June 15, 1937. C. F. HOFSTETTER 2,083,564

FUSE FOR BOMBS

Filed Nov. 11, 1936 3 Sheets-Sheet 1

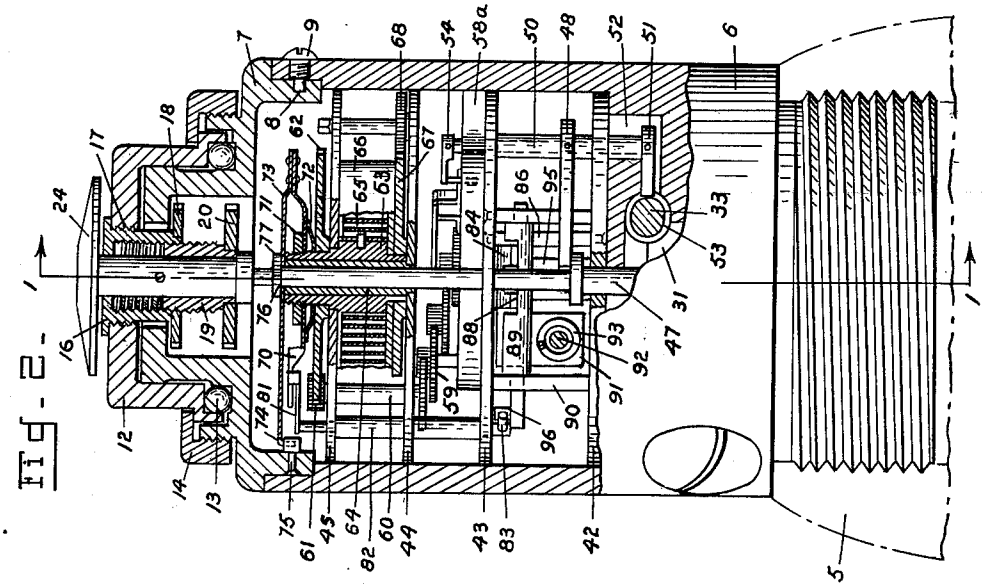


Fig. 2.

