Aug. 31, 1948. J. F. McCASLIN ET AL 2,448,228

DELAY BOOSTER ARMING MECHANISM

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Fig. 1.

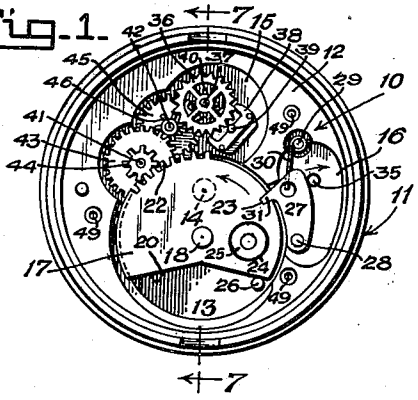


Fig. 4.

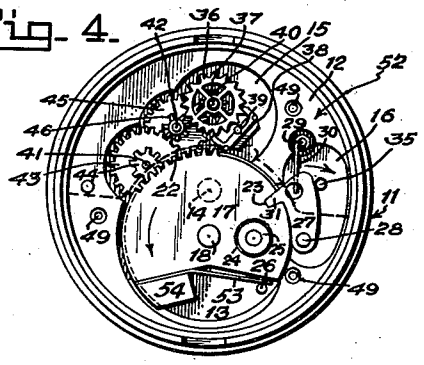


Fig. 2.

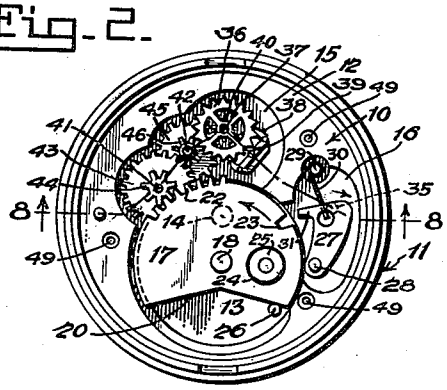


Fig. 5.

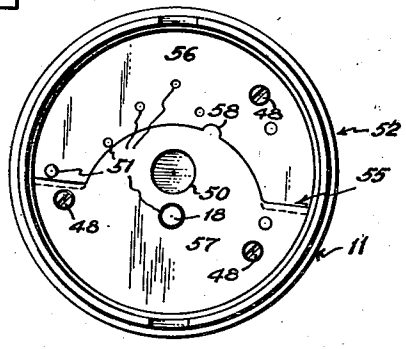


Fig. 3.

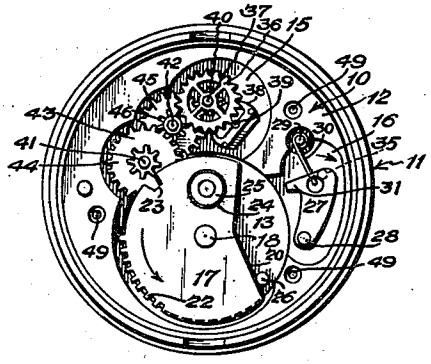
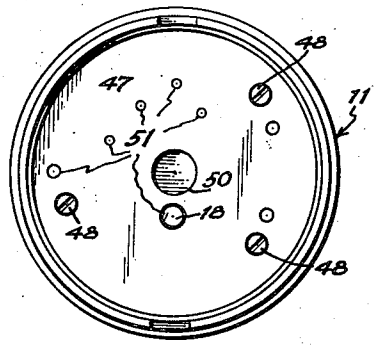


Fig. 6.



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Fig. 7.

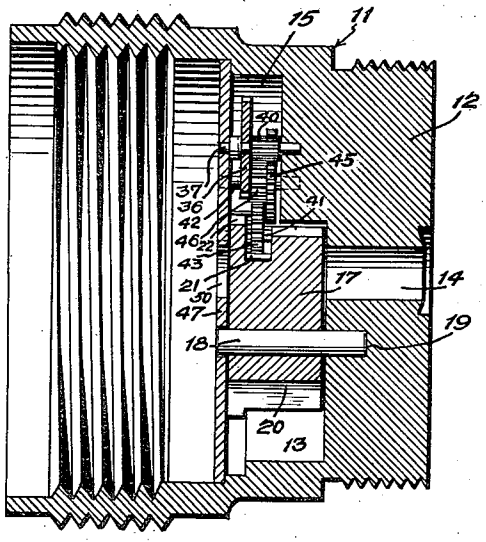


Fig. 9.

