Feb. 13, 1951 J. F. McCASLIN 2,541,082

DELAY ARMING DEVICE FOR PROJECTILE FUSES

Filed Aug. 21, 1945 3 Sheets-Sheet 1

Fig. 1.

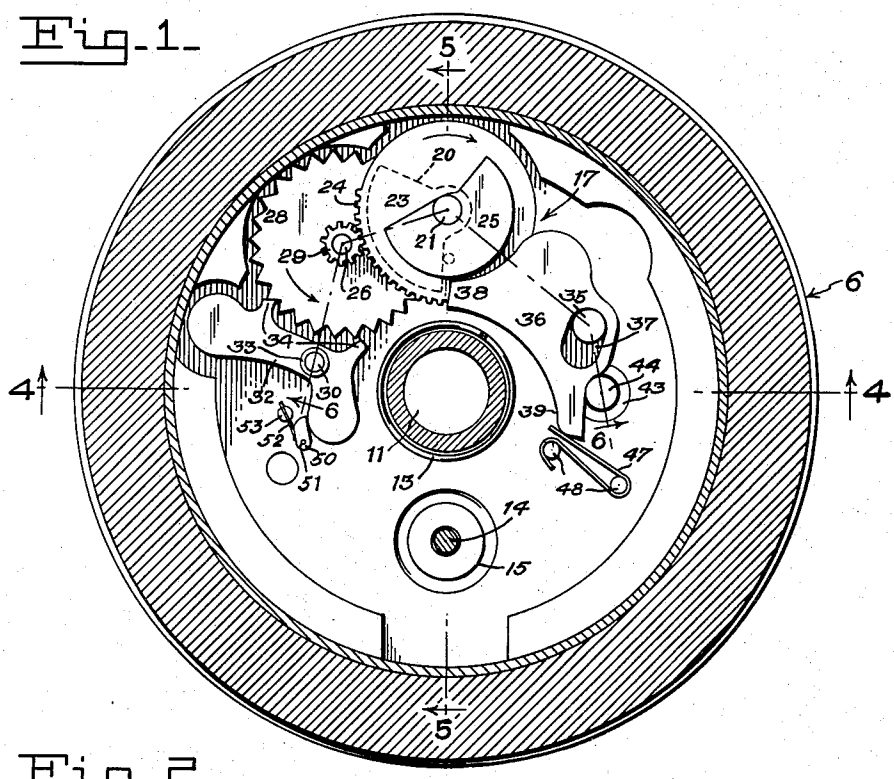
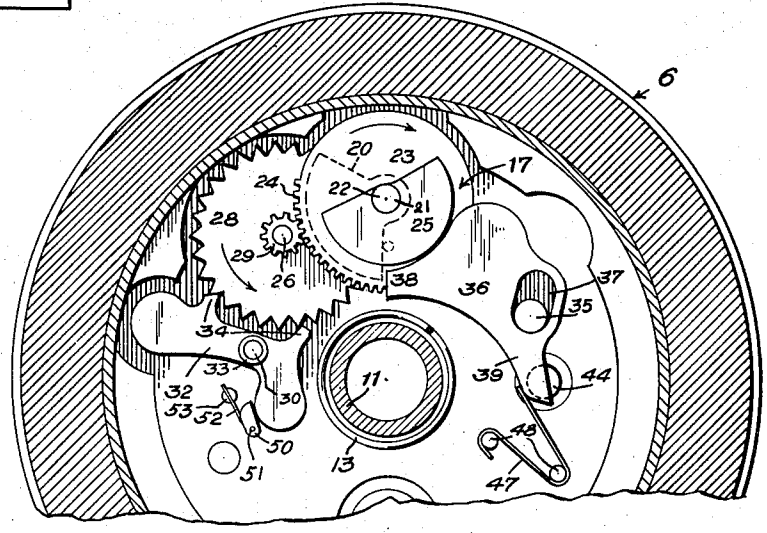


Fig. 2.



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Feb. 13, 1951 J. F. McCASLIN 2,541,082

DELAY ARMING DEVICE FOR PROJECTILE FUSES

Filed Aug. 21, 1945 3 Sheets-Sheet 2

Fig. 3.

