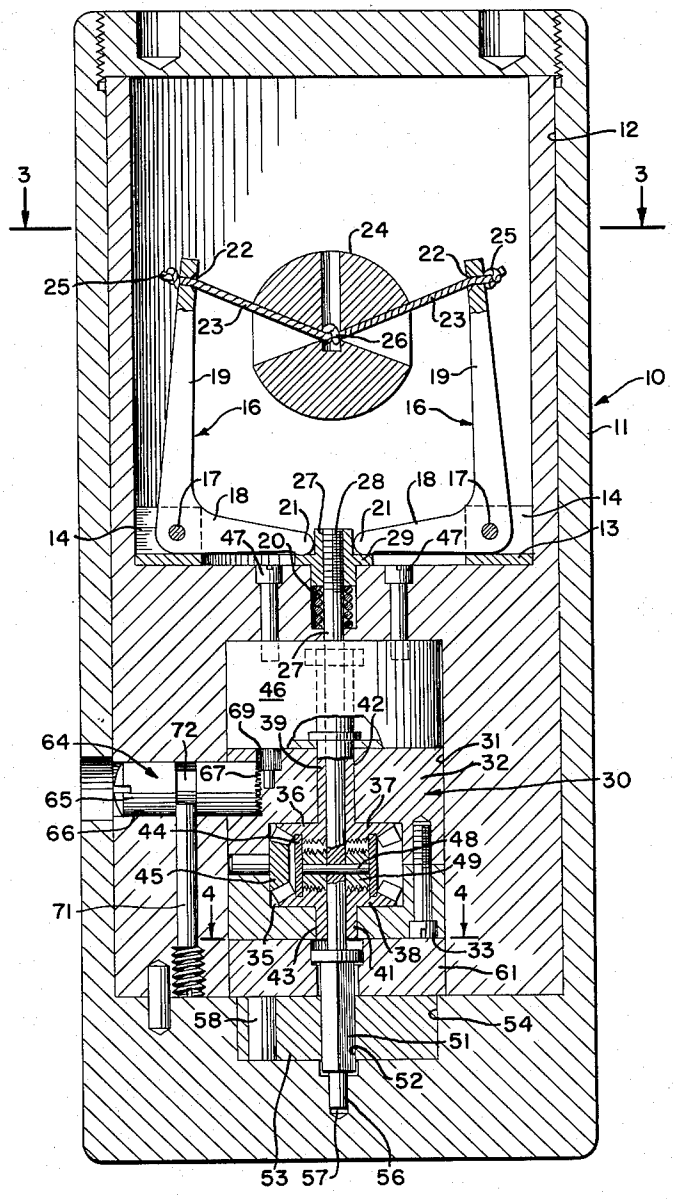
Aug. 15, 1961 W. J. DONAHUE, JR., ET AL 2,996,009

DELAY ARMING DEVICE

Filed Sept. 14, 1956 3 Sheets-Sheet 1

FIG.1.



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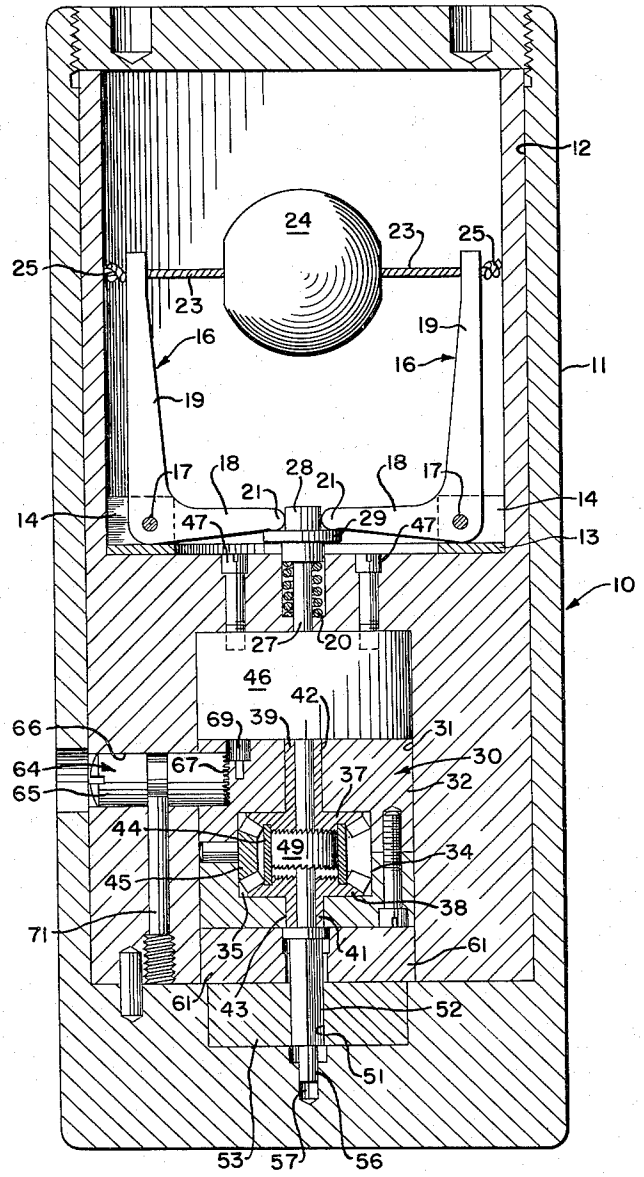
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FIG.2.