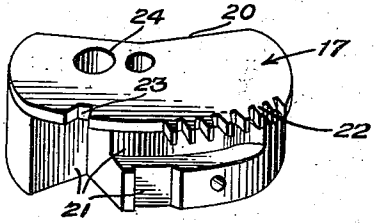
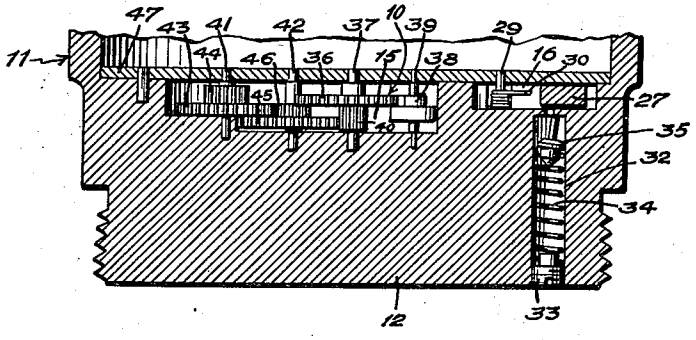


Fig. 8.



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DELAY BOOSTER ARMING MECHANISM

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Application May 24, 1945, Serial No. 595,512

9 Claims. (Cl. 102—83)

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This invention relates to an improved delay arming means for a booster of a rotatable type projectile which is interposed in a projectile between its fuze and booster, for interrupting the communication therebetween for a predetermined portion of the flight of the projectile, to thereby maintain the projectile in a safe condition during the initial stage of its flight and until it is at a sufficient range from the gun so that its detonation will not endanger the gun crew.

More particularly, it is an object of the invention to provide a device for the above described purpose which is of very simple construction and which is controlled by a gear train, to one end of which is connected an escapement means, and which is driven by a centrifugally actuated rotor which forms a carrier for means, forming a part of an explosive train, between the fuze and its booster, and which is initially disposed in a non-registering position to interrupt the explosive train, and thereafter moved by centrifugal force to a registering position, to function as a part of the explosive train to thereby arm the projectile at a predetermined point in its flight.

A further object of the invention is to provide a compact and efficiently operating structure for the above described purpose wherein the rotor or detonator carrier is utilized as the weighted element, actuated by centrifugal force for driving the gear train and escapement means, so that the regulated element provides the actuator for the regulating means.

Another object of the invention is to so construct the device that it can be readily assembled in the coupling member or housing which connects a fuze and booster, with only slight modification of said housing.

Still a further aim of the invention is to provide a safety device which will require no preparation for firing and which will consequently function automatically, thereby eliminating the possibility of duds resulting from a failure to manually arm the device prior to firing.

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

Figure 1 is a plan view of one form of the invention and showing the parts in their initial, unarmed positions;

Figure 2 is a similar view showing the parts in an intermediate position;

Figure 3 is a view similar to Fig. 1 and showing the device in a fully armed position;

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Figure 4 is a view similar to Fig. 1 of a slightly different form of the invention;

Figure 5 is a plan view of the device, shown in Fig. 4, with the cover shown applied thereto;

Figure 6 is a view similar to Fig. 5 of the embodiment of Figs. 1 to 3;

Figure 7 is an enlarged sectional view on the line 7—7 of Fig. 1;

Figure 8 is an enlarged sectional view on the line 8—8 of Fig. 2; and

Figure 9 is a perspective view of one of the parts of the device, shown detached.