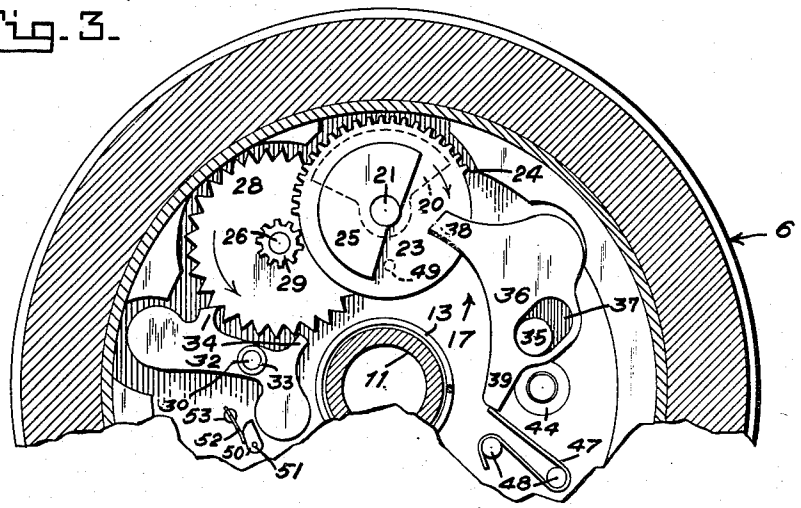
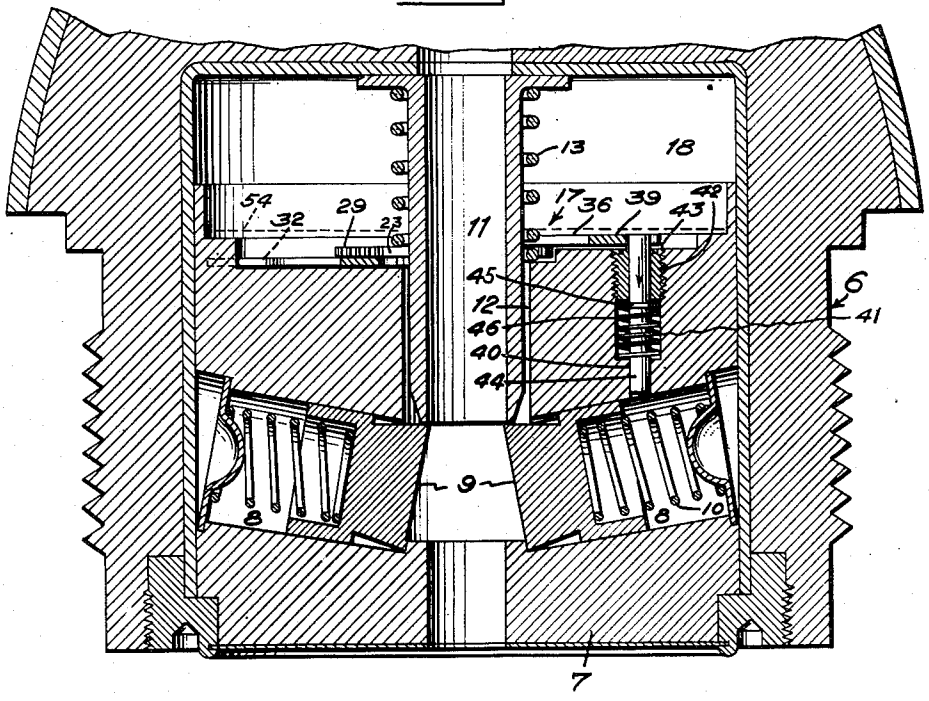


Fig. 4.



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Filed Aug. 21, 1945 3 Sheets-Sheet 3

Fig. 5.

