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3,054,870

VARIABLE SENSITIVITY INERTIA SWITCH

Filed June 9, 1958

4 Sheets-Sheet 1

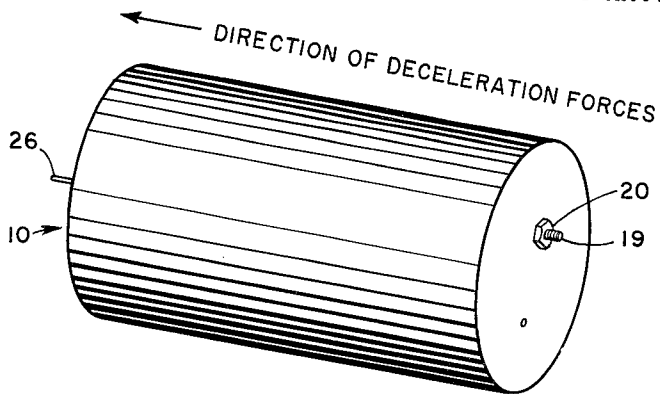


FIG. 1

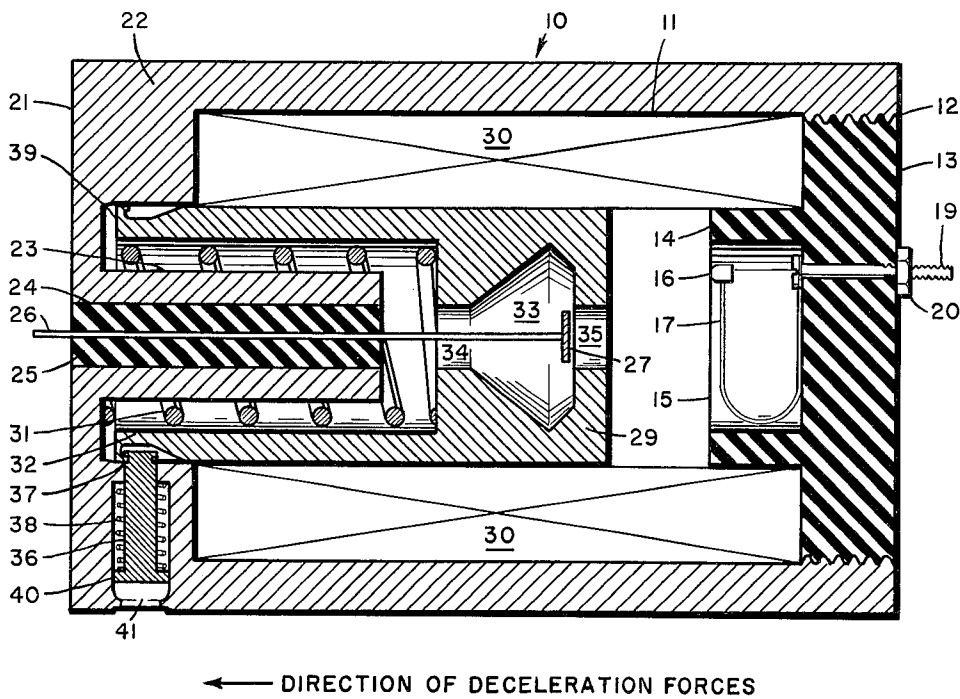


FIG. 2

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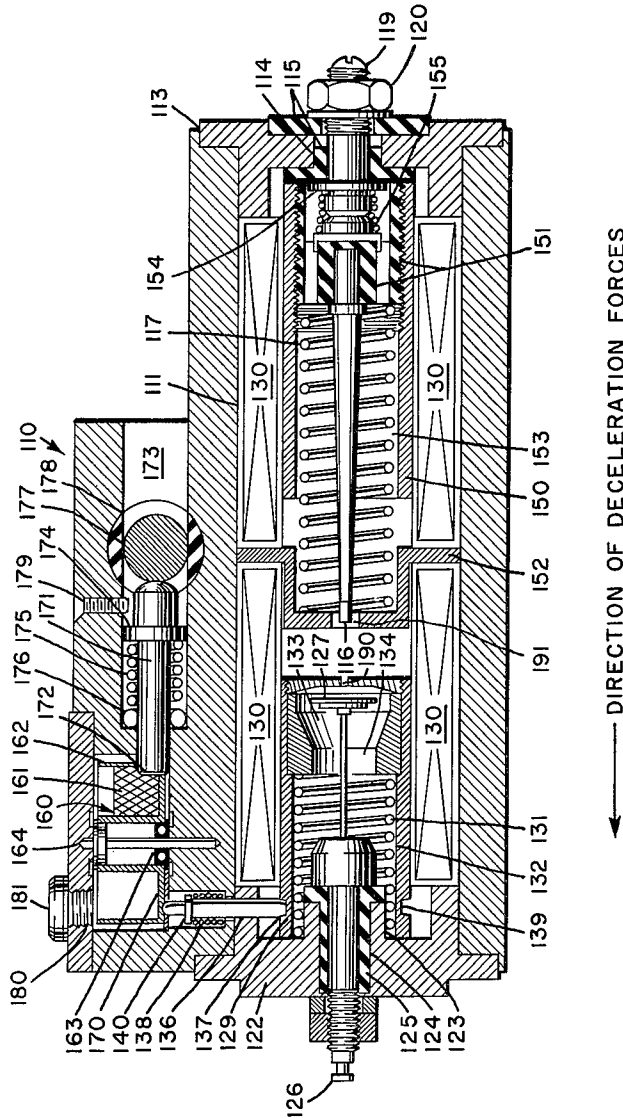


FIG. 4

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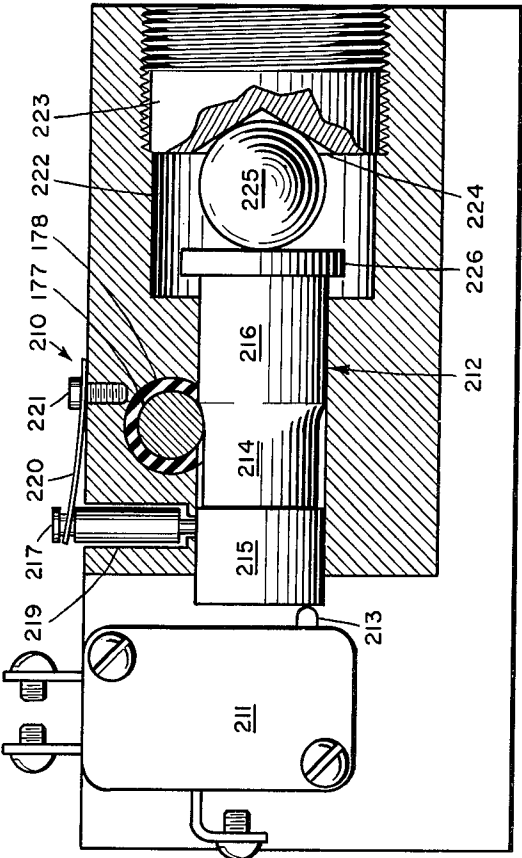


FIG. 5

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VARIABLE SENSITIVITY INERTIA SWITCH
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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates generally to a variable sensitivity switch for a water discriminating fuze in aerial launched guided torpedoes, plunge bombs or other air-to-water weapons intended to explode on target contact.

Prior to the present invention the detonation switch mechanism for a fuze of a missile which has an air trajectory or an air trajectory followed by entry into water and a subsequent run under water was either a complicated multi-leaf mechanical integrator, as disclosed in an application for a Water Discriminating Fuze, Serial No. 405,264, filed January 20, 1954, now Patent #2,949,855, by Henry D. Sanderson or a multicontact ball-cone inertia switch as disclosed in applicant's copending application "Detonation Circuit for Multiple Sensitivity Fuze," Serial No. 571,852, filed March 15, 1956 now Patent #2,952,208.

