Sept. 28, 1937. H. H. ZORNIG 2,094,032

FUSE FOR BOMBS

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Fig. 1.

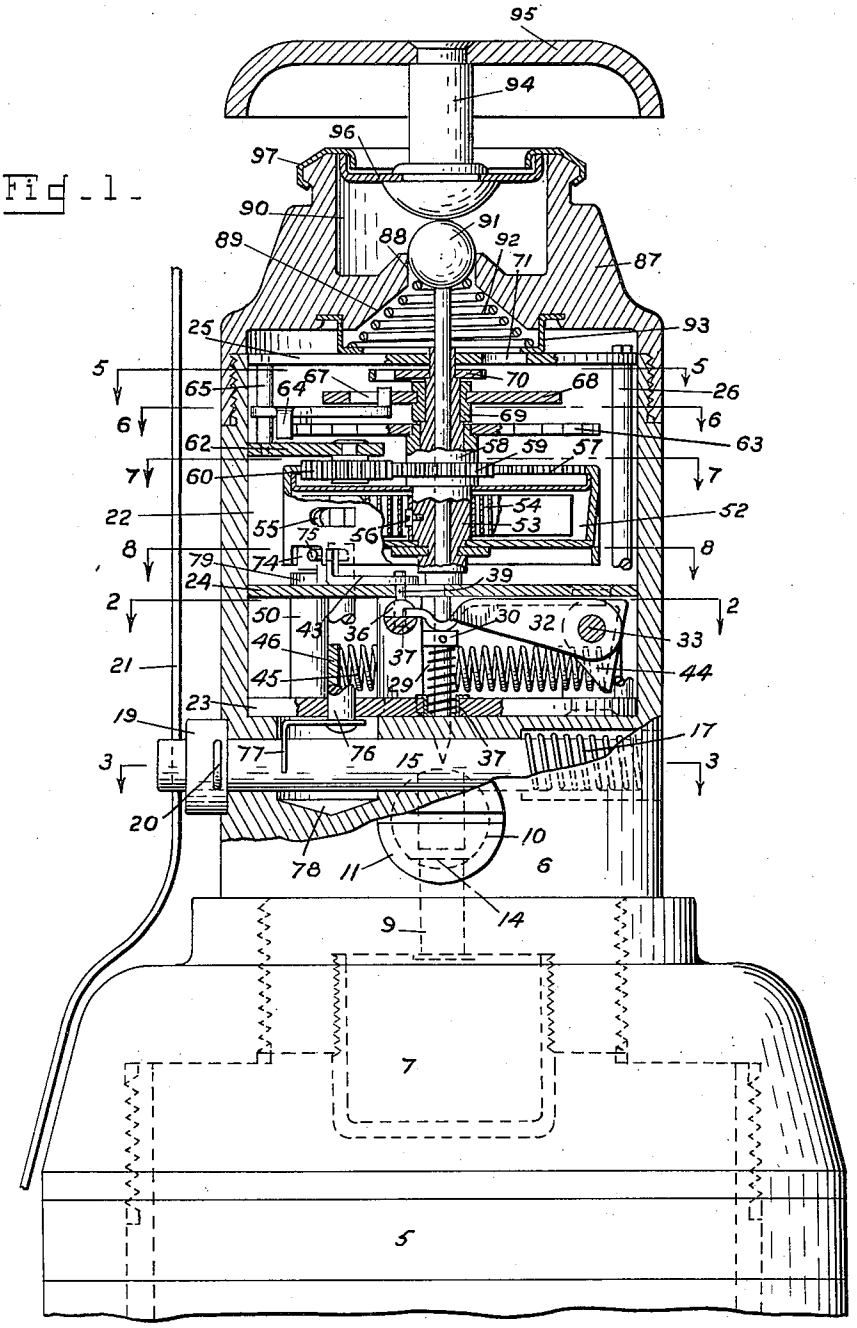

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Fig. 2.

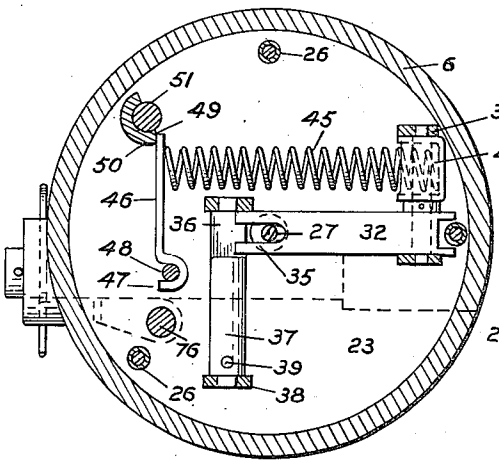

Fig. 3.