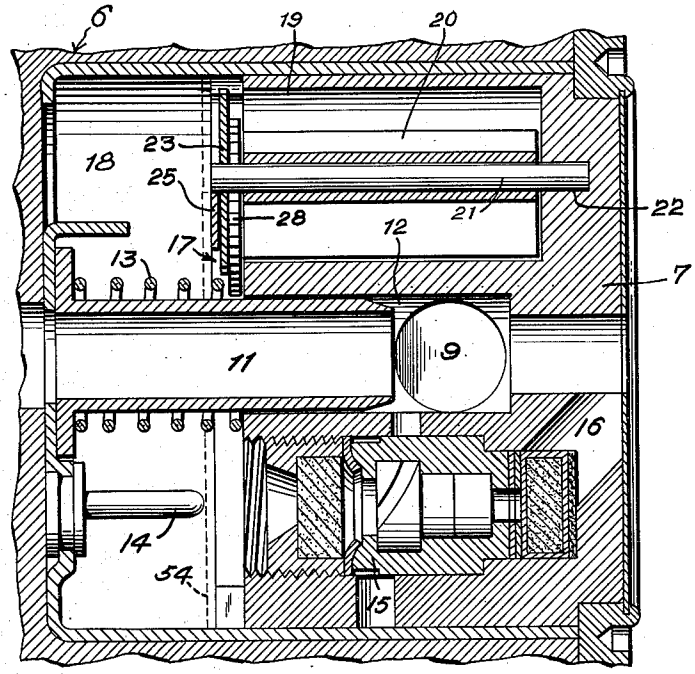
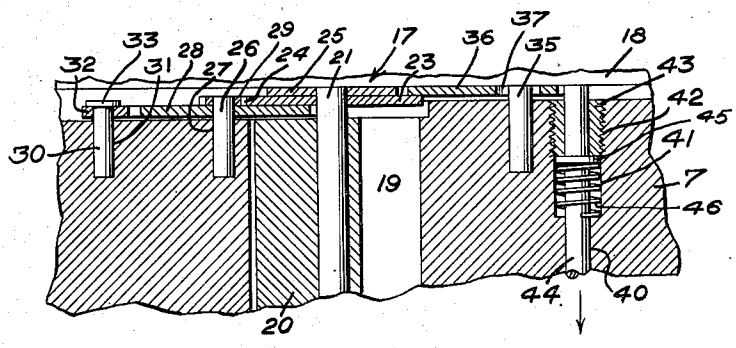


Fig. 6.



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UNITED STATES PATENT OFFICE

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DELAY ARMING DEVICE FOR PROJECTILE FUSES

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10 Claims. (Cl. 102—76)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an improved delay arming device for use with projectile fuzes of the rotating type and which functions to retain a fuze, with which it is associated, in a disarmed or safe condition until a projectile, in which the fuze is contained, has traveled a predetermined distance in its flight.

More particularly, the present invention relates to a safety attachment for use with the M48, and M51 series fuzes, to provide additional safety means for delaying the arming of the fuze to insure a minimum travel of the projectile in flight prior to the arming of the fuze, and which is sufficient so that the projectile will be beyond a zone where the gun crew could be endangered by the detonation of the projectile, when the device permits arming of the fuze.

Specifically, the invention comprises a centrifugally operated gear train the operation of which is regulated for arming the fuze at a predetermined point beyond the muzzle of the weapon by releasing a conventional safety element of the fuze.

Still a further object of the invention is to provide a device of the aforedescribed character capable of being readily applied to the types of fuzes, heretofore mentioned, without modification of the conventional parts of the fuze and by only slight modifications of the fuze housing, by so arranging the parts of the device that they will principally occupy an otherwise unused space in the housing.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, which illustrate a preferred embodiment thereof, and wherein:

Figure 1 is a cross sectional view through a part of a M48A2 fuze housing and showing the delay arming device, in top plan, disposed therein and its initial position;

Figure 2 is a fragmentary view similar to Figure 1 and showing the device in an intermediate position;

Figure 3 is a view similar to Figure 2 showing the device in its final, released position; and

Figures 4, 5, and 6 are longitudinal sectional views to an enlarged scale, taken substantially along the planes of the lines 4—4, 5—5, and 6—6, respectively, of Fig. 1.

Referring more particularly to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, 6 designates generally the part of the housing of a portion of the M48A2 fuze and which includes an inner portion, support or core 7 which is provided with substantially radially disposed bores 8, each of which contains a plunger 9 biased

2

inwardly by a spring 10 and into obstructing relationship to a sleeve 11. Core 7 is reciprocally mounted lengthwise of housing 6 and relatively to the sleeve 11. A bore 12 in core 7 accommodates the sleeve 11 when core 7 moves forward relatively to housing 6. Core 7 is normally spring biased rearwardly by an expansion spring 13. The sleeve 11 is connected to a firing pin 14, which is radially offset from the sleeve 11 and from the axis of the housing 6, and which is in alignment with a primer and powder train 15, contained in core 7, and which has a flash passage 16 leading to a booster, not shown, disposed behind the core 7 and which is adapted to be mounted in the nose of a projectile. The parts previously described and the operation of which will be briefly described, form no part of the present invention but are conventional in fuzes of the aforementioned types.