In the present invention the variable sensitivity switch closes the electrical initiation circuit to fire the detonator of the fuze upon target impact. The impact force required to effect closure is a variable between two limits and is an explicit function of the instantaneous torpedo velocity. The upper limit is the force required to actuate the switch when the contact of the torpedo with the target is a direct air contact at high velocity before the torpedo has made a run through the water or has broached upon hitting the water and then has made contact with the target. The lower limit is the force required when the torpedo is moving at its ambient propelled water velocity and makes contact with the target. The switch displays the same characteristics for head-on, transverse, or grazing impacts. The switch action is effected by two sets of contacts, one set for the head-on impacts and the other for grazing or transverse impacts. The switch function for transverse-graze variable sensitivity is effected by means of a mass mounted on the end of a cantilevered elastic member which deflects under the inertial force of impact to make contact with the surface of a conical cavity within the switch. The position of the conical cavity, which is a portion of an elastically activated mass, varies with respect to the cantilever contact as a function of the torpedo deceleration due to water passage, so that the deflection of the cantilever required for contact varies as the torpedo loss of impulsive momentum. The nose-impact variable sensitivity occurs due to the varied deflection distance required for contact between a spring activated mass and a spring restrained stab contact. The spring activated mass with the conical cavity also serves as the contact surface for the head-on stab contact, so that the deflection distance for contact varies as the loss of impulsive momentum.

In one of the disclosed embodiments the contacts are maintained in the least sensitive position until after water entry by means of an unbalanced restrained wheel which rotates under the inertial effects of torpedo deceleration to free one of the contacts and enable it to vary in contact closure sensitivity with respect to the other contacts. This embodiment also is combined with a water entry switch, inertially operated, which transfers a portion of a stored electrical energy through a delay network so

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that if target acquisition has not occurred within a predetermined period the torpedo or missile is exploded.

The principal object of the invention is to provide a variable sensitivity switch for controlling the actuation of a fuze firing circuit in an aerial torpedo.

A further object of the invention is to provide a switch capable of discriminating between an air flight of a torpedo and a run of the torpedo at its ambient propelled water velocity.

A further object of the invention is to provide an inertia operated switch which will operate to initiate a desired operation after it has been subject to either a high initial deceleration force exceeding a predetermined critical value or a low deceleration force after a sustained period of decreasing deceleration forces.

A further object of the invention is to provide a variable sensitivity switch in the initiation circuit of a missile warhead that will fire the detonator upon target impact either as a direct air drop or after a sustained run of the missile through water.

It is a further object of the invention to provide a variable sensitivity switch which will initiate the firing circuit to a torpedo detonator upon any head-on, transverse or grazing target impacts but will not be initiated by impact with the water.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of one embodiment of the invention;

FIG. 2 is a sectional side view taken along the center line of the embodiment of FIG. 1;

FIG. 3 is a top plan view of a second embodiment of the invention in combination with a water entry delay switch;

FIG. 4 is a sectional side view taken on line 4—4 of FIG. 3;

FIG. 5 is a sectional side view taken on line 5—5 of FIG. 3.

Referring first to FIGS. 1 and 2, the device shown in these figures comprises a cylindrical housing 10 having mounting brackets (not shown) to facilitate securing to an arming device of a guided torpedo or missile, the normal mounting position being along a fore and aft axis of the missile. A longitudinal bore 11 extends from the open end 12 of the housing 10 and provides the enclosure for the switch mechanism. The inner wall surface of the bore 11 is screw-threaded at the aft end 12 to receive a plug member 13 of insulating material. The plug 13 has a cylindrical shoulder portion 14 protruding into the bore 11 and a recessed portion 15 in the shoulder portion 14 is adapted to receive the longitudinal motion stab contact switch 16. The stab switch 16 is maintained in its normal position by a resilient leaf spring member 17. The spring 17 is secured to the insulation plug 13 by a bolt 19 and nut 20 which are of a conducting material and adapted to receive an external lead (not shown) from the fuze firing circuit.

At the opposite end 21 the housing 10 is enclosed by an integral wall member 22 which has an integral reduced cylindrical projection 23 protruding into the bore 11 and a bore 24 extending through the projection 23 provides a housing for an insulating core 25. A cantilevered elastic contact member 26 extends through the core 25 and a mass mounted on the inner end of the elastic contact member completes the unit known as the transverse graze variable sensitivity switch 27 having a constant compliant length.

A sliding cylinder 29 is reciprocally mounted within the housing 10 with a plurality of bearing members 30 guiding

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the cylinder 29 along the longitudinal axis of the housing 10. A coil compression spring 31 is mounted over the projection 23 and abuts against the wall 22 and the cylinder 29 has a large bore 32 adapted to fit over the opposite end of the spring 31. The inner end of the cylinder 29 has a conical cavity 33 which communicates through passage 34 with the bore 32 and through the passage 35 with the bore 11 of the housing 10.

Cylinder 29 is maintained in its "cocked" or least sensitive position by means of a latch pin 36 reciprocally mounted in the wall 22 normal to the cylinder 29. The pin 36 has an undercut portion 37 on its inner end forming a detent catch for a flanged latch 39 on the outer end of the cylinder 29. Pin 36 is withheld from its locking position with the latch 39 by means of a coil compression spring 38 which reacts between the wall 22 and a shoulder 40 on the pin 36. Any suitable tool member (not shown) can be inserted in the passage 41 to push the pin 36 into its locking position with the latch 39. As shown in FIG. 2 the outer end of cylinder 29 and wall 22 are spaced apart a sufficient distance when the cylinder is in the "cocked" position to allow the latch 39 and pin 36 to become disengaged whenever the cylinder 29 is set forward by a deceleration force sufficient to overcome the spring 31.

The above described device is designed to operate as follows:

The cylinder 29 is moved to its "cocked" position and retained by pin 36 as shown in FIG. 2 and the longitudinal motion stab switch 16 and the transverse graze switch 27 are connected by leads (not shown) to the firing circuit of a detonator. The housing 10, bearings 30, spring 31 and cylinder 29 provide the ground for the circuit and detonation occurs when either the longitudinal motion stab switch 16 or the transverse graze switch 27 touch the cylinder 29 or conical cavity 33 respectively and permit current from the external source to flow through the detonator.

When the torpedo or missile is launched or dropped from an aircraft or other suitable airborne means the cylinder 29 is in the "cocked" position, wherein the transverse graze switch 27 is in its least sensitive position since it is near the larger part of the conical cavity 33 and would have to be deflected a large amount by a lateral force in order to make contact with the cylinder 29 and the longitudinal motion stab switch 16 is at a maximum distance from the inner end of the cylinder 29 and thus in its least sensitive position.

After the torpedo or missile is dropped or launched the deceleration force due to water entry moves the cylinder 29 forward (to the left as shown in FIG. 2) and the latch 39 disengages the undercut portion 37 of pin 36 whereby the pin 36 is withdrawn by the coil spring 38. As the deceleration forces decrease and the torpedo approaches and reaches its ambient propelled water velocity the cylinder 29 moves aft (to the right in FIG. 2), the smaller end of the conical cavity 33 approaches a position in close proximity to the transverse motion contact and the inner end of the cylinder 29 approaches a position in close proximity to the longitudinal motion switch 16. As can readily be seen, when the cylinder reaches its furthest aft position and the switches 16 and 17 are in their most sensitive position, any specific minimum change of inertia due to target impact head-on, transverse or grazing will cause movement of one of the switches 16 or 27 relative to the cylinder 29, complete the circuit and fire the denators.

In the event the torpedo or missile either makes a direct air contact with the target before water entry or the torpedo broaches upon entry into the water and then makes contact with the target, the cylinder 29 would be in its forward position and the switches would be in their least sensitive position. However, the torpedo or missile would be traveling at such a high rate of speed that upon target contact either, head-on, transverse or grazing the forces acting on the switches would cause a maximum

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change of inertia and one of the switches would make contact with cylinder 29 or conical cavity 33 and complete the firing circuit for the detonator.

The device shown in FIGS. 3-5 comprises a housing 101 wherein both a second embodiment of the variable sensitivity switch 110 and a water entry switch 210 are housed.

The second embodiment of the variable sensitivity switch shown in detail in FIG. 4 differs from the first embodiment shown in FIG. 2 in that an unbalanced restrained wheel 160 locks the cylinder 129 in its forward position and a modified longitudinal motion stab contact switch 116 is used in place of the stab switch 16.

With reference to FIG. 4 the second embodiment 110 has a bore 111 extending longitudinally through the housing 101 and is enclosed at its aft end by a plug member 113 and by a plug member 122 at its forward end. A bolt 119 mounted in a bore 114 of the plug 113 by means of a nut 120 is of a conducting material and insulated from the plug 113 by the bushings 115. A longitudinal motion stab contact switch 116 is rigidly mounted in a bushing 151 inside a reciprocable sliding cylinder 150 by threads or other appropriate means.

The bore 111 has an offset cylindrical spacer member 152 mounted intermediate the end plugs 113 and 122 and the off-set part of the spacer member 152 provides a seat for the forward end of a spring 117. The spring 117 is seated at its opposite end inside a bore 153 of the cylinder 150 and against the forward end of the bushing 151.

The bolt 119 has a reduced neck portion 154 adjacent its inner end and a compressed spring member 155 has one end mounted on the inner end of the bolt by a snap fit in the reduced neck portion 154 and the other end on the end of the stab switch 116 projecting beyond the bushing 151. The spring member 155 is, of course, made of a conductive material in order to complete the circuit as hereinafter described.

The forward end of the switch 110 is enclosed by a plug or cap member 122 having an integral reduced cylindrical projection 123 protruding into the bore 111 and a bore 124 extending longitudinally through the projection 123 provides a housing for an insulation core 125. A bolt member 126 extends through the core 125 and in combination with a mass mounted on the end of an elastic cantilevered element makes the unit hereinafter referred to as the transverse-graze variable sensitivity switch 127 having a constant compliant length.

A sliding cylinder 129 is reciprocally mounted within the bore 111 and a plurality of bearing members 130 guide the cylinders 129, 150 along the longitudinal axis of the housing 101. A coil compression spring 131 is mounted over the projection 123 and abuts against the cap member 122 at one end and the cylinder 129 has a large bore 132 extending longitudinally therein and adapted to be mounted over the opposite end of spring 131. As in the cylinder 29 the inner end of the cylinder 129 has a conical cavity 133 which communicates through a passage 134 with the bore 132 and provides the housing for the cantilevered mass of switch 127.

The cylinder 129 is maintained in its "cocked" or least sensitive position by means of a latch pin 136 reciprocally mounted in the wall 122 normal to the cylinder 129. Pin 136 has a tapered portion 137 on its inner end adapted to be inserted into an annular groove 139 near the outer end of the cylinder 129 and is withheld from its locking position with the groove 139 by means of a coil compression spring 138 which reacts between the housing 101 and a shoulder 140 on the outer end of the pin 136.

The unbalanced restrained wheel 160 which retains the pin 136 in its locked position with the annular groove 139 has an eccentrically mounted weight carried by a cup-shaped housing 162 and is rotatably mounted by a suitable bearing means 163 on a vertically mounted shaft 164 in the housing 101. Bottom plate 170 of the cup-shaped housing 162 has an elongated cam slot 165 (see

FIG. 3) therein and a stop pin 166 mounted in the housing 101 is adapted to ride within the cam slot 165 allowing the wheel 160 to rotate approximately 90°.

An aperture 167 in the bottom plate 170 provides a passage to receive the upper end of the pin 136 and thus release the cylinder 129 from its "cocked" position. The pin 136 is normally held in its locked position by the bottom plate 170 and snaps out of the locked position whenever the aperture 167 and pin 136 are aligned.

The unbalanced wheel 160 is restrained from freely rotating by a lock pin 171 which is adapted to be inserted in an aperture 172 in the side wall of the cup-shaped housing 162. The pin 171 is reciprocally mounted in a longitudinally extending bore 173 in the housing 101. A shoulder portion 174 acts as a piston to guide the pin 171 in the bore 173. A coil compression spring 175 mounted on the pin 171 is adapted to react between the shoulder portion 174 and a rubber washer member 176 abutted against the inner end of the bore 173.

An arming rod 177 is mounted in a lateral extending bore in the housing 101 by means of a bushing member 178, and as can readily be seen in FIG. 4 the arming rod 177 retains the pin 171 in engagement with the aperture 172.

A stop pin 179 mounted in the top of the housing 101 is adapted to limit the rearward movement of the pin 171.

An access aperture 180 is provided in the housing 101 directly above the unbalanced wheel 160 and a cap bolt 181 is provided to close the aperture 180. By removing the bolt 181 and inserting a suitable tool (not shown) the pin 136 can be pushed down into locking engagement with the groove 139 and the wheel 160 rotated to the position shown in FIG. 4 thereby retaining the pin 136 in its locked position.

The water entry switch 210 shown in detail in FIG. 5 comprises a micro switch 211 mounted on the side of the housing 101 and a plunger 212 reciprocally mounted in a longitudinally extending bore in line with the actuator 213 of the switch 211. The plunger 212 has a reduced portion 214 intermediate the enlarged end portions 215—216 and the arming rod 177 is aligned with the reduced portion 214 in such a manner as to restrict movement of the plunger 212 when the rod 177 is in its initial position.

A lock pin 217 is reciprocally mounted in a vertically extending bore 219 in the housing 101 and has a reduced lower end portion adapted to lock the plunger 212 in its forward position by engaging the shoulder formed by the end 215 and reduced portion 214. One end of a leaf spring 220 engages the upper end of the pin 217 and the opposite end of the spring 220 is secured to the top of the housing 101 by a bolt 221 or other suitable means.

A large bore 222 in the housing 101 is aligned with the plunger 212 and extends from the aft end of the housing 101 to a position just forward of the end of the plunger 212. A cylindrical block 223 mounted by screw threads or other appropriate means into the end of the bore 222 has conical cavity 224 in its inner end and a ball 225 is adapted to ride in the cavity 224 and against the end cap 226 on the plunger 212.

The above described variable sensitivity switch 110 and water entry switch 150 are designed to operate as follows:

Prior to launching of the torpedo or missile the cylinder 129 is in its forward "cocked" position as shown in FIG. 4 and is retained in this position by the pin 136. The pin 136, in turn, is held in the groove 139 by the bottom plate 170 of the wheel 160 and the wheel 160 in its initial position is rotated whereby the eccentric weight 161 is in the position shown in FIGS. 4 and 5. The locking pin 171 is then inserted in the aperture 172, the arming rod 177 is moved into the position shown in FIGS. 4 and 5 and the water entry switch is in the initial position

shown in FIG. 5 with the arming rod 177 restraining movement of the plunger 212.

The arming rod has a plurality of reduced longitudinally extending portions (not shown) and at the time of launching the rod is moved longitudinally by an external means (not shown) whereby the reduced portions are aligned with the pin 171 and the plunger 212. Since the pin 171 is no longer restrained it moves aft under the influence of spring 175 and releases the wheel 160 to rotate freely; however, the forces of acceleration will tend to rotate the wheel 160 in a clockwise direction due to the unbalanced weight 161 and the stop pin 166 will restrict such clock-wise movement.

The longitudinal motion stab switch 116 and the transverse-graze switch 127 are connected by leads (not shown) to the firing circuit of a detonator and as in the first embodiment the housing 101, bearings 130 and cylinder 129 provide the ground for the firing circuit and detonation occurs when either the longitudinal motion switch 116 or the transverse-graze switch come in contact with the cylinder 129 or the conical cavity 133 respectively permitting current from the external source to flow through the detonator. As in the first embodiment the longitudinal motion stab switch 116 or the transverse graze switch are in their least sensitive position when the torpedo or missile is launched. Also plunger 212 is acted upon by the set back due to acceleration as the torpedo or missile is launched therefore it does not move to actuate the switch 211 until acted upon by the deceleration forces.

As the missile enters the water the deceleration force rotates the wheel 160 counter-clock-wise to a position whereby the pin 136 snaps into the aperture 167 and the cylinder 129 is now free to move aft; however, the initial deceleration forces are greater than the force of the coil spring 131 and the cylinder 129 moves aft only as the torpedo or missile slows to its ambient propelled water velocity and the deceleration forces decrease. As the cylinder 129 moves aft the smaller end of the conical cavity 133 approaches a position adjacent the mass on the transverse-graze switch 127 and the inner end of the longitudinal motion stab switch 116. When the cylinder 129 is in its rearmost position the switches 116 and 127 are in their most sensitive position and any specified minimum change of inertia due to target impact, head-on, transverse or grazing will cause movement of one of the switches 116—127 relative to the cylinder 129, complete the circuit and fire the detonator.