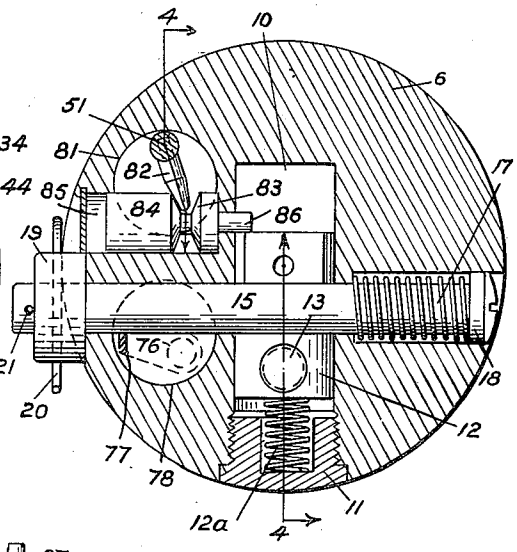

Fig. 4.

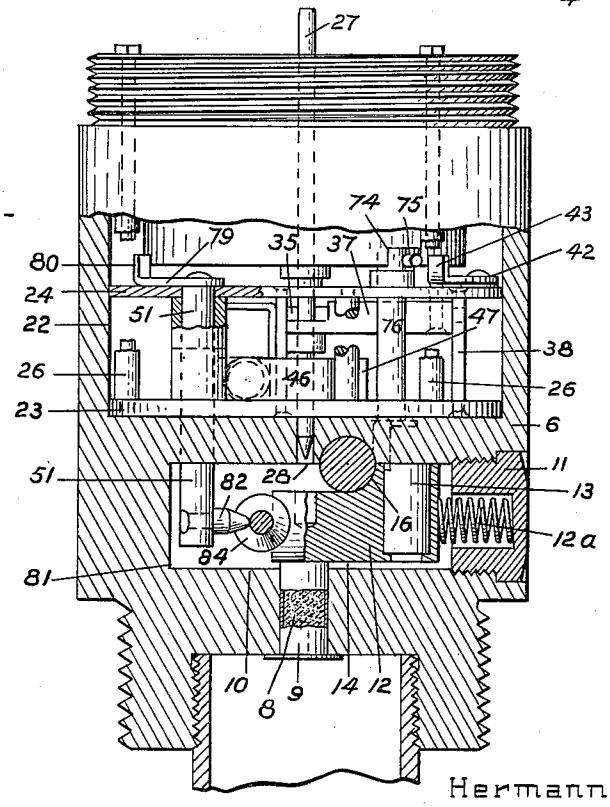

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Fig. 5.

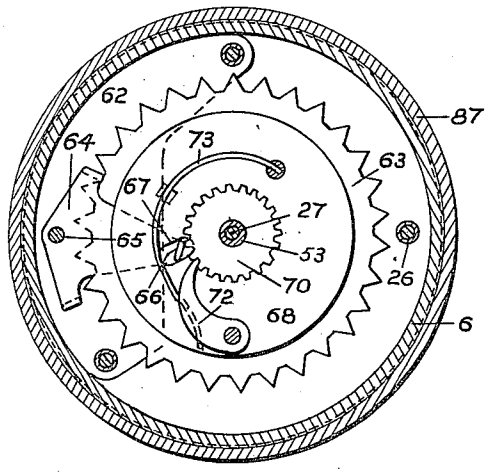


Fig. 6.

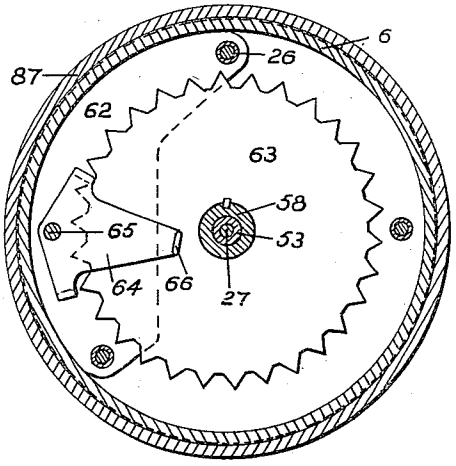


Fig. 7.