Briefly, a detonator, not shown, disposed forwardly of the housing 6, may be exploded upon the impact of a projectile, containing the fuze, with its target, and the blast therefrom will pass through the sleeve 11 and bore 12 to immediately detonate the booster charge when the fuze is set for superquick action. The fuze can also be set for delay action by obstructing the passage for the flash, from the detonator contained in the nose, forward of the sleeve 11. When thus arranged, and assuming that the plungers 9 have been set back by centrifugal force, upon impact with a target, core 7 is moved forward, relatively to housing 6, to cause firing pin 14 to strike the primer of powder train 15 which produces a flash through passage 16 for setting off the booster and bursting charge, not shown, after a short delay, all of which operation is conventional in fuzes of the aforementioned types.

The delay arming device, comprising the invention, and designated generally 17, is contained for the most part within an annular chamber 18 which is a conventional part of the fuze housing 6 and which is located forwardly of core 7, and in addition, the core 7 is provided with a forwardly opening well or recess 19 (Fig. 5) constituting a modification thereof and in which a portion of the device 17 is contained. The delay arming device 17 includes an elongated, segmental shaped centrifugally operated element 20 which is contained in the well 19 and which is keyed to a shaft 21 which extends axially through said well. The rear end of the shaft 21 is journalled in a recess 22 of the core 7, which opens into the bed of the well 19. The forward end of the shaft 21 extends into the chamber 18 and has keyed thereto a disk 23, a portion of the periphery of which is provided with teeth 24, forming a gear segment. A segmental shaped detent or stop 25 is keyed to the forward end of the shaft 21, forwardly of the disk 23. Disk 23 and detent 25 are located in the recess 18.

A shaft 26 is journalled in a recess 27 in the core 7, and extends forwardly therefrom into the recess 18, and has an escapement wheel 28 keyed thereto and a pinion 29 keyed to its forward end and forwardly of the escapement wheel 28. Escapement wheel 28 and pinion wheel 29 are disposed in the recess or chamber 18. As best seen in Fig. 6, the escapement wheel 28 is disposed behind and in partly overlapping relationship to the disk 23, and the pinion 29 is disposed in the same plane as the disk 23 and is located so as to mesh with the gear teeth 24, when the device 17 is in its initial and intermediate positions, as illustrated in Figs. 1 and 2, respectively.

A shaft 30 is seated in a recess 31 of the core 7 and projects forwardly therefrom into the chamber 18. An escapement or pallet 32 is disposed in chamber 18 and is swingably mounted on the shaft 30 which is provided with a head 33 which retains the pallet 32 in engagement with the shaft 30. Pallet 32, as seen in Figs. 1–3, is located adjacent the escapement wheel 28 and is provided with pawls 34 for alternately engaging the teeth of escapement wheel 28, to regulate the rotation thereof, in a conventional manner.

A pin 35 is anchored in the core 7 and protrudes therefrom forwardly into the chamber 18. A lever 36 is provided with an elongated slot 37 in which the pin 35 is loosely received and by means of which the lever 36 is pivotally and slidably mounted in chamber 18. The lever 36, as seen in Fig. 6, is disposed in the same plane as the stop or detent 25 and is provided with a portion 38 which is located in partial overlapping relationship to the disk 23 and which normally bears against the arcuate edge of the stop 25. Lever 36, on the opposite side of its pivot, is provided with an extension 39.

Referring to Fig. 6, the core 7 is provided with a bore having a restricted rear end 40, which opens into one of the bores 8 at its rear end, as seen in Fig. 4, and an enlarged forward end 41 having an internally threaded forward portion 42 which opens forwardly into the chamber 18. A bushing 43 is disposed in threaded engagement with the portion 42 and is provided with a bore of the same diameter as the bore portion 40 and which is in alignment therewith, for receiving a setback pin 44 which is reciprocally mounted in the bore portion 40 and the bushing 43. A collar 45 is suitably fixed to the pin 44 and is reciprocally disposed in the bore portion 41. A helical spring 46 is carried by the pin 44 and is contained in the bore portion 41, between the bed thereof and the collar 45, for urging the pin 44 forwardly and to its position of Fig. 4; in which position the forward end of the pin 44 protrudes into the chamber 18 and forms a stop against which the lever end 39 bears to prevent counterclockwise swinging movement of the lever 36 as seen in Figs. 1–3.