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DELAY ARMING DEVICE

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FIG.3.

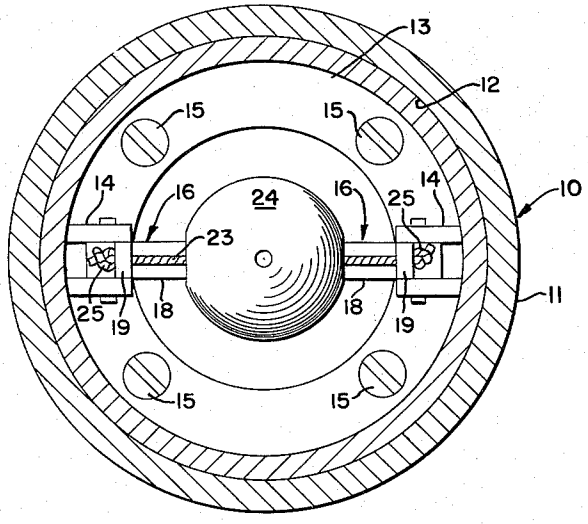


FIG.4.

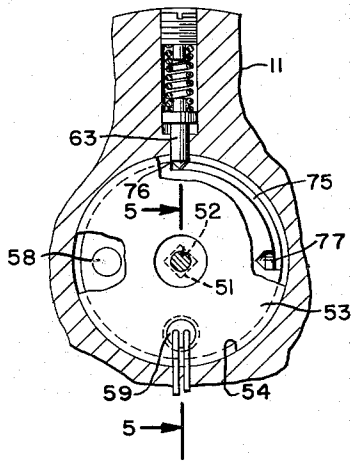
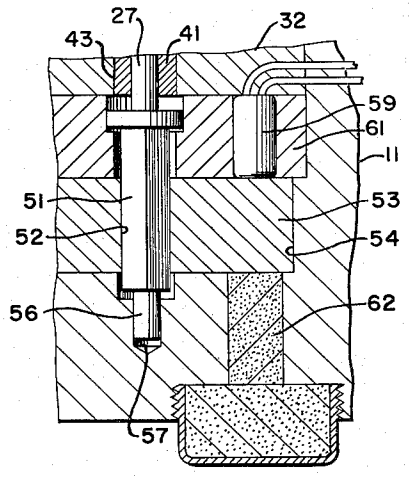


FIG.5.



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2,996,009

DELAY ARMING DEVICE

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3 Claims. (Cl. 102—76)
(Granted under Title 35, U.S. Code (1952), sec. 266)

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.

The present invention relates to a fuze and more particularly to a gravity actuated fuze. Moreover, the invention contemplates the provision of a new and improved delay arming device for a non-rotating ordnance missile such, for example, as a bomb, rocket or mortar projectile.

Furthermore, the present invention is constructed and arranged to overcome all the difficulties encountered in prior art delayed arming devices, particularly, the types used in non-spin ordnance missile and employing external devices for releasing the mechanical arming means as the missile is launched toward a target and the type employing electrical arming means which necessitates the use of an electrical cable connected to the missile and a source of electrical energy carried by the launching means to initiate the fuze as the missile is released toward a target by providing a fuze construction which is completely enclosed in the missile and which does not require the use of external devices or an electrical cable to initially arm the fuze.

