorporates a safety feature so that the impact mode of operation is impossible until a predetermined time after activation of the fuze. Contrary to those fuzes generally used in the prior art, the fuze of the instant invention incorporates a single delay train which performs the double function of uncaging the impact firing mechanism and firing the fuze should there be no impact within a predetermined length of time. It also utilizes a novel impact sensing switch which is truly omnidirectional in response.

The fuze as assembled and ready for use has the parts in the interrelationship shown in FIG. 7. That is, spring 124 is compressed and is attempting to act both on operator 118, which is restrained from movement by removable supports 126 and safety slide 134, which is restrained from movement by combustible spacer 142. The fuze is then inserted in the ordnance item, for example, a handgrenade. When the grenade is to be thrown, the primer 114 is fired by conventional means such as pulling the pin or pressing a trigger. Upon the firing of primer 114, pyrotechnic delay train 144 is ignited and begins to burn at a predetermined rate. By this time, the handgrenade has been thrown. Pyrotechnic element 144 burns for a predetermined length and then it passes and ignites combustible spacer 142, which is made of material which is fast burning and thus quickly consumed. The pyrotechnic delay train 144 continues to burn. Once combustible spacer 142 has been removed, safety cage 136 is free to move upwards, as pictured in FIG. 8, in response to the biasing action of compression spring 124. When the safety cage 136 is moved upward, the skirt section 140 disengages from the support members 126 thus leaving

them free to be moved outward radially. The impact mechanism is now armed. Upon impact of the grenade in any direction, impact weight 118 will be caused to move and in so doing, will dislodge one or more of supports 126. The movement of one of the supports 126 out of the way upsets the equilibrium of the support system such that the force of compression spring 124 acting on flange 121 of operator 118 can drive the firing pin 119 home. Note a preferred arrangement of support means 126 wherein the upper ends of the support means contact a slightly inclined portion 130 of the impact piston and thus the support means not removed by action of impact weight 134 are easily pushed away by the power of spring 124. The firing of the detonator by this means is shown in FIG. 8. By caging impact weight 134 within the envelope subscribed by the support means 126, the weight will react to impact in any direction, including that along the axis of the casing.

If the fuze has not sensed impact within a predetermined time, it is exploded by the time-fuze portion of the mechanism. Pyrotechnic delay element 144 continues to burn after it has ignited combustible spacer 142, at which time safety slide 136 moves upward to uncage the impact-sensing mechanism. Should there be no impact, the pyrotechnic delay element 144 continues to burn until it communicates with combustible spacer 132 by means of ports 122. Combustible spacer 132 is ignited and consumed. The removal of combustible spacer 132 enables compression spring 124, acting on flange 121, to drive operator 118 the distance required to strike and ignite detonator 116, as shown in FIG. 9. When the fuze is fired by this time mode, rather than impact, it is not necessary to remove or displace the supports 126, for they do not act directly on operator 118, but on impact piston 131, which also remains stationary.

A comparison between FIG. 8 and FIG. 9 shows that the main difference between operation by the impact (FIG. 8) and operation by time mode (FIG. 9), is that in the former, impact weight 134 removes supports 126 from beneath the impact piston 131, which is interlocked with operator 118, and the compression spring drives operator 118, combustible spacer 132, and the impact piston 131 towards the detonator. In the time mode, however, combustible spacer 132 has been consumed, but supports 126, holding the impact pistons 131, are still intact. The compression spring drives only operator 118 toward the detonator, with impact piston 131 and supports 126 remaining stationary. Either mode of fire is operated by a single pyrotechnic delay element and by the novel interrelationship between compression spring 124, operator 118, combustible spacer 132, and impact piston 131. The fuze operates mechanically in both modes using the same few pieces of hardware.

DESCRIPTION OF AN ALTERNATE FUZE

The fuze described in the preceding paragraphs provides a basic time-impact fuze, but the concept is such that it lends itself well to modification by the addition of many accessory features in response to requirements for additional specific operating parameters and characteristics.

In addition to the safety features offered in the original fuze, FIG. 10 shows a time-impact fuze into which is incorporated a mechanical safety means which precludes full movement of the firing pin until the fuze has been exposed to rotational forces. The impact-sensing switch used in the fuze of FIG. 10 is the same as that shown diagrammatically in FIG. 6. Construction of this fuze is similar to those described above, except that interposed between the firing pin 119 and the detonator 116, there are a plurality of small balls 152, of diameter greater than firing pin 119. These balls block passage 154 through which firing pin 119 must pass in order to strike the detonator. Attached to skirt portion 140 of safety cage 136 is an element containing a trough 156, this trough being of such size and design as to provide a haven for the balls 152. Above the trough is a flange 158 which holds the balls in

passage 154 in the initial stages of operation of the fuze. Skirt 140 also contains a plurality of indentations 155, into which certain of supports 126 can move when uncaged and knocked askew by the sensing of impact by weight 134.