Referring more particularly to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, and referring particularly to Figs. 1 to 3 and 6 to 9, 10 designates generally the delay arming device in its entirety and which includes a housing designated generally 11 which forms a coupling between a conventional fuze and a conventional booster, not shown, of the type which are mounted in the nose of a rotatable type projectile, not shown. As best seen in Fig. 7, the housing 11 is provided with a substantially solid rear portion 12 which is recessed to form a forwardly opening rotor well 13. In body portion 12 is provided a flash passage 14, in the rear part thereof, which has an open rear end adapted to communicate with a booster, not shown, and an open forward end which opens into the well 13, for a purpose which will hereinafter become apparent. The body portion 12 is also provided with forwardly opening recessed portions 15 and 16, as seen in Fig. 8, both of which communicate with portions of the well 13.

A rotor 17 is mounted rotatably in the well 13 on a shaft 18, the lower end of which is journalled in a recess 19 of the body 12, as clearly illustrated in Figs. 1 to 3. As best seen in Fig.9, the rotor 17 is provided with a recessed portion 20 in one segment thereof, and substantially in opposed relationship to the recessed portion 20, rotor 17 is provided with milled out portions 21 which are undercut and which extend from the bottom or rear face of the rotor to a point adjacent the top or front thereof, for reducing the weight of the rotor in one of its segments, for a purpose which will hereinafter become apparent. A portion of the top surface or forward face of the rotor 17 is extended outwardly and said portion is cut to form a gear segment 22 and is also provided with a notch 23 which is spaced from the gear segment 22 in a clockwise direction. Rotor 17 has a bore 24 extending therethrough, from side to side thereof, and which is disposed off-center of the

rotor and which contains a detonator 25. A pin 26 is anchored in the body 12 and projects into the well 13 and into the space provided by the recess 20.

Recess 16 contains a pawl or detent 27 which is loosely disposed therein and pivotally mounted on a pin 28 which extends into the recess 16 from the body 12. A post 29, which is anchored in the body 12 and projects into the recess 16, anchors a torsional spring 30, the free end of which engages with the free end of the pawl 27 for urging the pawl inwardly and toward the rotor 17. Pawl 27 is provided with a bill 31 which is received in the outwardly opening notch 23, when the rotor 17 is turned to the limit of its movement in a clockwise direction, as governed by the pin 26, as seen in Fig. 1. Referring to Fig. 8, the body 12 is provided with a bore 32 the open rear end of which is closed by a removable threaded stop 33 which forms a seat for a helical spring 34. The spring 34 bears against a setback pin 35 which has a restricted forwardly projecting stem which extends through the restricted forward end of the bore 32 and into the recess 16, behind the pawl 27, when said pawl is in its position of Fig. 1. Thus, the setback pin 35 functions, prior to acceleration of a projectile in which the device 10 is mounted, for locking the pawl in engagement with the rotor.

The recess 15 contains an escapement including an escapement wheel 36 which is keyed to a shaft 37 and a pallet 38 which is keyed to a shaft 39 and which has pawls at the ends thereof for alternately engaging the teeth of the escapement wheel 36 for regulating the rotation thereof. A pinion 40 is keyed to the shaft 37 and is disposed behind the escapement wheel 36. Two shafts 41 and 42 are also rotatably disposed in the recess 15. Shaft 41 has a gear 43 and a pinion 44 keyed thereto. The pinion 44 is disposed forwardly of the gear 43 and meshes with the teeth of the gear segment 22. The shaft 42 has a gear 45 keyed thereto and which meshes with the pinion 40. A pinion 46 is keyed to the shaft 42, forwardly of the gear 45 and meshes with the gear 43. The gears, pinions, and shafts combine to form a gear train for connecting the rotor 17 to the escapement, formed by the escapement wheel 36 and the pallet 38. The rear ends of the shafts 37, 39, 41 and 42 are journalled in recesses in the body 12 as illustrated in Figs. 7 and 8.