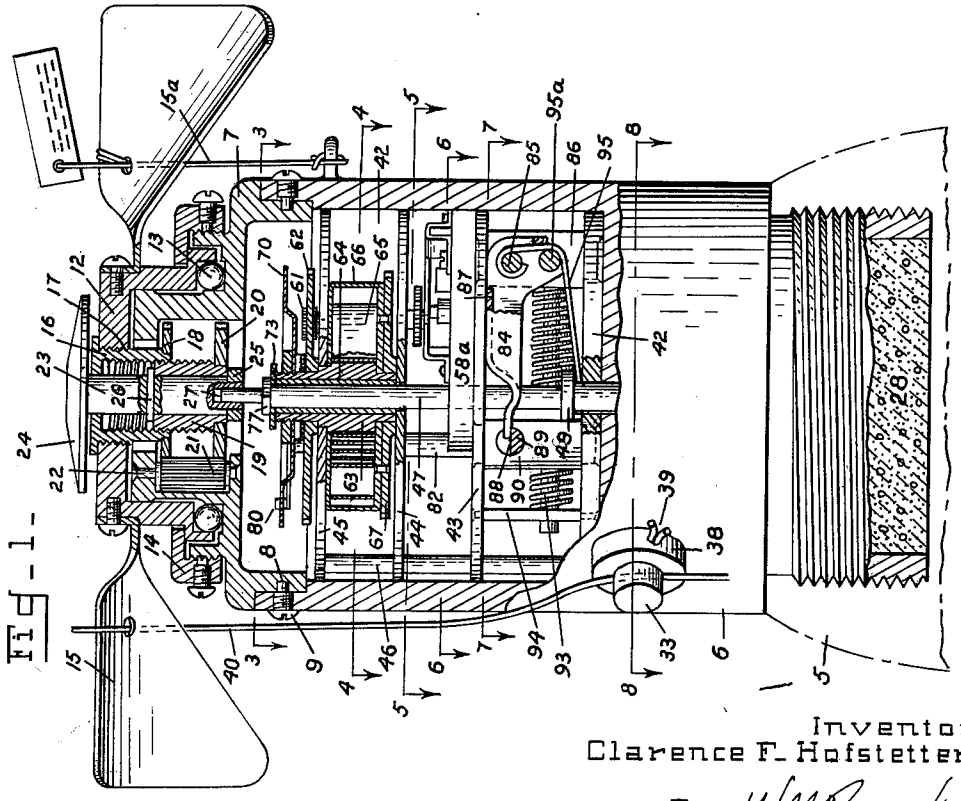


Fig. 1.

Inventor
Clarence F. Hofstetter
By W. N. Roach
Attorney

June 15, 1937. C. F. HOFSTETTER 2,083,564

FUSE FOR BOMBS

Filed Nov. 11, 1936 3 Sheets-Sheet 2

Fig. 3.

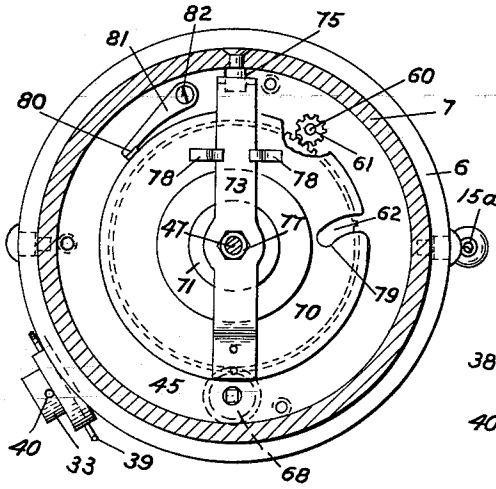


Fig. 4.

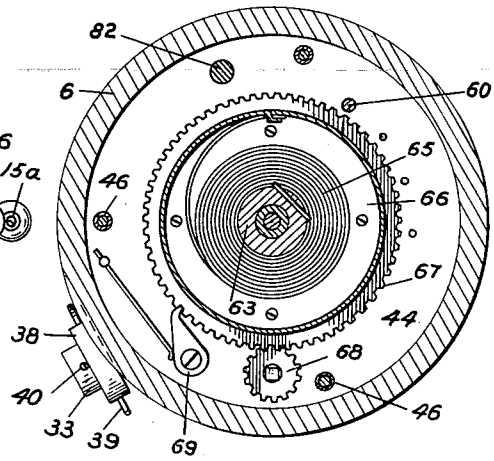


Fig. 5.

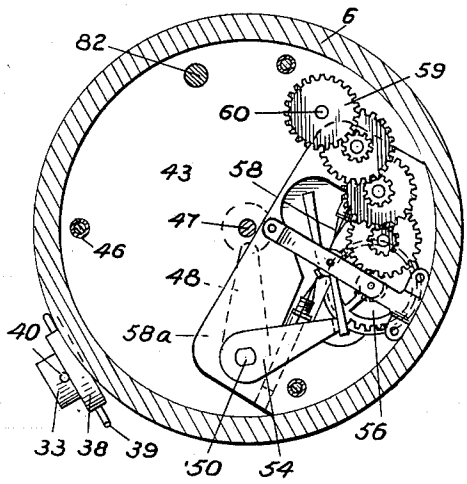
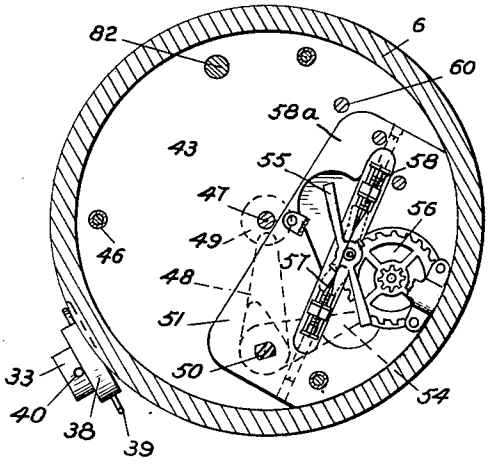


Fig. 6.