In operation, the fuze works as follows: Prior to use the fuze components are arranged as shown in FIG. 10, with balls 152 blocking passage 154 and being held in such position by the flange 158. Upon the firing of the initiator 114, powder train 144 is ignited and begins to burn, subsequently igniting consummable spacer 142, which burns away and allows the safety cage 136 to move upward. When the safety cage moves upward, trough 156 and flange 158 are also moved upward such distance as to align the opening of the trough with the balls 152. Impact weight 134 has now been uncaged and is free to operate in the normal manner, but balls 152 are still in position to block the movement of firing pin 119 and preclude initiation of detonator 116. However, when the weapon in which this fuze is installed is thrown, either by hand or from a barrel or launcher, and spin is imparted to it, balls 152 react to the centrifugal force to move outward into trough 156 thus clearing the way for the passage of firing pin 119. Once the spin-arming sequence is completed, the fuze functions in the same manner as described above. Note, however, the difference in arrangement of components brought about by the use of the impact switch set out in FIG. 6, rather than the type described in FIG. 3. Upon impact, supports 126 are dislodged from beneath the washer 160 and the firing pin is driven home by the action of spring 124 against shoulder 121 of the operator 118. If no impact is sensed, powder train 144 burns to completion and through ports 122 communicates with and ignites combustible spacer 132, upon the collapse of which operator 118 can be moved by the spring in order to fire the detonator, notwithstanding the fact that supports 126 are still intact. The position of the components upon firing by impact are shown in FIG. 11.

The fuzes described above have utilized explosive powder trains and consummable wafers in order to provide the sequence of safing and arming functions. However, it would be entirely feasible and possible to substitute for the explosive powder train 144, such mechanisms as spring motors, dashpots, or other timing devices, mechanical or electrical, to accomplish the same thing as explosive powder train. It is also within the scope of this invention to substitute for igniter 114, electric means which would ignite the powder train or being the operation of the mechanical device substituted therefor.

It is thus seen that the instant invention provides a new and novel impact or vibration-sensing switch mechanism and a fuze incorporating said switch mechanism therein. The switch responds to impact or vibration in any direction, is simple in construction, and is easily provided with safing means. It is also easily adaptable for use with a multitude of accessories. The fuze constructed by using this impact switch is a dual mode fuze, including means for impact firing and means for firing upon the expiration of a predetermined length of time if insufficient impact is sensed. The fuze is constructed of a minimum of parts, provides all the safety features and characteristics which are necessary, and can be provided with many different types of accessories including such as a spin-arming mechanism. Obviously, many modifications and variations are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

I claim:

1. A fuze having a casing containing all the components thereof and comprising
 - a detonator for firing an ordnance item,
 - an operator having a firing pin portion, said operator being movable between an armed position and a firing position,
 - biasing means for urging said operator toward said firing position,
 - a plurality of supports radially disposed about a support axis to form an envelope, said support releaseably engaging

said operator and holding said operator in said armed position against the action of said biasing means, and a weight positioned within said envelope established by said plurality of supports, said weight being releasably engaged and supported by said supports, whereby movement of said weight in response to a predetermined degree of impact of said fuze in any direction disengages said supports from said operator, thereby allowing said operator to be moved to said second position by said biasing means and said firing pin portion to contact said detonator.

2. The fuze of claim 1 wherein said weight has a passage through the center thereof, said passage being coincident to said support axis, wherein said operator is aligned longitudinally and coincident with said support axis, said firing pin portion extending through said passage in said weight, and wherein said detonator is aligned along said support axis and positioned adjacent to said weight, whereby said firing pin portion extending through said passage contacts said detonator when said operator moves to said second position.

3. The fuze of claim 2 wherein said operator further comprises an annular flange spaced from said firing pin portion, said flange being engaged on one side by said supports and on the other side by said biasing means.

4. The fuze of claim 2 further comprising an annular safety cage slideably mounted in said casing and radially disposed about and aligned with said support axis, said safety cage being movable between a safe position and an armed position and having an annular skirt engaging said plurality of supports to lock said supports against movement when said safety cage is in said safe position, biasing means for urging said safety cage toward said armed position, and locking means for releasably holding said safety cage in said safe position.