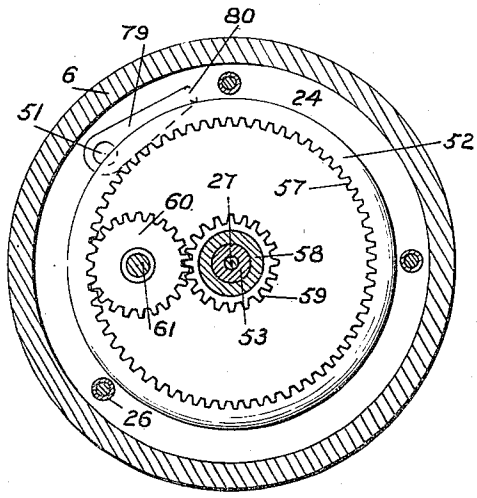
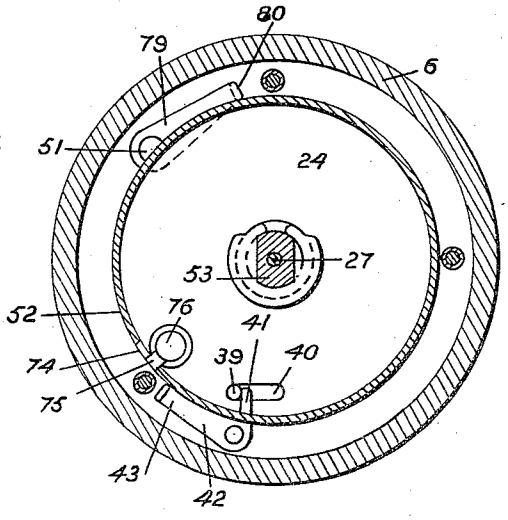


Fig. 8.



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2,094,032

UNITED STATES PATENT OFFICE

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FUSE FOR BOMBS

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Application March 20, 1936, Serial No. 69,854

5 Claims. (Cl. 102—37)

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

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 a fuse for a bomb.

In dropping bombs from low-flying aircraft it is desirable that the bomb remain in flight and the fuse remain unarmed until such time as the aircraft has gained sufficient distance from the place of impact to assure its safety from the effects of the explosion. The delay in flight is obtained by providing the bomb with some form of parachute.

The purpose of this invention is to provide a timing mechanism for controlling delayed arming of a fuse and also for controlling a firing mechanism after a predetermined interval of time.

A further object is to provide an arrangement wherein a single spring is adapted to actuate a hammer and the delay arming mechanism.

With the foregoing and other objects in view, the invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed. it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A practical embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a longitudinal sectional view with parts in elevation of a fuse constructed in accordance with the invention.

Figs 2 and 3 are sectional views on the corresponding lines of Fig. 1.

Fig. 4 is a fragmentary view with parts in side elevation and parts in section on the line 4—4 of Fig. 3.

Figs. 5 to 8 are sectional views on the corresponding lines of Fig. 1.

Referring to the drawings by characters of reference there is shown a bomb 5 (Fig. 1) having a threaded opening for attachment of a fuse body 6. The fuse body carries a booster charge 7 and a booster lead 8 which is contained in a tube 9 positioned axially of the body and extending forwardly to a transverse passage 10 having one end closed by a plug 11.

A cylindrical slide 12 mounted in the passage 10 and adapted to be moved to armed position by a spring 12a (Fig. 4) carries a detonator 13 and has a flattened side 14 engaged by the tube 9 and held thereby against rotational displacement. The slide is normally held in safe position with the detonator 13 out of line with the booster lead 8 by means of an arming bolt 15 (Figs. 1, 3 and 4) extending through the fuse body transversely of the slide and engaging a shoulder 16 of the slide. A spring 17 acting on the head 18 at one end of the bolt normally tends to eject the bolt from the fuse body. The bolt is held against the action of the spring by means of a washer 19 mounted on the other end of the bolt outside the fuse body and retained by a cotter pin 20 during storage and by an arming wire 21 passing through the bolt when the bomb is placed in the rack of an aircraft. The arming wire is part of a conventional launching apparatus and is withdrawn from the bolt when the bomb is dropped.

The forward part of the fuse body 6 is formed with a large chamber 22 (Fig. 1) for receiving timing, firing and slide control mechanisms. These mechanisms are carried in a frame consisting of an inner plate 23, a center plate 24 and an outer plate 25 spaced by means of tubular separators 26. When the frame is inserted in the chamber 22 the inner plate rests on the floor thereof and the outer plate is at the forward edge of the fuse body.