Inventor
Clarence F. Hofstetter
By W. N. Roach
Attorney

June 15, 1937. C. F. HOFSTETTER 2,083,564

FUSE FOR BOMBS

Filed Nov. 11, 1936 3 Sheets-Sheet 3

Fig. 7.

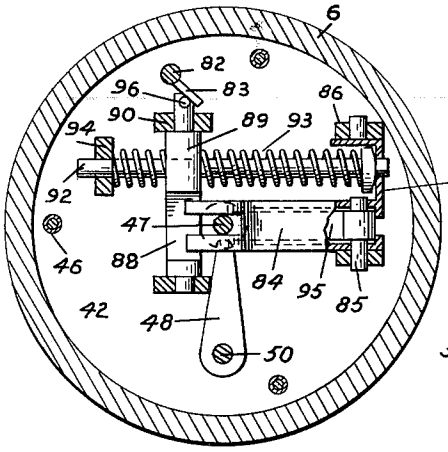


Fig. 8.

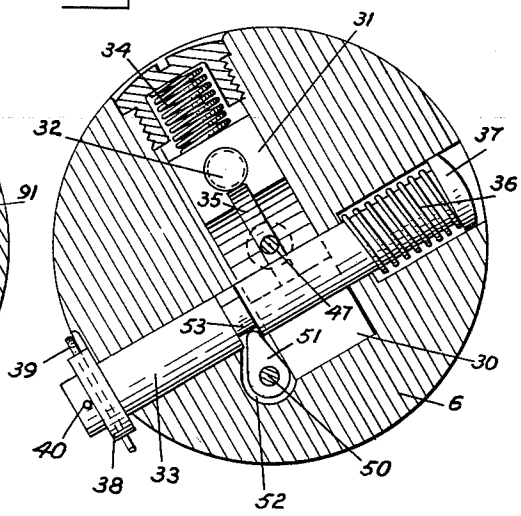


Fig. 9.

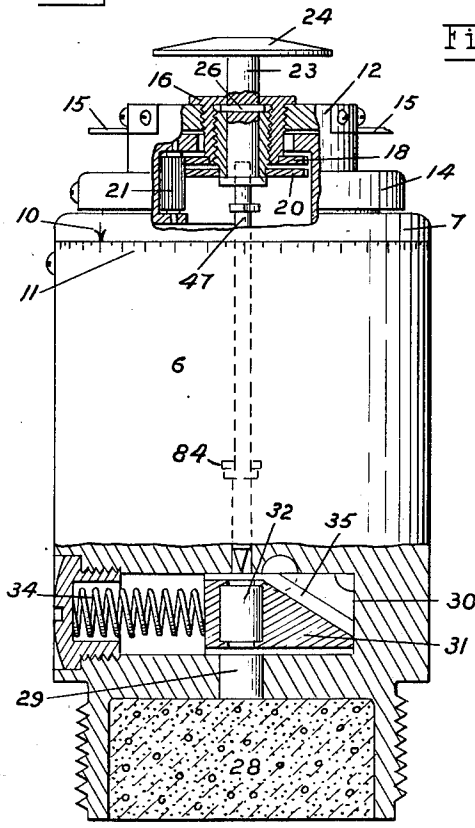
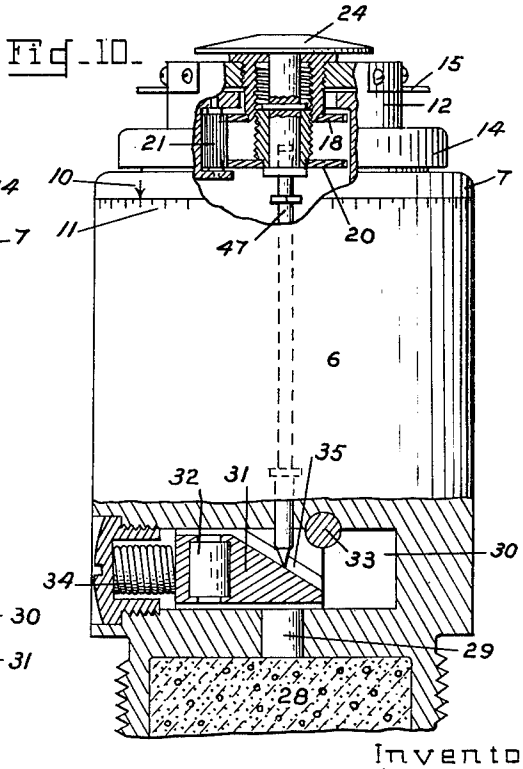