5. The fuze of claim 4 wherein said biasing means for said operator and said biasing means for said safety cage together comprise

a coil spring disposed about and aligned with said support axis, said spring being of radius less than the radius of said safety cage, being interposed between and engaging said operator and said safety cage, and operating to bias said operator toward said firing position, and said safety cage toward said armed position.

6. The fuze of claim 5 wherein said operator further comprises an annular flange longitudinally spaced from said firing pin portion and engaging said spring.

7. The fuze of claim 6 further comprising

a piston of radius greater than said spring but less than said safety cage disposed about and longitudinally aligned with said support axis, said piston having an inward-turned shoulder extending past said operator flange and engaging said plurality of supports,

a first fast-burning combustible spacer disposed about said support axis and interposed between and engaging said operator flange and said piston shoulder, and means for igniting said combustible spacer.

8. The fuze of claim 7 further comprising

an explosive powder train having a radius less than the radius of said spring disposed about and longitudinally aligned with said support axis and communicating at one end with said combustible spacer, and means for igniting said powder train at the end opposite from said combustible spacer, whereby said combustible spacer will be ignited by said powder train when said powder train has burned to completion.

9. The fuze of claim 8 wherein said locking means for releasably holding said safety cage in said safe position comprises

a second fast-burning combustible spacer interposed between said casing and said safety cage, said explosive powder train being in communication with said second spacer and igniting said second spacer after a portion of said powder train has burned, whereby, after a predetermined time, said second spacer will be consumed, allowing said spring to move said safety cage to said armed position, thus allowing said weight and said supports to react and interact upon impact of said fuze to allow said spring to move said operator to said firing position.

10. The fuze of claim 1 further comprising means responsive to centrifugal force interposed between said firing pin and said detonator for blocking operator movement and movable in response to rotational movement of said fuze to a position offset from said firing pin portion, whereby free passage of said firing pin portion is allowed.

11. The fuze of claim 2 further comprising means responsive to centrifugal force interposed between said firing pin portion and said detonator for blocking operator movement and movable in response to rotational movement of said fuze to a position offset from said firing pin portion, whereby free passage of said firing pin portion is allowed.

12. The fuze of claim 11 further comprising means for locking said blocking means in said interposed position until said safety cage has moved to said armed position.

13. The fuze of claim 6 further comprising

a first fast-burning combustible spacer annularly disposed about said firing pin portion of said operator and abutting said annular flange, and

a washer loosely and slideably positioned on said firing pin portion of said operator, said washer abutting said first spacer and being engaged by said supports, whereby upon dislocation of said supports by movement of said weight in response to impact of said fuze, said operator will be moved to said firing position wherein said firing pin portion contacts said detonator.

14. The fuze of claim 13 further comprising an explosive powder train having a radius less than the radius of said spring disposed about and longitudinally aligned with said support axis and communicating at one end with said combustible spacer, and means for igniting said powder train at the end opposite said combustible spacer, whereby said combustible spacer will be ignited by said powder train when said powder train has burned to completion.

15. The fuze of claim 14 wherein said locking means for releasably holding said safety cage in said safe position comprises

a second fast-burning combustible spacer interposed between said casing and said safety cage, said explosive powder train being in communication with said second spacer and igniting said second spacer after a portion of said powder train has burned, whereby after a predetermined time said second spacer will be consumed, allowing said spring to move said safety cage to said armed position, thus allowing said weight and said support to react and interact upon impact of said fuze to allow said spring to move said operator into said firing position.

16. The fuze of claim 15 further comprising means responsive to centrifugal force interposed between said firing pin portion and said detonator for blocking operator movement and movable in response to rotational movement of said fuze to a position offset from said firing pin portion whereby free passage of said firing pin portion is allowed.

17. The fuze of claim 16 further comprising means for locking said blocking means in said interposed position until said safety cage has moved to said armed position.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,580,176 Dated 25 May 1971

Inventor(s) George T. Boswell

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

1. Column 2, line 47, "weight 11" should be --weight 10--.
2. Column 3, line 48, "FIG. 1" should be --FIG. 7--.
3. Column 3, line 59, "Primer 14" should be --Primer 114--.
4. Column 3, line 62, "beings" should be --begins--.
5. Column 8, claim 10, line 3, after "pin" insert --portion--.

Signed and sealed this 28th day of December 1971.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents