

July 22, 1952

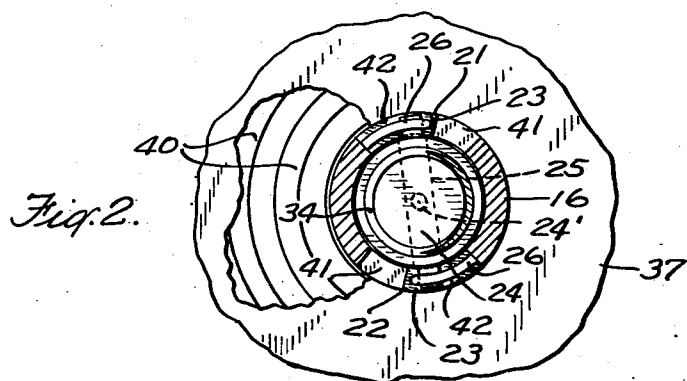
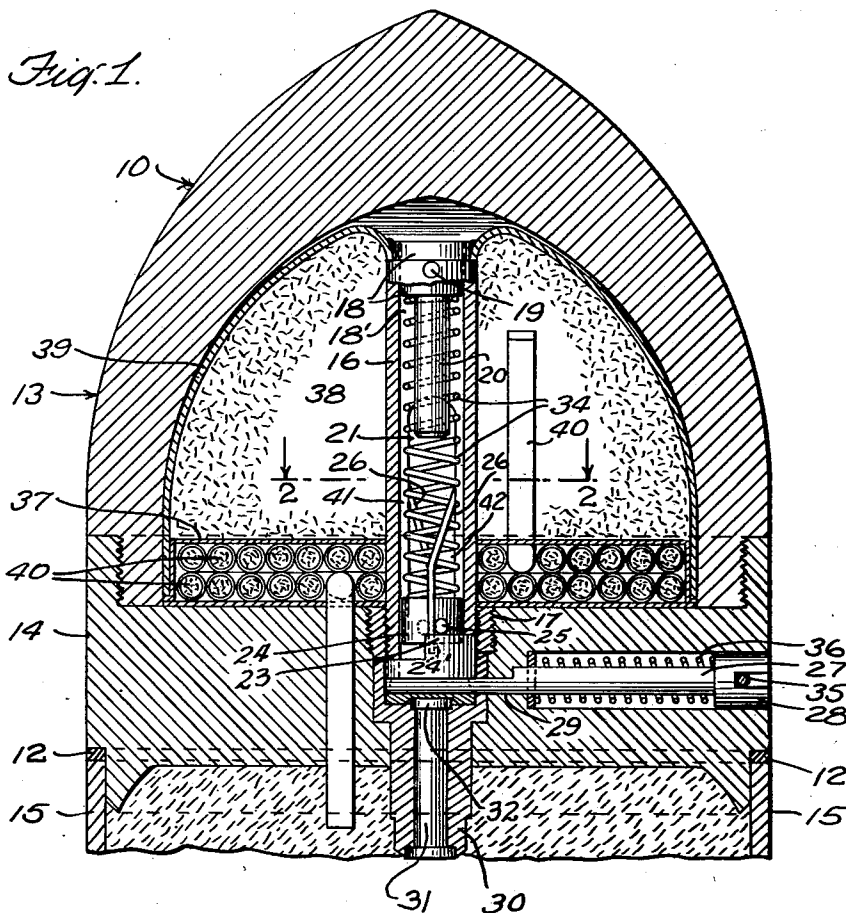
S. N. ARNOLD

2,604,045

MISSILE

Filed March 9, 1946

2 SHEETS—SHEET 1



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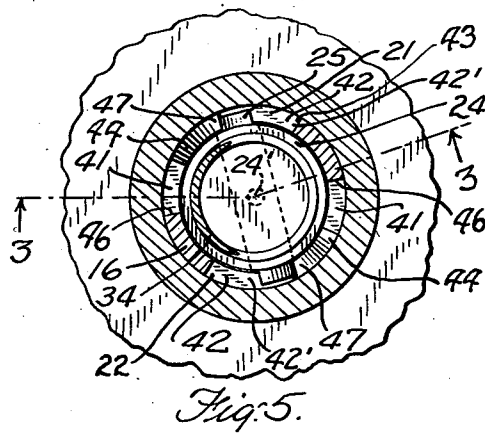
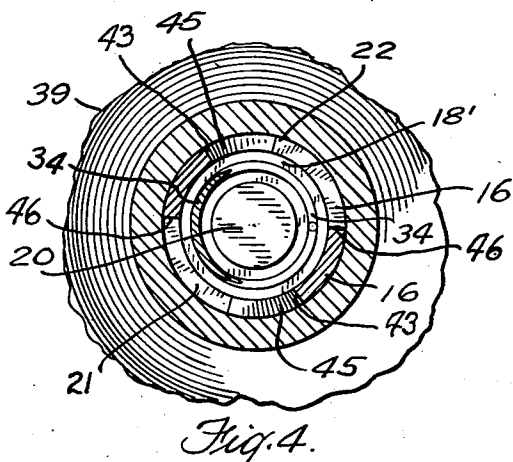
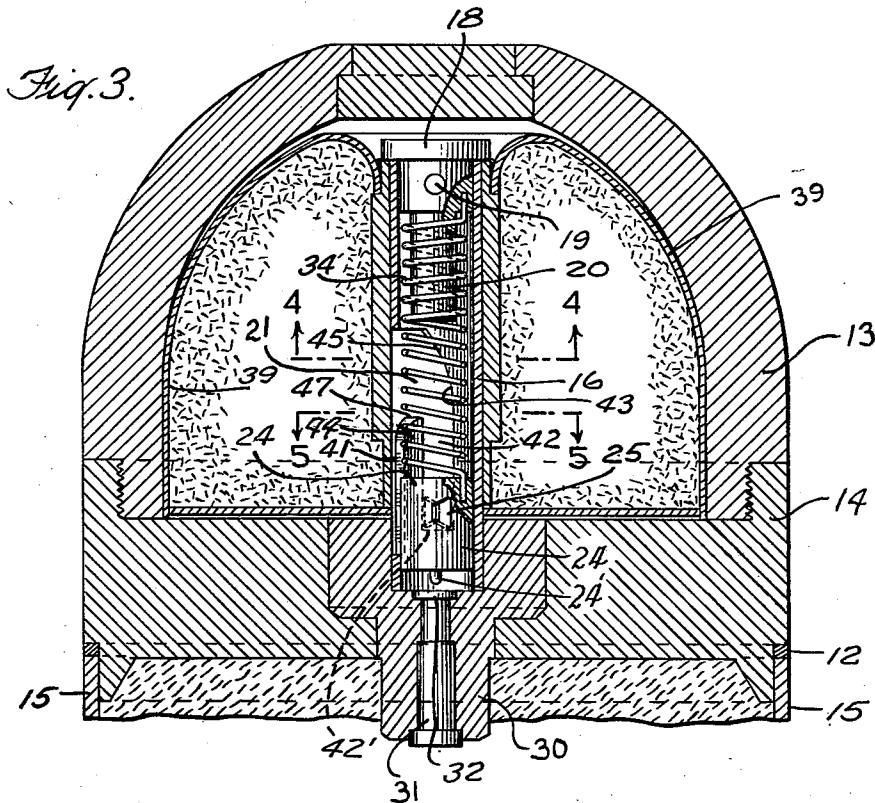
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2. SHEETS—SHEET 2



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## UNITED STATES PATENT OFFICE

2,604,045

MISSILE

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7 Claims. (Cl. 102—75)

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The present invention provides an article of munition, and more particularly a bomb having a firing mechanism which will not function to detonate the bomb until the rate of deceleration of the bomb upon its striking an object is at or above a predetermined minimum. The firing mechanism is so constructed that the rate of deceleration of the bomb when the bomb is accidentally dropped or jarred will be insufficient to fire the bomb.

The invention will be understood from the following description when considered in connection with the accompanying drawings forming a part thereof and in which:

Fig. 1 is a longitudinal sectional view of the nose portion of the bomb of the present invention.

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 1 but of another form of the invention partially taken on line 3—3 of Fig. 5.

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 3, and

Fig. 5 is a view similar to Fig. 4 but taken on the line 5—5 of Fig. 3.

Like characters of reference refer to like parts throughout the views.

Referring to Fig. 1 of the drawings, a bomb is illustrated which consists of a nose 10 pointed at its forward end and comprising a hollow cap 13 secured to a base 14 at the rearward end of the nose by screw threads 11. The base 14 is attached by any desirable means, such as solder 12 to the body portion 15 of the bomb.

The firing mechanism of the bomb of the present invention comprises a cylindrical tube or mounting means 16 which extends axially of the nose of the bomb in the central portion thereof and is secured to the base by means of screw threads 17 at one end of the tube. The opposite end of the cylindrical tube 16, which is adjacent the forward end of the nose, is closed by a plug 18 held therein by means of a pin 19. Plug 18 has a projection or stop 20 which extends into the tube a predetermined distance, the stop 20 being of a lesser diameter than the plug 18 thereby forming a passage 18' between the stop and the inner wall of the tube. Slots 21 and 22 extend through the wall of the cylindrical tube 16 at diametrically opposite sides thereof, the slots extending from a point adjacent the base 14 of the nose to a point short of the opposite end of said tube. Slots 21 and 22 each have a step portion 23 adjacent said one end thereof which step portion extends substantially half way into the slots.

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A weight 24 is positioned within the cylindrical tube 16 and slidably engages the inner periphery thereof. Guide pin 25 extends through the weight 24 and the opposite ends thereof project from the opposite sides of the weight into the slots 21 and 22, while a firing pin 24' extends from the weight axially thereof and toward the rearward end of the nose 10. A spring arm 26 of spring wire is secured to the end of the tube 16 adjacent the rear end of the nose and adjacent each slot 21 and 22. The arms 26 extend longitudinally of said tube and the slots along the center line of the slots 21 and 22 substantially parallel to the axis of the tubular member. At a point intermediate the opposite ends of the slots 21 and 22 and in spaced relationship with the end of the stop 20, the arms 26 project diagonally inwardly across the safety guideways 42 toward the inner wall of the tube to a point closely adjacent or engaging said wall. The slots 21 and 22 are each thereby divided into safety guideway 42 and a firing guideway 41.

Fuse body 30 is positioned in the central portion of the base 14 in axial alignment with the tube 16 and has a fuse 31 with a primer cap 32 mounted in the end thereof adjacent the firing pin 24'. An arming pin 27 having a slotted head 28 is positioned in a passage 29 and extends transversely of the base to a point slightly past the center thereof in such position that the pin 27 is interposed between the primer cap 32 and firing pin 24' thereby rendering the bomb unarmed so long as the pin is in position in the passage. Arming pin 27 is held in position against the tension of the spring 36 by an arming wire 35 which traverses the slot in the head 28 and slidably engages holes, not shown, in the nose. When the bombs are in a cluster, the pin 27 is held in position in the passage 29 against the tension of the spring 36 by contact with the adjacent bomb in the cluster.

Resilient means consisting of a compressible helical spring 34 is positioned in the cylindrical tube 16 and extends longitudinally thereof, one end of said spring extending into the passage 18' and bearing against the plug 18, while the other end bears against the weight 24. The fuse is assembled for use with the projecting ends of the guide pin 25 of the weight 24 positioned in the safety guideways 42 and held firmly in contact with the step portion 23 of said slot by the tension of the spring 34.

As shown, the nose of the bomb has a fuse box 37 positioned on the base 14 which fuse box extends into the space within the cap 13. An explosive compartment 38 is formed in the cap by means of metallic walls 39. One end of the time

fuse 40 in the fuse box projects into the compartment 38, while the other end of the fuse extends through a passage in the base 14 and into the body of the bomb or another explosive compartment, not shown.

In operation, the bomb is armed through ejection of the arming pin 27 by the spring 36 which pin is released by withdrawing the arming wire 35 as the bomb leaves a bomb rack or, when the bombs are in a cluster, by declustering the bombs. Although the bomb is armed when the pin 27 is ejected, there is no danger of the bomb firing as the projecting ends of the guide pin 25 are in the safety guideways 42 wherein the firing pin 24' is prevented from contacting the primer cap 32 by engagement of the ends of the guide pin 25 with the step portion 23. Upon impact of the nose of the bomb upon a target with sufficient force to cause a rate of deceleration of the bomb at or above a predetermined minimum, the weight 24 moves in the tube 16 toward the nose of the bomb against the tension of the spring 34 thereby compressing the spring, the projecting ends of guide pin 25 engaging the inclined portion of the spring arms 26 forcing the spring arms to move toward the firing guideways 41 and away from the safety guideways 42 a sufficient distance to permit the projecting ends of the guide pins to pass out of the safety guideways. When the ends of the guide pins have passed out of the safety guideways 42 and beyond the inclined portion of the spring arms 26, the spring arms return to their normal position with the inclined portion of the arms extending across the safety guideways 42 to a point closely adjacent or engaging the inner wall of the tube 16. The stop 20 arrests the forward movement of the weight 24 after it has passed from the safety guideways and beyond the inclined portion of the arms 26 and prevents the crushing of the spring 34 should the rate of deceleration of the bomb be too great. When the forward movement of the weight is arrested, the tension of the spring 34 reverses the movement of the weight and causes it to be forcibly moved toward the base of the nose. In moving toward said base the projecting ends of the guide pin 25 engage the inclined portion of the arms 26 which causes the weight to be rotated in a clockwise direction (Fig. 2) sufficiently to permit the ends of the guide pin to enter the firing guideways 41 and move therein toward and forcibly strike the primer cap 32 and detonate said cap. Detonation of the primer 32 causes the fuse 31 to be ignited, the fuse thereafter burning toward an explosive or other charge with which it is in communication.

Should the rate of deceleration of the bomb upon impact on an object be insufficient to cause the weight 24 to move past the inclined portion of the arms 26 against the tension of the spring 34, the projecting ends of the guide pin 25 will remain in the safety guideways 42 and will be forced back against the steps 23 the bomb thereby being prevented from firing since the firing pin will not be permitted to impact on the primer cap 32. The strength of the spring 34, therefore, determines the force of the impact and rate of deceleration of the bomb required to cause the weight to move beyond the inclined portion of the arms 26 to fire the bomb. The spring will be of such strength that a predetermined rate of deceleration will be required to fire the bomb.

The embodiment of the invention disclosed in Figs. 3 to 5 is somewhat similar to the form of the invention shown in Figs. 1 and 2 but separate

firing and safety guideways 41 and 42 are provided in the tube 16 instead of guideways provided by dividing slots 21 and 22 by the spring arms 26. The slots 21 and 22 are divided into a firing guideway 41 and a safety guideway 42 by partitions 44. The safety guideways 42 extend through the wall of the tube 16 substantially diametrically opposite one another. As shown, the guideways 42 have one side 43 thereof which extends longitudinally of the tube from a point in spaced relationship with the cap 32 to a point closely adjacent the end of the stop 20. The side 43 has a curved portion 45 extending from a point intermediate the opposite ends of the guideways across the slot and to the end adjacent the stop 20. The ends 42' of the safety guideways 42 prevent the weight from detonating the primer since the ends 42' are spaced such a distance from the primer that engagement of the pin 25 thereon prevents the weight from contacting the primer. The partition 44 of the slots 21 and 22 projects to a point short of the curved portion 45 of the side 43 of guideways 42 and has an end 47 at said point. The firing guideways 41 extend longitudinally of the tube 16 and through the wall of the tube substantially diametrically opposite one another at points substantially 90° from the safety guideways 42. Each of the guideways 41 have a side 46 thereof which extends from a point closely adjacent the end of the plug 20 to a point closely adjacent the cap 32.

The operation of the form of the invention shown in Figs. 3 to 5 is substantially the same as that shown in Figs. 1 and 2 with the exception that upon impact of the bomb upon a target the weight 24 moves toward the stop 20 but when the guide pin 25 passes beyond the guideways 42 and the end 47 of the partition 44, the weight 24, due to the torsional stress of the spring 34, turns in a counter-clockwise direction (Fig. 5). After the impact and turning of the weight, the tension of the compressed spring 34 causes the weight to move toward the primer 32, the pin 25 entering the firing guideways 41 and moving in said guideways toward said primer 32 until the firing pin 24' strikes and detonates the primer thereby causing the fuse 31 to become ignited.

While the firing mechanism of the present invention has been disclosed with the nose structure of the bomb of copending United States patent application Serial No. 648,588, filed February 19, 1946, it will be understood that this firing mechanism may be used with other types of bombs.

Since changes may be effected in the forms of the invention selected for disclosure without departing from the principles of the invention, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. In a bomb adapted to be fired upon impact with an object, a nose having a forward portion for striking an object, a primer element in said nose adapted to be detonated, mounting means comprising a tubular member having diametrically opposed slots therein, a flexible arm for each of said slots, said arms separating the slots into separate guideways, the arms extending longitudinally of the slots to a point spaced a predetermined distance from the primer thence toward the wall of the tubular member and across one of the guideways, a weight for detonating the primer movably mounted in said mounting means, guiding means on said weight

adapted to slidably engage the guideways, a compressible helical spring in said tubular member, said spring being secured at one end to the mounting means and positioned to impose a torsional stress on said spring, the guideways being so arranged that the weight upon movement is guided toward and away from the primer, the movement away compressing the spring, said one of the guideways of each slot being arranged to limit the movement of the weight toward the primer to a point short thereof, the other of the guideways of each slot being arranged to permit the weight to strike the primer, the arrangement being such that when the bomb strikes an object with a force which results in a rate of deceleration of the missile greater than a predetermined rate of deceleration the weight moves past said arms in a direction away from the primer, the torsional stress on the spring causing the guiding means to pass from one of the guideways of each slot to said other guideway of each slot wherein the weight is returned toward and impacts the primer by force provided by the spring thereby detonating the primer.

2. In an article of munition that is fired upon impact with an object, said article comprising mounting means having a longitudinally extending path therein, a primer element adapted to be detonated, the primer element being positioned in alignment with said path, a weight associated with the mounting means and having longitudinal movement in the path, the relative position of the weight and primer element being such that impact of the article with an object moves the weight in a direction away from the primer, guiding means associated with the mounting means, said guiding means comprising diametrically opposed slots in the mounting means, a flexible arm for each of said slots, said arms separating the slots into separate guideways, the arms extending longitudinally of the slots to a point a predetermined distance in said direction away from the primer element thence toward a side wall of the slot and across one of the guideways, means movable in the guideways and associated with the weight and said one of the guideways to guide the movement of the weight, and resilient means cooperating with the weight and arranged so that said movement away from the primer element is against the resistance of the resilient means, the resistance of the resilient means being such as to normally prevent movement of the weight said predetermined distance, said one of the guideways being arranged to limit the movement of the weight toward the primer to a point short thereof and the other guideway being arranged to permit the weight to strike the primer, the portion of the flexible arms extending toward the side wall of the slot causing said means movable in the guideways to be transferred from said guideway to said other guideway when the weight is moved past said predetermined distance away from the primer element so that the weight is guided in said other guideway and impelled toward the primer to detonate the same by force provided by the resilient means.

3. In a bomb adapted to be fired upon impact with an object, a nose having a forward portion for striking an object, a primer element in said nose adapted to be detonated, mounting means comprising a tubular member having diametrically opposed slots therein, a flexible arm for each of said slots, said arms separating the slots

into separate guideways, the arms extending longitudinally of the slots to a point spaced a predetermined distance from the primer thence toward the wall of the tubular member and across one of the guideways, a weight for detonating the primer movably mounted in said mounting means, guiding means on said weight adapted to slidably engage the guideways, a compressible helical spring in said tubular member, the relative position of the spring and the weight in the tubular member being such that the weight is moved against the compression of the spring by the force of impact, the guideways being so arranged that the weight upon movement is guided toward and away from the primer, the movement away compressing the spring, said one of the guideways of each slot being arranged to limit the movement of the weight toward the primer to a point short thereof, the other of the guideways of each slot being arranged to permit the weight to strike the primer, the arrangement being such that when the bomb strikes an object with a force which results in a rate of deceleration of the missile greater than a predetermined rate of deceleration the weight moves past said arms in a direction away from the primer, the portion of the flexible arms extending toward the wall of the tubular member causes the guiding means to pass from one of the guideways of each slot to said other guideway of each slot wherein the weight is returned toward and impacts the primer by force provided by the spring thereby detonating the primer.

4. In an article of munition that is fired upon impact with an object, said article comprising mounting means having a longitudinally extending path therein, a primer element adapted to be detonated, the primer element being positioned in alignment with said path, a weight associated with the mounting means and having longitudinal and rotative movement in the path, the relative position of the weight and the primer element being such that impact of the article with an object moves the weight in a direction away from the primer, guiding means associated with the mounting means, said guiding means comprising a longitudinally extending slot in said mounting means, a flexible arm in said slot, said arm separating the slot into separate guideways, the arm extending longitudinally of the slot to a point a predetermined distance in said direction away from the primer element thence toward a side wall of the slot and across one of the guideways, means movable in the guideways and associated with the weight and said one of the guideways to guide the movement of the weight, and resilient means cooperating with the weight and arranged so that said movement away from the primer element is against the resistance of the resilient means, the resistance of the resilient means being such as to normally prevent movement of the weight said predetermined distance, said one of the guideways being arranged to limit the movement of the weight toward the primer to a point short thereof and the other guideway being arranged to permit the weight to strike the primer, the portion of the flexible arms extending toward the side wall of the slot causing said means movable in the guideways to be transferred from said guideway to said other guideway when the weight is moved past said predetermined distance away from the primer element so that the weight is guided in said other guideway and impelled toward the primer to detonate the same by force provided by the resilient means.