The invention provides a fuze which is actuated to an armed position during the free fall of the missile toward a target at which time the effective weight of a movable mass arranged within the fuze releases a compressed spring. When this occurs a normally locked shaft is released and moved axially in one direction and a gear mounted thereon moves into engagement with a power driven differential gear structure whereupon the arming rotor carried by the shaft is moved from an initial safe position to an armed position and locked therein by a conventional spring urged detent. Should the missile be accidentally dropped during handling or transportation, the shaft may be actuated to a release position momentarily and cause rotation of the arming rotor to a partially armed position. Upon impact or when the free fall of the missile stops, the effective weight of the mass is of a value sufficient to cause the shaft to be moved in a reverse direction into engagement with the power driven differential gear structure whereupon the arming rotor is moved from said partially armed position to the initial safe position.

An object of the present invention is to provide a new and improved delay arming device for a non-spin ordnance missile.

Another object of the invention is the provision of a gravity actuated arming device for a non-rotating missile which is void of external arming means and which is completely embedded within the missile casing.

A still further object of the invention is the provision of a delay arming fuze suitable for use in a bomb, rocket or mortar projectile and which is admirably suited for use in a long delay nuisance bomb.

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 drawing wherein:

FIG. 1 is a central longitudinal sectional view of the

fuze constructed in accordance with the present invention, illustrating the fuze in an initial safe condition;

FIG. 2 is a view similar to FIG. 1 illustrating the fuze in an armed condition;

FIG. 3 is a cross sectional view taken on the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary sectional view taken on the line 4—4 of FIG. 1; and,

FIG. 5 is a fragmentary sectional view taken on the line 5—5 of FIG. 4.

Referring now to the drawings wherein like numerals designate corresponding parts throughout the several views and more particularly to FIG. 1 the numeral 10 generally indicates the fuze constructed in accordance with the present invention. The fuze comprises a casing 11 having a well or recess 12 formed in one end thereof. An annular ring 13 is disposed within the well 12 and having a pair of diametrically disposed bifurcated bosses 14 formed thereon, the annular ring being secured to the casing 11 preferably by screws 15. A substantially L-shaped lever 16 is pivotally mounted on each of said bosses 14 as at 17 and comprises a short arm 18 and a long arm 19, the arms 18 of the bosses 14 being provided with substantially circular heads 21 and the longer arms 19 being formed with flared openings 22. Disposed through the openings 22 and bridging the arms 19 is a flexible element 23 having a weight or mass 24 mounted thereon and centrally disposed between the arms 19, the flexible element being secured to arms 19 by a hitch or knot 25 formed on the free end thereof, the mass or weight being maintained centrally between the arms 19 by a hitch or knot 26 formed on the flexible element as more clearly shown on FIGS. 1 and 3.

A shaft 27 is slidably and rotatably mounted within the casing 11 and has a hub 28 secured to one end thereof and a flange 29 formed integrally therewith. The shaft 27, however, is normally held against movement in the direction of its longitudinal axis by the circular heads 21 on levers 16 since the heads are forced and maintained in frictional engagement with flange 29 in response to the load applied to the levers by the aforesaid mass when the missile is in a state of rest. A spring 20 is disposed about the shaft 27, one end of the spring being in engagement with the hub 28, the other end thereof being in engagement with casing 11 whereby the shaft may be moved axially within the casing 11 as the shaft is released.

A gear cage generally indicated by the reference character 30 is disposed within a bore 31 formed in casing 11 and comprises a pair of members 32 secured together by a plurality of screws 33. The members 32 are each provided with a recess 34, forming a centrally disposed chamber 35 having arranged therein a differential gear structure generally indicated by the numeral 36. The gear structure comprises a pair of mutually spaced gears 37—38 having hollow shafts 39—41 respectively, journaled in members 32 as at 42—43. An annular spacer 44 and an idle gear 45 is disposed between the gears 37—38, gear 45 being in meshing engagement with gears 37—38. The aforesaid gear structure is driven through shaft 39 connected to a suitable power unit 46 such, for example, as a spring motor or the like, the motor being disposed within bore 31 and secured to the casing 11 by a plurality of screws 47.