A firing pin 27 disposed axially of the fuse extends through all of the plates of the frame and is normally in the position shown in Fig. 1, with its outer end projecting from the outer plate 25 and its inner end projecting through the inner plate 23 and through a passage 28 in the fuse body leading to the passage 10. The firing pin is held in the normal safe position by a spring 29 confined between the inner side of a collar 30 on the firing pin and a cup 31 in the inner plate 23. Movement of the firing pin under the influence of the spring is limited by a hammer 32 which is mounted on a pivot pin 33 between cheeks 34—34 fixed between the inner plate 23 and center plate 24, and has one arm 35 positioned between the outer side of the collar 30 and the center plate 24.

The extremity of the arm 35 (Figs. 1, 2 and 4) rests in a notch 36 of a bolt 37 which is pivotally mounted between cheeks 38—38 fixed between the inner and center plates. A pin 39 on the bolt projects through an elongated slot 40 (Fig. 8) in the center plate and is engaged by an arm 41 of a latch 42 which is pivotally mounted in the center plate and has another arm 43 which is arranged to be releasably held by the barrel 52 of the timing mechanism as will be described

hereinafter. The other arm 44 (Fig. 2) of the hammer is engaged by a coil spring 45 normally tending to rotate the hammer and actuate the firing pin. The spring is seated on a lever 46 having a hooked end 47 fulcrumed on a pin 48 and having its outer end engaging a shoulder 49 formed on a sleeve 50 fixed on a shaft 51 extending through the inner plate 23 and center plates 24 of the frame.

The timing mechanism is positioned between the center plate 24 and outer plate 25 and will be but briefly described as its major differences from a conventional clock-work are covered in a separate application. It comprises a barrel 52 (Fig. 1) rotatably mounted on a hollow spindle 53 which is seated on the center plate 24 and through which the firing pin passes. A spiral main spring 54 within the barrel has its outer end connected to a hook 55 on the barrel and its inner end is connected to a pin 56 carried by the spindle. The outer end of the barrel is provided with a ring gear 57.

A sleeve 58 rotatably mounted on the spindle carries a pinion 59 which meshes with an idler 60 which in turn meshes with the ring gear 57. The arbor 61 of the idler is mounted in a segmental plate 62 carried by some of the tubular separators 26. An escapement wheel 63 is fixed on the sleeve 58 and therefore moves with the pinion 59.

A pallet 64 whose arbor 65 is mounted between the segmental plate 62 and outer plate 25 engages the teeth of the escapement wheel 63 and has an arm 66 engaging a slot 67 in a balance wheel 68. The balance wheel is fixed to a sleeve 69 rotatably mounted on the spindle on the outer side of the sleeve 58. The escapement functions in the conventional manner to control movement of the barrel 52.

A winding gear wheel 70 is fixed on the outer end of the spindle directly underneath the outer plate 25 which is provided with an aperture 71 for insertion of a winding key (not shown). The winding gear wheel 70 is held against counter-clockwise movement by means of a pawl 72 (Fig. 5) and pawl spring 73 both carried by the outer plate 25.

The inner end of the barrel 52 is provided with a recess 74 (Fig. 4) for receiving a locking pin 75 constituting an arm of a lever and fixed on the outer end of a shaft 76 which extends through the center plate 24 and inner plate 23 inside the periphery of the barrel. An arm 77 on the inner end of the shaft is disposed in a cavity 78 in the fuse body and normally bears against the bolt 15 whereby the shaft 76 is held against rotation and the pin 75 holds the barrel against action of the main spring. The barrel is not released until the bolt is ejected upon launching the bomb. As clearly shown in Fig. 4 the arm 43 of the latch bears against the rim of the barrel adjacent the recess 74 and is held by the barrel.

The outer end of the shaft 51 (Figs. 2 and 4) carries a lever arm 79 having a upright finger 80 bearing against the rim of the barrel. The inner end of the shaft 51 extends into a cavity 81 (Fig. 3) in the fuse body and carries a lever arm 82 inserted in an annular groove 83 in a bolt 84. The bolt is slidably mounted in a passage 85 and is normally held at the inner end of the passage with a reduced pin 86 projecting into the path of movement of the slide 12 and holding the slide in the unarmed position with the detonator 13 out of line with the firing pin. The hammer spring 45 acting through the lever 46 on the sleeve 50 normally holds the lever arm 79 against the barrel and tends to move the lever arm 82 to withdraw the bolt 84 from the path of the slide 12.

A fuse head 87 (Fig. 1) threaded to the fuse body and closing the chamber 22 carries a striker mechanism which is covered in a separate application and will be but briefly described. The fuse head is formed with a central passage 88 which is in communication with a flared recess 89 in the inner side of the head and a cylindrical recess 90 in the outer side of the head. A ball 91 in the passage is seated on the firing pin 27 and on a valve spring 92 carried by a cup 93 fixed in the fuse head.