Fig. 10.



Inventor
Clarence F. Hofstetter

By W. N. Roach
Attorney

Patented June 15, 1937 2,083,564

UNITED STATES PATENT OFFICE

2,083,564

FUSE FOR BOMBS

Clarence F. Hofstetter, Missoula, Mont.

Application November 11, 1936, Serial No. 110,320

7 Claims. (Cl. 102—36)

(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 bombs.

In dropping bombs from aircraft it is desirable that the fuse on the bomb remain unarmed for a short period or until such time as the aircraft has gained sufficient distance from the place of launching or the place of impact to assure its safety from the effects of the explosion.

The purpose of this invention is to provide a mechanical time fuse in which a firing mechanism is maintained in the safe position by a novel delay arming mechanism that is actuated by air pressure after launching of a bomb.

Further objects are to utilize the delay arming mechanism to extrude a striker and to provide simple and efficient arrangements for holding and releasing the timing 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, generally on the line 1—1 of Fig. 2 and partly in elevation, showing the various elements in the safe position.

Figs. 2 to 8 are sectional views on the corresponding lines of Fig. 1.

Fig. 9 is a view partly in section and partly in elevation showing the firing pin and slide in armed position.

Fig. 10 is a similar view with the parts in safe position.

Referring to Figs. 1 and 2 of the drawings by characters of reference there is shown a bomb 5 having a threaded opening for attachment of a fuse. The fuse casing consists of a body 6 and a rotatable head 7 having a skirt disposed within the body and provided with a groove 8 for receiving the inner ends of retaining pins 9 threaded in the body. The pins may be additionally turned to exert pressure on the skirt and hold the head in position of rotatable adjustment, which position is indicated by a reference mark 10 (Fig. 9) which is inscribed on the outer surface of the head and is readable against a time scale 11 on the outer surface of the body.

A cap 12 on the outer end of the head is held on ball bearings 13 by a retaining ring 14 threaded on the head. The cap carries vanes 15 which are acted on by air pressure during flight of the bomb to produce rotation of the cap. A removable wire 15a serves to tie the vane to the fuse body during storage and transportation. A nut 16 fixed to the center part of the cap extends through an aperture 17 in the head and on its inner end it carries a gear 18. An externally threaded sleeve 19 normally engaging the innermost threads of the nut 16 also carries a gear 20 on its inner end. The gears 18 and 20 have a different number of teeth, the gear 18 for example having twenty-nine teeth and the gear 20 having thirty teeth. A long pinion 21 mounted on a shaft 22 in the body is in mesh with the gears 18 and 20. This gearing of the Cushman type functions in the usual manner to give reduced motion, that is, the nut 16 and sleeve 19 will revolve twenty-nine times in order to move the sleeve one revolution relative to the nut.