As seen in Fig. 6, the housing 11 is provided with a cover 47 which is removably mounted in the open forward part thereof to provide a closure for the recesses 13, 15, and 16 and a cover for the parts contained therein. The cover 47 is secured in place by means of a plurality of screw fastenings 48 which extend therethrough and which engage threaded recesses 49 in the body 12. Cover 47 is provided with a central opening 50 which is disposed centrally of the housing 11 and in alignment with the flash passage 14. The cover 47 is also provided with a plurality of openings 51 of varying sizes into which the forward ends of all the shafts, previously described, extend and which provide pivots or bearings for said shaft ends, as best illustrated in Fig. 8.

As clearly illustrated in Figs. 1 to 3, the rotor 17 is disposed off-center of the housing 11. Assuming that the delay arming device 10 is mounted in a rotatable type projectile, not shown, coupled between a fuze and booster, now shown, prior to firing of the projectile the parts will be in the positions as seen in Fig. 1. When the projectile is fired from a weapon, upon initial acceleration thereof the setback pin 35 will be set back against the spring 34 and out of engagement with the restricted forward end of the bore 32 and due to the shape of the setback pin, as seen in Fig. 8, and because of the fact that the spring 34 will bear unevenly thereon, said pin will rock in the bore 32 sufficiently so that upon deceleration its stem will not find its way back into the restricted forward end of the bore 32 and will consequently be "locked out" in a setback position. After setback of the pin 35, centrifugal force will act on the pawl or detent 27 to cause it to swing outwardly against the action of its spring 30 and out of engagement with the notch 23, as seen in Fig. 2. This will release the rotor 17 which has been previously held thereby in a position in which the detonator 25 is out of alignment with or in a non-registering position relative to opening 50 and the flash passage 14. Upon release by the pawl 27, the rotor 17 will be actuated by centrifugal force for rotation in a counterclockwise direction, due to the fact that the preponderance of its weight is in the left hand part of said rotor, as seen in Figs. 1 and 2, due to the milled out portions 21. This counterclockwise rotation of the rotor 17 will be regulated by the escapement 36, 38 through the gear train to limit the rotational speed of the rotor 17 so that the distance of flight of the device 10 before the rotor has reached its position of Fig. 3 can be accurately predetermined, and varied at will by the simple expedient of varying the number of teeth provided in the gear segment 22. The gear segment 22 is arranged so that it will move out of engagement with the pinion 44 prior to completion of the movement of rotor 17 to its armed position of Fig. 3, so that said rotor will have an unimpeded final movement. The stop 26 engages the rotor to stop the movement thereof in its armed position in which the detonator 25 is in alignment with passage 14 and opening 50. With the rotor thus disposed it is still urged by centrifugal force which combines with the stop 26 to retain the rotor in an armed position and the detonator in registry with passage 14 and opening 50. Thus, the flash from a primer in a fuze, not shown, will explode the detonator 25, the flash from which will pass through passage 14 for detonating the booster, not shown, which is mounted directly behind the housing 11.

The delay arming device 52, illustrated in Figs. 4 and 5, differs only slightly from the device 10 and the parts which have not been modified will therefore not be again described. The rotor 17 thereof is modified only to the extent that it is provided with a torsional spring 53, one end of which is anchored to a face of the recessed portion of the rotor by means of a block 54. The free end of the spring 53 bears against the stop 26 and is disposed between the stop and the other face of the recessed portion of the rotor. Consequently, when the device 52 is revolved and the pawl 27 is retracted out of engagement with the notch 23 by centrifugal force, the spring 53 through engagement with the stop 26 will impart the initial counterclockwise movement to the rotor 17 independent of the centrifugal force exerted thereon.

Instead of the cover 47, the device 52 is provided with a cover 55 formed of the sections 56 and 57. The section 56 is shaped to cover the recesses 15 and 16 and parts contained therein and the section 57 is shaped to cover the well 13 and the rotor 17. Said sections are provided with the openings 51, for the purpose previously de-

scribed and also the opening 50, and each of the sections is separately attached to the body 12 by screw fastenings 48. The abutting edges of these sections are provided with a projection and receiving indentation as seen at 58 to prevent either section being applied in an inverted position. The section 56 is also provided with portions which fit under overlying portions of the section 57 so that the section 57 must be applied last and removed first. The separately removable cover sections permit the section 56 to be applied and thereafter and at a future time the bore 24 has a detonator 25 applied thereto after which the cover section 57 is applied. This eliminates the possibility of the gear train being jammed or damaged by improper application of the cover to the shafts thereof, as the cover section 56 can be applied at the time of manufacture and need never be removed.