The shaft 27 has secured thereto as by a pin 48 a gear 49, and adapted to be moved into meshing engagement with either one of the gears 37—38, gear 49 being normally in meshing engagement with gear 38 when the missile is in a state of rest. The shaft 27 is provided with a square portion 51 disposed within a corresponding opening 52 formed in an arming rotor 53 rotatably supported in a recess 54 formed in casing 11, the square portion 51 of the shaft terminating in a journal 56 rotat-

ably supported in the casing **11** as at **57**. The arming rotor **53** is formed with a substantially 90° arcuate groove **75** terminating in shoulder **76** at one end and a countersunk hole **77** at the other. The rotation of the arming rotor **53** is limited by the extent of this groove, the shoulder **76** abutting the pin **63** when in safety position while the countersunk hole **77** receives the pin **63** and holds the rotor in armed position.

Disposed within the rotor is a primer or detonator **58**, the primer being normally out of alignment with an electro-responsive detonator **59** disposed within a member **61** arranged between the gear cage **30** and a lead in charge **62** carried by the casing as best shown on FIG. 5. It will be understood that when the arming rotor is rotated to an armed position the primer **58** is moved into alignment with the aforesaid electro-responsive detonator and lead-in charge, the rotor being locked in the armed position by the spring urged detent **63**, FIG. 4.

As more clearly shown on FIG. 1 a suitable winding mechanism generally indicated by the numeral **64** is provided for winding the spring motor **46** and comprises a shaft **65** rotatably supported within a bore **66** formed in the casing and one of the members **32**. A gear **67** is formed on one end of the shaft **65** in mesh with a winding gear **69** included in the motor structure, the shaft being maintained within the bore **66** by a pin **71** having one end thereof in threaded engagement with the casing and the other end thereof disposed within an annular groove **72** formed in shaft **65**.

When the missile is dropped the state of equilibrium is upset, there being no upward force. The compressed spring **20** expands and there is relative movement between the casing **11** and the weight **24**, the levers **16** permitting longitudinal axial movement of the shaft **27**. Thus shaft **27** is released and motor **46** is set in operation, shaft **27** is moved axially by spring **20** whereupon gear **49** on shaft **27** is moved into engagement with gear **37** imparting rotary movement to shaft **27** whereby the arming rotor **53** is moved from an initial safe position to an armed position whereupon primer **58** is aligned with detonator **59** and lead-in charge **62**. As more clearly shown in FIG. 4, a spring urged detent is provided within casing **11** for locking the rotor **53** in the armed position upon rotation of the rotor thereto. Should, for any reason, during the free fall of the missile, the aforesaid free-fall condition of the missile and mass be removed or interrupted momentarily before the arming cycle is completed, the levers **16** are moved into engagement with the disc **29** by the mass whereupon the shaft **27** is moved in a reverse direction an amount sufficiently to cause gear **49** to engage gear **38**, and shaft **27** is rotated in a reverse direction by motor and differential gear structure whereby the arming rotor **53** is moved to a safe position with the primer **58** out of alignment with the detonator **59** and lead-in charge **62**.

From the foregoing, it will be apparent that a new and improved delay fuze has been devised for use in an ordnance missile wherein means are provided for arming the fuze only during the free fall of the missile toward a target and which actuates the fuze from a partially armed position to an initial safe position should for any reason the free fall of the missile be interrupted momentarily before the arming cycle is completed.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A gravity actuated arming device for a non-rotating ordnance missile comprising a casing, a shaft mounted for rotation and axial movement in said casing, means tending to rotate said shaft, a mass, means suspending said mass in said casing for limited free motion, said mass suspending means normally holding said shaft from axial movement, an arming rotor connected to said shaft, means connected with the shaft rotative means to move the rotor in one direction to a safety position, means connected with the shaft rotative means to move the rotor in an opposite direction to an armed position, the longitudinal position of the shaft controlling the direction of rotation of the rotor, and means yieldably held in an initial position by said mass and adapted to move the shaft axially to a moved position in which the first named means is effective to rotate the rotor in said opposite direction to an armed position.

2. A gravity actuated arming device according to claim 1 wherein the mass suspending means comprises a cord to which the mass is attached.

3. A gravity actuated arming device according to claim 1 wherein the means moving the shaft in an axial direction is a spring held compressed when the arming device is in a rest position.

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