A striker 94 with a large impact plate 95 on its outer end has its inner end engaging the ball 91 and carries a rocker plate 96 laterally confined by the walls of the recess 90 and retained by a cap 97 on the end of the fuse head. On impact the striker will be directly driven into the fuse or caused to pivot about an edge of the rocker plate and thereby actuate the firing pin.

The parts of the fuse are in the normal safe position shown in Figs. 1–4 with the arming bolt 15 and the bolt 84 both holding the detonator slide in unarmed position. The arming bolt 15 also prevents movement of the timing mechanism through the instrumentality of the lever 75—76—77. When the bomb is placed in the bomb rack of an aircraft preparatory to being launched the arming wire 21 is applied to the arming bolt 15 and the cotter pin 20 removed.

Upon launching the bomb the arming wire 21 is withdrawn and the spring 17 immediately ejects the arming bolt 15 from the fuse body, the slide now being solely held by the control mechanism 79, 51, 82, 85. The arm 77 is no longer opposed by the arming bolt 15 and the barrel 52 of the timing mechanism commences to be rotated in a clockwise direction under the influence of the main spring 54 and rotates the locking pin 75 until it is clear of the recess 74 in the barrel.

The rotation of the barrel is controlled by the escapement in the conventional manner and in the present example the barrel makes one revolution in ten seconds. When the barrel has moved one-third of a revolution corresponding to a time interval of three and one-third seconds, the recess 74 of the barrel is opposite the finger 80 of the lever arm 79 which is moved through the recess because the shaft 51 is now free to be rotated by the hammer spring 45. During such rotation of the shaft, the lever arm 82 on its lower end withdraws the bolt 84 from the path of the slide 12 which is now moved by its spring 12*a* to an armed position with the detonator 13 in line with the firing pin 27 and booster lead 8. The movement of the lever is arrested when the bolt is brought up against the outer end of its passage.

The fuse is now armed after the lapse of three and one-third seconds from the time of launching and if impact thereafter occurs the firing pin 27 will be driven into the detonator to set off the bomb.

If impact does not occur, or if it is not accompanied by sufficient force to drive the firing pin into the detonator, the barrel 52 continues its clockwise rotation under the action of the main spring. When the barrel has moved slightly less than one complete revolution the recess 74 is opposite the upright end of the latch arm 43 which heretofore has been bearing against the

barrel to restrain the latch **42** and now moves through the recess **74**. Since the latch is now released it no longer opposes the pin **39** on the bolt **37** and the latter is immediately rotated by the arm **44** of the hammer **32** under the action of the hammer spring **45**. The hammer drives the firing pin **27** into the detonator **13** to explode the charge.

I claim.

1. In a fuse, a casing, a timing mechanism in the casing and including a barrel, a slide mounted for movement transversely of the casing, a spring for moving the slide, a bolt in the path of movement of the slide, a lever for moving the bolt and having an arm engaging the barrel and held thereby for a predetermined time after starting of the timing mechanism, a spring for moving the lever when released by the timing mechanism, and a firing hammer under the influence of said spring.

2. In a fuse, a frame having a plate with a slot, a timing mechanism in the frame including a barrel, a firing pin extending through the frame, a pivoted hammer engaging the firing pin, a rotatably mounted bolt having a notch for seating the extremity of the hammer, a spring acting on the hammer and holding it in engagement with the bolt and firing pin, a pin on the bolt extending through the slot in the plate of the frame, a latch pivotally mounted on the plate having one arm engaging the pin on the bolt and having another arm engaging the barrel of the timing mechanism, and released therefrom after a predetermined interval.

3. In a fuse, a casing, a timing mechanism in the casing, a firing pin in the casing, a pivoted hammer engaging the firing pin, a rotatably mounted bolt having a notch for seating the extremity of the hammer, a spring acting on the hammer and holding it in engagement with the bolt and firing pin, and a latch controlled by the timing mechanism and controlling rotation of the bolt.

4. In a fuse, a casing, a firing pin in the casing, a slide carrying an explosive element adapted to be set off by the firing pin, a timing mechanism in the casing, a lever controlling release of the slide and controlled by the timing mechanism, a hammer for actuating the firing pin, a spring common to the lever and hammer, and means controlled by the timing mechanism and controlling release of the hammer.

5. In a fuse, a casing, a firing pin in the casing, a slide carrying an explosive element adapted to be set off by the firing pin, a timing mechanism in the casing, a lever controlling release of the slide and controlled by the timing mechanism, a hammer for actuating the firing pin, and a spring common to the lever and hammer.

HERMANN H. ZORNIG.