A striker 23 having an impact disc 24 on its outer end extends through the sleeve 19 and the nut 16 and is arranged to be moved longitudinally of the bomb by the sleeve. To this end it has a flange 25 engaging the inner end of the sleeve and a pin 26 engaging the outer end of the sleeve. If impact occurs before the time set for functioning of the fuse, the striker is driven inwardly, shearing the pin 26 and actuating the firing pin 47 whose upper end is disposed in a recess 27 in the inner end of the striker 23.

The fuse body carries in its inner end (Figs. 9 and 10) a booster charge 28 and a booster lead 29 which is positioned axially of the fuse and extends to a transverse passage 30. A cylindrical slide 31 mounted in the passage carries a detonator 32 which is normally out of line with the booster lead 29 when the slide is held in unarmed position by an arming bolt 33 but is adapted to be disposed in line with the booster lead when the slide is moved to armed position by a spring 34 after removal of the arming bolt. The slide is formed with an inclined groove 35 for receiving the point of the firing pin 47.

The arming bolt 33 (Fig. 8) extends through the fuse body transversely of the slide 31 and engages the slide to oppose movement thereof under influence of the spring 34. A spring 36 acting on the head 37 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 38 mounted on the other end of the bolt outside the fuse body and retained by a cotter pin 39 during storage and by an arming wire 40 (Fig. 1) passing through the bolt when the bomb is placed in the rack of an aircraft. The arming wire which also passes through one of the vanes 15 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 is formed with a large chamber 41 (Figs. 1 and 2) for receiving timing, firing and slide control mechanisms. These mechanisms are carried in a frame consisting of an inner plate 42, center plates 43—44 and an outer plate 45 spaced by means of separators 46. When the frame is inserted in the chamber 41, the inner plate rests on the floor thereof and the outer plate is at the forward edge of the fuse body.

A firing pin 47 disposed axially of the fuse extends through all of the plates of the frame and is normally in the position shown in Figs. 1, 2 and 10 with its outer end disposed in the recess 27 of the striker 23 and its inner end riding on the lips of the groove 35 of the slide 31. The firing pin 47 is held in this position by means of an arm 48 (Fig. 7) which engages a collar 49 on the firing pin and which is secured to a shaft 50 (Fig. 2).

An arm 51 (Figs. 2 and 8) on the lower end of the shaft 50 is disposed in a cavity 52 in the fuse body and has its free end disposed in an annular groove 53 in the arming bolt 33 so that when the arming bolt is ejected the shaft 50 will be rotated and move the arm 48 out of engagement with the firing pin.

An arm 54 (Figs. 2 and 5) on the upper end of the shaft 50 is arranged to control the starting of a timing mechanism, and in the present instance its outer end is in engagement with an oscillatable pallet 55 which is associated with an escape wheel 56. This type of escapement with its hair spring 57 and regulators 58 is housed in a recessed plate 58a well known in the art and is shown in Patent No. 1,319,304 of October 21, 1919. The escape wheel forms part of a train of gear generally indicated at 59 and disposed between the center plates 43 and 44 of the frame.

The end gear of the train 59 is on a shaft 60 (Figs. 2 to 4) that extends through the plates 43 and 44 and on its outer end carries a pinion 61 which is in mesh with a gear wheel 62 fast on a spindle 63. The spindle is rotatably mounted on a tubular post 64 fixed to the plate 44 and extends through the plate 45. A spiral main spring 65 has its inner end attached to the spindle and its outer end attached to a barrel 66 which encloses the spring and is rotatably mounted on the spindle between the plates 44 and 45. A gear wheel 67 fixed to the inner side of the barrel is in mesh with a winding gear wheel 68 and is engaged by a ratchet 69.