5. In an article of munition that is fired upon impact with an object, said article comprising mounting means having a longitudinally extending path therein, a primer element adapted to be detonated, the primer element being positioned in alignment with said path, a weight associated with the mounting means and having longitudinal and rotative movement in the path, the relative position of the weight and the primer element being such that impact of the article with an object moves the weight in a direction away from the primer, guiding means associated with the mounting means, said guiding means comprising a longitudinally extending slot in said mounting means, a flexible arm in said slot, said arm separating the slot into separate guideways, the arm extending longitudinally of the slot to a point a predetermined distance in said direction away from the primer element thence toward a side wall of the slot and across one of the guideways, means movable in the guideways and associated with the weight and said one of the guideways to guide the movement of the weight, and a compressible helical spring in said path in the mounting, the spring being secured at one end to the mounting means and at the opposite end to the weight, the spring being arranged so that movement of the weight away from the primer element is against the resistance of the spring and so as to normally impose a torsional stress on said spring, the resistance of the spring being such as to normally prevent movement of the weight said predetermined distance, said one of the guideways being arranged to limit the movement of the weight toward the primer to a point short thereof and the other guideway being arranged to permit the weight to strike the primer, the portion of the flexible arms extending toward the side wall of the slot and the torsional stress of the spring causing said means movable in the guideways to be transferred from said guideway to said other guideway when the weight is moved past said predetermined distance away from the primer element so that the weight is guided in said other guideway and impelled toward the primer to detonate the same by force provided by the resilient means.

6. In firing mechanism for a missile having a primer element adapted to be detonated by force of an impact, mounting means comprising a tubular member having diametrically opposed slots therein, the primer element being positioned in the tubular member, a weight mounted in the tubular member for axial and rotative movement therein, the relative position of the weight and primer element being such that impact of the article with an object moves the weight in a direction away from the primer, a flexible arm in each of said slots, the arms separating said slots into separate guideways, each of the arms separating the slot in which it is positioned into separate guideways, the arms extending longitudinally of the slots to a point a predetermined distance in a direction away from the primer element thence toward a side wall of said slot and across one of the guideways, said arms extending in opposite directions toward opposite sides of the slots means movable in the guideways and associated with the weight and said one of the guideways to guide the movement of the weight, and resilient means cooperating with the weight and arranged so that said movement away from the primer element is against the resistance of the resilient means, the resistance of the resilient means being such as to normally prevent

movement of the weight said predetermined distance, said one of the guideways being arranged to limit the movement of the weight toward the primer to a point short thereof and the other guideway being arranged to permit the weight to strike the primer, the portion of the flexible arms extending toward the side wall of the slot causing said means movable in the guideways to be transferred from said guideway to said other guideway when the weight is moved past said predetermined distance away from the primer element so that the weight is guided in said other guideway and impelled toward the primer to detonate the same by force provided by the resilient means.

7. In a bomb adapted to be fired upon impact with an object, a nose having a forward position for striking an object, a primer element in said nose adapted to be detonated, mounting means comprising a tubular member having diametrically opposed slots therein, a flexible arm in each of said slots, the arms separating said slots into separate guideways, each of the arms separating the slot in which it is positioned into separate guideways, the arms extending longitudinally of the slots to a point a predetermined distance in a direction away from the primer element thence toward a side wall of said slot and across one of the guideways, said arms extending in opposite directions toward opposite sides of the slots, a weight for detonating the primer movably mounted in said mounting means, guiding means on said weight adapted to slidably engage the guideways, a compressible helical spring in said tubular member, said spring being secured at one end to the mounting means and positioned to impose a torsional stress on said spring, the guideways being so arranged that the weight upon movement is guided toward and away from the primer, the movement away compressing the spring, said one of the guideways of each slot being arranged to limit the movement of the weight toward the primer to a point short thereof, the other of the guideways of each slot being arranged to permit the weight to strike the primer, the arrangement being such that when the bomb strikes an object with a force which results in a rate of deceleration of the missile greater than a predetermined rate of deceleration the weight moves past said arms in a direction away from the primer, the torsional stress on the spring causing the guiding means to pass from one of the guideways of each slot to said other guideway of each slot wherein the weight is returned toward and impacts the primer by force provided by the spring thereby detonating the primer.

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