Under normal operating conditions the bore 111 is filled with a damping fluid in order to assure smooth operation of the cylinders 129, 150. Therefore, when the cylinder 129 has moved to its rearmost position and after the torpedo has reached its ambient propelled water velocity the switches 116 and 127 are in their most sensitive positions, the forces of deceleration due to target impact causes movement of the cylinders 129 and 150 along the longitudinal axis of the bore 111. The cylinder 150 carrying the stab switch 116 will move forward at a faster rate than the cylinder 129 due to the difference in cross sectional area of the orifice 190 in the cylinder 129 and the opening 191 in the member 152 wherein the fluid flow is restricted as the cylinders 129 and 150 move. It is to be understood that trapped air in the bore 111 would have the same damping effect in the event oil or other fluid is omitted.

As in the first embodiment shown in FIGS. 1 and 2 the embodiment of FIG. 4 reacts to large deceleration forces to fire the detonators, should the torpedo or missile make a direct air contact or broaches upon water entry and then makes contact with the target.

The water entry switch is a second inertial closed switch and upon water entry of the torpedo the deceleration forces move the plunger 212 forward closing the micro switch 211 controlling a delay network (not shown)

so that if target acquisition has not occurred within a predetermined period the torpedo is exploded.

As the plunger 212 moves forward the lock pin 217 is urged against the reduced portion 214 by the leaf spring 220, and the plunger 212 is prevented from moving aft and opening the micro switch 211. The water entry switch is also actuated by forces other than longitudinal deceleration forces since any impact causing lateral forces to act on the ball 225 will roll the ball 225 up the inclined surface of the cavity 224, thus moving the plunger 212 forward and closing the switch 211.

Obviously many modifications and variations of the present invention are possible in the 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.

What is claimed is:

1. A variable sensitivity switch for initiating a firing circuit of a missile detonator upon any one of a head-on, transverse and grazing target impact comprising in combination a switch housing, a spring activated cylinder reciprocally mounted in a longitudinal bore in said housing, a latch means in said switch housing operable to retain said cylinder in a minimum sensitive position until said switch is acted on in one direction by deceleration forces exceeding a predetermined value, said cylinder including a flange at one end thereof and said latch means comprising a spring activated pin reciprocally mounted in said housing normal to said cylinder, a detent catch at one end of said pin whereby said detent catch and said flange are engaged to lock said cylinder in said minimum sensitive position, spring means acting on said cylinder tending to move said cylinder in an opposite direction into a maximum sensitive position, a first and second switch means associated with said cylinder, said first switch means responsive to actuation by longitudinal deceleration forces due to head-on target impact, said second switch means responsive to actuation by deceleration forces due to either transverse or grazing target impact, said housing including a closure for one end of said longitudinal bore and said cylinder being spaced from said closure when in said minimum sensitive position, whereby deceleration forces exceeding said predetermined value move said cylinder toward said closure thereby releasing said pin from said locking engagement with said flange.

2. A variable sensitivity switch for initiating the firing circuit of a missile detonator upon any one of a head-on, transverse and grazing target impacts comprising in combination a switch housing, a spring activated cylinder reciprocally mounted in a longitudinal bore in said housing, a latch means in said switch housing operable to retain said cylinder in a minimum sensitive position until said switch is acted upon in one direction by deceleration forces exceeding a predetermined value, said cylinder including an annular groove adjacent one end thereof, said latch means comprising a spring activated pin engaging said groove and a rotor member retaining said pin in said groove, said rotor member comprising an eccentrically weighted cup-shaped body pivotally mounted on a shaft, said shaft being rigidly mounted in said housing whereby said body in its initial position engages one end of said pin to retain said pin in said groove, an aperture in said cup-shaped body operable to receive said one end, and a locking means mounted in said housing and operable to retain said cup-shaped body in said initial position, whereby said cup-shaped body rotates upon the release of said locking means and the influence of deceleration forces it to a position wherein said aperture and said one end are aligned, spring means acting upon said cylinder tending to move said cylinder in opposite direction into a maximum sensitive position, a first and second switch means associated with said cylinder, said first switch means responsive to actuation by longitudinal deceleration forces due to head-on target impacts, said second switch

means responsive to be actuated by deceleration forces due to either transverse or grazing target impacts.