A setting disc 70 mounted on the outer end of the spindle is held in frictional engagement with a nut 71 on the spindle 63 by means of a spring 72 bearing on the gear wheel 62. The disc is normally rotated with the spindle and gear wheel 62 but is capable of being moved relative to these members by means of a spring setting arm 73 which is attached to the disc and has a recessed end 74 fitting over a stud 75 on the inner side of the rotatable head 7 (Figs. 2 and 3). The setting arm extends diametrically across the disc on the outer side of the spindle and has an aperture 76 through which the firing pin 47 passes. A nut 77 on the firing pin holds the setting arm in engagement with the stud 74. A pair of lugs 78—78 punched out of the disc 70 are located at opposite sides of the setting arm 73 and are engaged thereby when the disc is to be rotated by means of the fuse head 7. The lugs also prevent the setting arm from rubbing on the head 7.

The disc 70 is formed with a peripheral recess 79 (Fig. 3) which is adapted to be entered by a finger 80 on an arm 81. The arm 81 is fixed on the outer end of a shaft 82 which extends through the plates 44, 43, and 42 and has an arm 83 on its inner end (Figs. 2 and 7) which is associated with a firing mechanism and acted on thereby so that the finger 80 will bear against the rim of the disc.

The firing mechanism comprises a hammer 84 (Figs. 1 and 7) mounted on a pivot pin 85 which is carried in cheeks 86—86 fixed between the plates 42 and 43. A horizontally disposed arm 87 of the hammer has a portion normally in engagement with the plate 43 and a bifurcated extremity straddling the firing pin above the collar 49 and resting in a notch 88 of a bolt 89 which is trunnioned in cheeks 90—90. A vertically disposed arm 91 of the hammer 84 is engaged by a plunger 92 on which is a plunger spring 93 seated on a cheek plate 94 (Fig. 7) that serves as a guide for one end of the plunger. A spring 95 (Fig. 1) carried by the pivot pin 85 and passing around a pin 95a has its free end disposed under the collar 49 of the firing pin and acts to move the firing pin into the armed position against the end of the arm 87 of the hammer.

An upright pin 96 on one end of the bolt 89 is in engagement with the arm 83 on the inner end of the shaft 82. The plunger 92 normally tending to rotate the hammer causes the arm 87 to act similarly on the bolt 89 with the result that the pin 96 is exerting pressure on the arm 83 and thereby tending to rock the shaft 82 and maintain the finger 80 on the arm 81 against the setting disc 70. Conversely, so long as the setting disc does not allow movement of the arm 81, the bolt 89 cannot yield and releases the hammer under influence of the plunger 92.

The parts of the fuse are in the normal safe position as shown in Figs. 1 to 8 and 10 with the arming bolt 33 holding the detonator slide 31 in unarmed position and also holding the shaft 50 against rotation so that the arms 48 and 51 on said shaft 50 respectively restrain the firing pin 47 and the pallet 55 of the timing mechanism. The striker 23 also holds the firing pin 47 against movement to armed position and the firing pin, through its nut 77, holds the setting arm 73 on the stud 75 and thereby prevents operation of the timing mechanism. When the bomb is placed in the bomb rack of an aircraft preparatory to being launched, the wire 15a is removed from the vane, the head 7 and vanes are rotated by reference to the time scale 11 to give the recess 79 of the setting disc 70 a predetermined angular position relative to the finger 80, the arming wire 40 is applied to the arming bolt 33 and one of the vanes, and the cotter pin 39 is removed.

Upon launching the bomb, the arming wire 40 is withdrawn to release the arming bolt 33 and the vane unit, the former being immediately ejected by the spring 36, and the latter commencing to rotate due to air pressure. Upon rotation of the vane unit, the gear 18 on the nut 16 drives the pinion 21 which in turn drives the gear 20 on the sleeve 19 and causes the sleeve to thread itself into the nut (Fig. 9) thereby moving the

striker 23 to extruded position and freeing the firing pin 47.

The arming bolt 33 during its ejection acts on the arm 51 to rotate the shaft 50 which in turn swings the arm 48 to free the firing pin and also swings the arm 54 to free and at the same time impel the pallet so that it will commence oscillating. As soon as the firing pin is free of the arm 48 it is moved by its spring 95 until its outer end which is disposed in the recess 27 of the striker 23 is brought up against the floor of the recess so that thereafter its further movement is controlled by the striker. The initial movement of the firing pin is sufficient to enable the setting arm 73 to clear the stud 75 and immediately release the setting disc 70 which is part of the timing mechanism.