In view of the detailed description of the delay arming device 10, a further description of the operation of the delay arming device 52 is considered unnecessary.

Various other modifications and changes in the construction and arrangement of the parts forming the invention 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 preferred embodiments have been disclosed.

We claim:

1. A delay arming device for boosters comprising a housing disposed between a fuze and a booster in a rotatable type projectile, a rotor, means rotatably disposing the same in an off-center position in the housing and having a detonator contained therein and normally disposed in a non-registering position relative to the fuse and the booster, said rotor having a slotted portion providing an overhanging flange, an integral gear segment formed on said overhanging flange, a gear train including a pinion of a predetermined diameter and a gear having a diameter greater than that of said pinion and concentric therewith, said slotted portion of said rotor receiving said gear whereby said pinion is adapted to be engaged and driven by said integral gear segment for activating said gear train by rotation of said rotor, and an escapement means associated with said gear train for regulating the same and thereby the speed of rotation of the rotor, when actuated by centrifugal force, to govern the length of time and the distance of flight of the projectile required to move the detonator to a registering position with the fuse and the booster.

2. A delay arming device as in claim 1, and a spring projected centrifugally retracted detent for engaging said rotor when in its initial position to prevent movement of the rotor and gear train, said detent being moved outwardly by centrifugal force to release the rotor.

3. A delay arming device as in claim 1, said rotor having a recessed portion, a stop anchored in the housing and projecting into said recessed portion for engaging a portion of the rotor when the detonator is in a registering position.

4. A delay arming device as in claim 1, said rotor having a recessed portion, a stop anchored in the housing and projecting into said recessed portion for engaging a portion of the rotor when

the detonator is in a registering position, and a spring fixed to the rotor and disposed in the recessed portion thereof to bear against the stop and to initially urge the rotor from its non-registering toward its registering position.

5. A delay arming device as in claim 1, said housing having a cover removably disposed over the parts contained in the housing and provided with a plurality of openings forming pivots for the corresponding ends of the shafts of the gear train.

6. A delay arming device as in claim 1, said housing having a cover removably disposed over the parts contained in the housing, said cover being formed of separately removable sections, one of said sections covering the rotor and the other section covering the gear train and escapement.

7. A delay arming mechanism for boosters of rotatable projectiles comprising a housing forming a coupling between a fuze and booster, a rotor, means mounting the same for rotation in the housing in an off-center position therein, said rotor having a recessed portion and a bore extending therethrough and containing a detonator, a spring projected, centrifugally retracted pawl engaging the recess of the rotor for normally holding it so that the detonator is in a non-registering position relative to the fuse and the booster, said rotor having a slotted portion providing an overhanging flange, an integral gear segment formed on said overhanging flange, a gear train including a pinion of a predetermined diameter and a gear having a diameter greater than that of said pinion and concentric therewith, said slotted portion receiving said gear whereby said pinion is adapted to be engaged and driven by said integral gear segment for activating said gear train by rotation of said rotor, and an escapement means associated with said gear train for regulating the same and thereby regulating the movement of the rotor when the pawl is retracted from said recess by centrifugal force and the rotor is centrifugally rotated for moving the detonator to a registering position with the fuse and the booster.

8. A delay arming device as in claim 7, a stop anchored in the housing and extending into the recessed portion of the rotor, and a spring carried by the rotor and bearing against the stop for initially urging the rotor toward a detonator registering position.

9. A delay arming device as in claim 7, the gear segment of the rotor being arranged to disengage the gear train during the centrifugal movement of the rotor to provide an unrestricted final movement of the rotor to a detonator registering position.

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