With the pin 44 thus disposed, as seen in Fig. 4, its rear end is disposed in the rear end of the bore portion 40 adjacent one of the radial bores 8 and slightly behind or outwardly of the plunger 9 which is disposed therein, for a purpose which will hereinafter be described.

A torsional spring 47 is located in the chamber 18 and is anchored to two spaced pins 48 which project from the housing 7 forwardly into chamber 18, as clearly illustrated in Figs. 1–3, and is provided with a free end which bears against the terminal of the lever end 39 and which is biased in a clockwise direction for urging the lever portion 39 against the setback pin 44 or in a counterclockwise direction.

As seen in dotted lines in Figs. 1, 2, and 3, a stop pin 49 projects upwardly from the bed of the well 19 and is disposed to be engaged by a portion of the member 20, when in its position of Figs. 1 and 2 to prevent back winding of the gear train beyond its starting position. A weighted arm 50 is swingably mounted in chamber 18 on a headed pin 51 which is anchored in core 7. A torsional spring 52 is anchored in a split pin 53 which projects into the chamber 18 from the core 7. Spring 52 bears against arm 50 for biasing said arm against a portion of the pallet 32 to resist rocking movement of the pallet to thereby prevent inadvertent movement of the gear train. The arm 50 is centrifugally swung out of engagement with the pallet 32, when the fuze is rotated in flight, to release the pallet and gear train for normal operation.

The parts of the device 17 which are contained in the chamber 18 are retained in place by means of a cover shown in dotted lines at 54, in Figs. 4 and 5.

Assuming the parts of the device 17 and of the fuze to be in their initial positions, as shown in Figs. 1 and 4, when a projectile, not shown, containing the parts is fired from a weapon, the initial acceleration of the projectile will cause the pin 44 to be set back against the thrust of its spring 46. This rearward movement of the pin 44 will cause the rear end thereof to move into the bore 8, into which the bore 40 opens, outwardly or behind the plunger 9 thereof, to form a stop to prevent radial outward retraction of said plunger 9 to a position where it will release the stem 11. Likewise, the rearward movement of the pin 44 will cause the forward end thereof to move out of the chamber 18 and out of engagement with the lever end 39. The lever 36 thus being released at its end 39 will slide in a direction substantially radially outward of the chamber 18 to the extend of its movement as permitted by the slot 37, so that said lever will move from its position of Fig. 1 to its position of Fig. 2. This movement is primarily produced by the free end of the spring 47 bearing against the terminal of the lever portion 39, but is also partially caused by the centrifugal force resulting from the rotation of the fuze. The rotation of the fuze will cause the segmental weighted element 20 to begin to revolve in a clockwise direction, as seen in Figs. 1 to 3, from its position of Figs. 1 and 2. The disk 23 and stop 25, being rotatively connected to the member 20, will be rotated therewith so that said stop 25 is rotated relatively to the concave edge of the lever portion 38. Likewise, the rotation of the parts 20, 23, and 25 are regulated by the escapement wheel 28 and pallet 32, due to the fact that the gear teeth 24 are in mesh with the pinion 29 which is rotatably connected to the escapement wheel 28. As the stop 25 approaches its position of Fig. 3, the gear teeth 24 move out of mesh with the pinion 29 to permit a final, free movement of the parts 20, 23, and 25, and as the trailing, substantially radial edge of the stop 25 clears the terminal of the lever portion 38, said lever end 38 is released and thereby permitted to swing by centrifugal force in a clockwise direction from its position of Fig. 2 to its position of Fig. 3. This clockwise movement of lever 36 causes its end 39 to move out of obstructing relationship to pin 44, and as deceleration of the projectile has already com-

menced, spring 46 will project the pin 44 forwardly and back to its position of Fig. 4, to release the plunger 9, which was held thereby, so that said plunger can be retracted radially outwardly and out of engagement with the sleeve 11. The other plunger 9 will have been previously moved outwardly by centrifugal force so that the fuze will have been held in a disarmed condition only by the plunger 9, which was engaged by the setback pin 44. Therefore, it will be readily apparent that the device 17 regulates the arming of the fuze when set for delay functioning. By simple expedient, such as varying the number of teeth 24, the length of time and the distance of flight required to arm the projectile fuze can be accurately regulated.