The slide 31 on being released is moved into armed position by its spring 34, and during this movement the lips of the groove 35 engage the firing pin and cam it outwardly. At the same time the firing pin whose movement is under control of the striker 23 acts as a brake on the slide 31 and prevents the slide from arriving in armed position until the expiration of the initial delay period as determined by the action of the gearing 18, 20, and 21.

The timing mechanism is now functioning and at the expiration of the time set for firing, the recess 79 in the setting disc 70 is opposite to and is entered by the finger 80 of the arm 81. The bolt 89 is now free to be rotated to release the hammer 84 which is actuated by the spring-pressed plunger 92 and drives the firing pin 47 into the detonator 32 to explode the charge.

In the event that impact occurs before expiration of the time set for firing the striker 23 is driven inwardly and actuates the firing pin.

I claim.

1. In a fuse, a casing, a cap on the casing rotatable during flight, a nut fixed to the cap and extending into the casing, a gear on the inner end of the nut, a sleeve threaded in the nut, a gear on the inner end of the sleeve and having more teeth than the gear on the nut, a pinion carried by the casing and meshing with both gears, a striker passing through the nut and sleeve and arranged for longitudinal movement with the sleeve, a firing pin mounted for movement longitudinally of the casing and adapted to engage the inner end of the striker, and means for moving the firing pin to armed position subject to movement of the striker.

2. In a fuse, a casing, a cap on the casing rotatable during flight, a nut fixed to the cap and extending into the casing, a gear on the inner end of the nut, a sleeve threaded in the nut, a gear on the inner end of the sleeve and having more teeth than the gear on the nut, a pinion carried by the casing and meshing with both gears, a striker passing through the nut and sleeve and arranged for longitudinal movement with the sleeve.

3. In a fuse, a casing, a cap on the casing rotatable during flight, a nut fixed to the cap and extending into the casing, a gear on the inner end of the nut, a sleeve threaded in the nut, a gear on the inner end of the sleeve and having more teeth than the gear on the nut, a pinion carried by the casing and meshing with both gears, a firing pin mounted for movement longitudinally of the casing, and means for moving the firing pin to armed position subject to movement of the sleeve.

4. In a fuse, a body, a rotatable head, a stud on the inside of the head, a timing mechanism in the body including a rotatable setting disc, a firing pin passing through the timing mechanism, means for moving the firing pin longitudinally of the fuse and into armed position, a resilient setting arm fixed to the disc and having one end engageable with the stud on the head, said arm engaged by the firing pin to be held on the stud and released from the stud on movement of the firing pin.

5. In a fuse, a casing, a firing pin mounted for movement longitudinally of the casing, a slide mounted for movement transversely of the casing and having an inclined cam for engaging the firing pin, a detonator in the slide, removable means for holding the slide in unarmed position, means for moving the slide to armed position to place the detonator in line with the firing pin, and a delay arming mechanism regulating movement of the firing pin.

6. In a fuse, a casing, a firing pin mounted for movement longitudinally of the casing, a slide mounted for movement transversely of the casing and having an inclined cam for engaging the firing pin, a detonator in the slide, removable means for holding the slide in unarmed position, and means for moving the slide to armed position to place the detonator in line with the firing pin.

7. In a fuse, a casing, a firing pin mounted for movement longitudinally of the casing, a collar on the firing pin, a timing mechanism in the casing including a pallet, a shaft in the casing, a first arm on the shaft restraining the pallet, a second arm on the shaft engaging the collar of the firing pin to restrain it, an arming bolt in the casing, means for moving the arming bolt, and a third arm on the shaft movable by the arming bolt to rotate the shaft and displace the first and second arms.

CLARENCE F. HOFSTETTER.