3. In a water discriminating fuze for an aerial launched torpedo wherein a water entry switch is actuated by deceleration forces upon entry of the torpedo into the water detonating the fuze after a predetermined period and a variable sensitivity switch is responsive to both longitudinal and lateral deceleration forces of a predetermined value for actuating said fuze, the improvement comprising an inertia member mounted in said variable sensitivity switch for free movement in one direction under the action of a deceleration exceeding a predetermined value, spring means for exerting a force on said inertia member tending to move it in the opposite direction into a maximum sensitive position, latch means for holding said inertia member in an initial minimum sensitive position until said torpedo is subjected to a deceleration exceeding said predetermined value, a first and second inertia contact means mounted within said variable sensitivity switch and operable to contact with said inertia member, said first contact means responsive to actuation by longitudinal deceleration forces and said second inertia contact means responsive to be actuated by lateral deceleration forces to complete a firing circuit for said fuze, said inertia member comprises a cylinder activated by said spring means and said first inertia contact means comprises a spring restrained stab switch whereby longitudinal deceleration forces move said stab switch against said cylinder completing said firing circuit.

4. In a water discriminating fuze for an aerial launched torpedo wherein a water entry switch is actuated by deceleration forces upon entry of the torpedo into the water detonating the fuze after a predetermined period and a variable sensitivity switch is responsive to both longitudinal and lateral deceleration forces of a predetermined value for actuating said fuze, the improvement comprising an inertia member mounted in said variable sensitivity switch for free movement in one direction under the action of a deceleration exceeding a predetermined value, spring means for exerting a force on said inertia member tending to move it in the opposite direction into a maximum sensitive position, latch means for holding said inertia member in an initial minimum sensitive position until said torpedo is subjected to a deceleration exceeding said predetermined value, a first and second inertia contact means mounted within said variable sensitivity switch and operable to contact with said inertia member, said first contact means responsive to actuation by longitudinal deceleration forces and said second inertia contact means responsive to be actuated by lateral deceleration forces to complete a firing circuit for said fuze, said inertia member comprises a cylinder having a longitudinal conical cavity therein, said second inertia contact means comprises a mass mounted on the end of a cantilevered elastic member within said conical cavity whereby the inertial force of transverse or grazing impacts of the torpedo with a target deflects said elastic member and mass making contact with the conical cavity and completing said firing circuit.

5. In a water discriminating fuze for an aerial launched torpedo wherein a water entry switch is actuated by deceleration forces upon entry of the torpedo into the water detonating the fuze after a predetermined period and a variable sensitivity switch is responsive to both longitudinal and lateral deceleration forces of a predetermined value for actuating said fuze, the improvement comprising an inertia member mounted in said variable sensitivity switch for free movement in one direction under the action of a deceleration exceeding a predetermined value, spring means for exerting a force on said inertia member tending to move it in the opposite direction into a maximum sensitive position, latch means for holding said inertia member in an initial minimum sensitive position until said torpedo is subjected to a deceleration exceeding said predetermined value, a first and sec-

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ond inertia contact means mounted within said variable sensitivity switch and operable to contact with said inertia member, said first contact means responsive to actuation by longitudinal deceleration forces and said second inertia contact means responsive to be actuated by lateral deceleration forces to complete a firing circuit for said fuze, said water entry switch comprising a micro switch, a plunger mounted adjacent said variable sensitivity switch parallel to the longitudinal axis of said torpedo and adapted to actuate said microswitch, a block having a V-shaped recess therein mounted adjacent one end of said plunger and a ball seated in said recess adapted to engage said one end whereby longitudinal deceleration

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forces move said plunger to actuate said micro switch and lateral deceleration forces move said ball against said plunger to actuate said micro switch.

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