Various modifications and changes are contemplated and may obviously be resorted to without departing from the spirit and scope of the invention as hereinafter defined by the appended claims, as only a preferred embodiment thereof has been disclosed.

I claim:

1. A delay action arming device for projectile fuzes of the rotating type, comprising a setback pin movable, upon acceleration of a fuze in which it is contained, into a position to render the fuze safe, a release lever slidably and pivotally mounted relatively to the setback pin, a centrifugally actuated detent against which the lever bears, said pin being setback upon acceleration out of engagement with the lever whereby the lever is released for sliding movement into a position to prevent return of the setback pin, and said detent being movable by rotation of the fuze, to a position to disengage the lever, whereby the lever is centrifugally swung to a position in unobstructing relationship to the setback pin so that upon deceleration, said pin is free to move to a position to arm the fuze.

2. A delay action arming device as in claim 1, and escapement means for regulating the movement of the detent to a lever releasing position.

3. A delay action fuze as in claim 1, and a torsional spring for urging said lever into an obstructing position relatively to the setback pin.

4. In a fuze for projectiles of the rotating type having a firing means secured thereto, a core slidable in said fuze relative to said firing means, centrifugal means in said core engaging said firing means to hold the same and said core immovable relative to each other and a delay arming device for the fuze, comprising a setback pin movable upon acceleration of the fuze into contact with the centrifugal means to hold the same inactive against centrifugal force thereby rendering the fuze safe, a pivotally mounted release lever normally engaging the setback pin and centrifugally movable when released by setback of said pin, into an obstructing position relatively to the pin, and a centrifugally actuated detent, against which the lever bears, movable by centrifugal force of the fuze in flight, for releasing the lever for movement to a position in unobstructing relationship to the setback pin, and spring means cooperating with said setback pin and effective to move the same upon deceleration of the fuze in the direction of its flight, away from the centrifugal means to release said firing means and said core for relative movement to each other, thereby arming the fuze.

5. A delay arming device as in claim 4, and escapement means for controlling the centrifugally impelled movement of the detent.

6. A delay arming device as in claim 4, said release lever being mounted for sliding and pivoting movement.

7. A delay arming device as in claim 4, said release lever being mounted for sliding and pivoting movement, and a torsional spring bearing against the release lever for urging it into an obstructing position relatively to the setback pin.

8. A delay arming device as in claim 4, a gear segment rotatable with the detent, a pinion in mesh with the gear segment, an escapement wheel rotatable with the pinion, and a pallet for governing the step by step rotation of the escapement wheel.

9. In a delayed action arming device for a projectile fuze of the rotating, centrifugally-armed type, a support adapted for attachment with a projectile and rotatable therewith about a longitudinal axis, an arming plunger fitting a radial bore in said support and slidable, in response to centrifugal force, from a safe position to a fuze-arming position, a setback pin slidable in said support in response to acceleration, from a first position to a second position in the path of said plunger and, when in second position, preventing movement of said plunger to fuze-arming position, means urging said pin into first position, a segmental-shaped stop pivoted in said support, centrifugally-operated means connected with said stop to pivot the same, escapement means carried by said support and normally connected to control the rate of rotation of said stop, a lever slidably and pivotally mounted in said support, spring means urging said lever into a position with respective ends in contact with said stop and pin, said pin when moved to second position, releasing one end of said lever for movement into the path of said pin to hold the same in second position, said stop when rotated to predetermined position under control of said escapement, releasing the other end of said lever to permit movement thereof out of said obstructing relation to free said pin and permit arming of said fuze.

10. In a delay action arming device for projectile fuzes of the rotating type, a plunger movable in response to centrifugal force from a safe position to a fuze-arming position, a lever slidably and pivotally mounted for movement into first, second and third consecutive positions, means urging said lever into said positions, consecutively, a pin and a movable stop normally engaging opposite ends of said lever, respectively, to hold the same in first position, said pin being movable, in response to linear acceleration, to release said lever for movement to second position and simultaneously to obstruct movement of said plunger to fuze-arming position, said lever in second position obstructing return movement of said pin, and centrifugally-operated time-controlled means operable to move said stop out of contact with said lever to permit movement of said lever to third position, said lever in third position again releasing said pin for movement to free said plunger.

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