

May 16, 1967

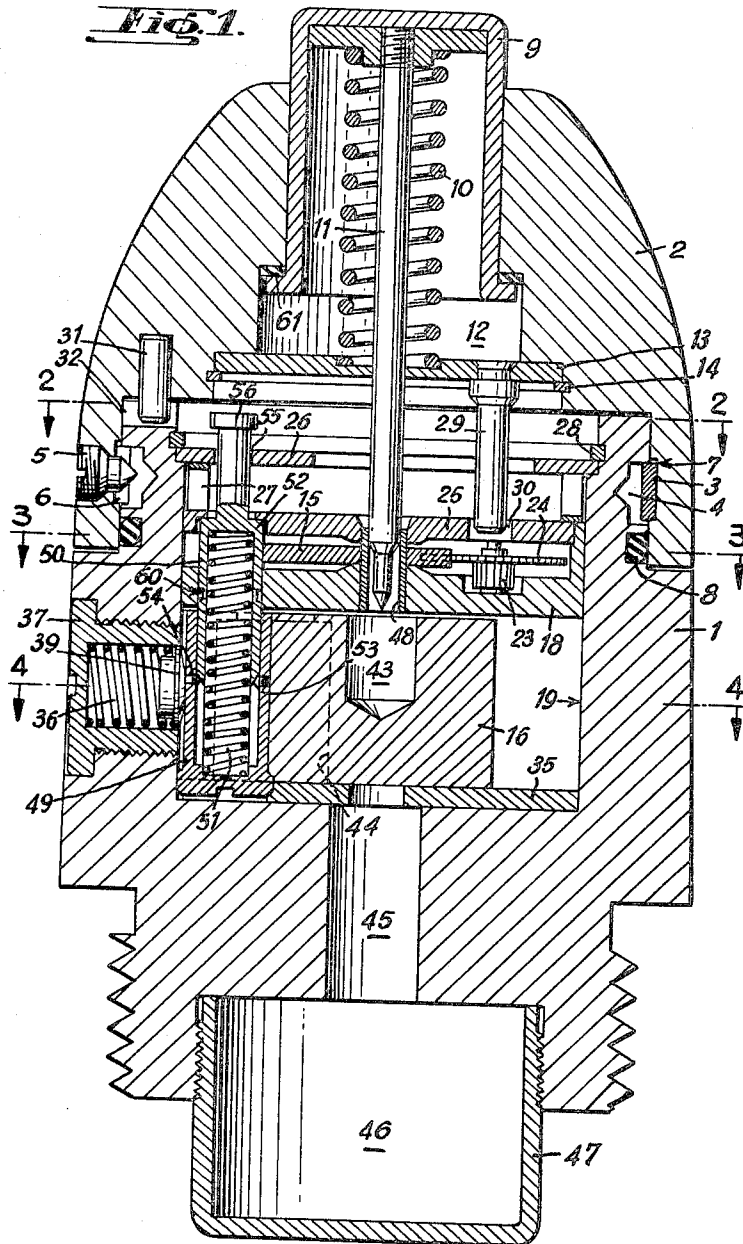
A. COMBOURIEUX

3,319,567

PROJECTILE FUSE

Filed May 24, 1965

2 Sheets-Sheet 1



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Fig. 2.

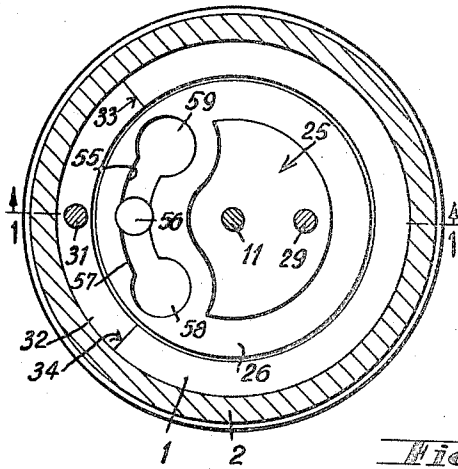


Fig. 3.

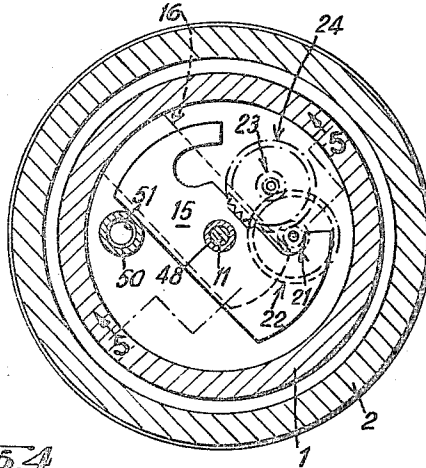


Fig. 4.

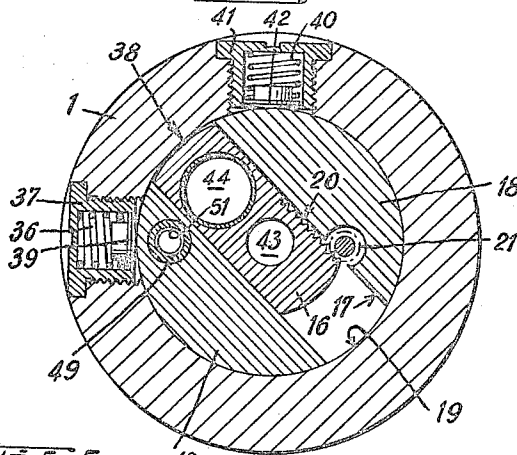
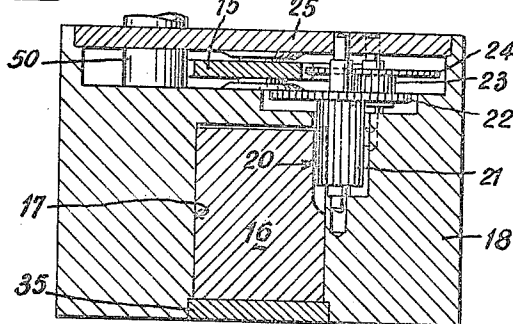


Fig. 5.



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PROJECTILE FUSE

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4 Claims. (Cl. 102-76)

The present invention concerns a projectile fuse of the type functioning on impact and comprising trajectory security means, including a balance driven by a spring, to control the cocking of the fuse, and locking means to prevent the balance functioning before firing and actionable by a member of the gun crew.

The fuse according to the invention is characterized in that the locking means has, in addition to its locking position, at least two firing positions, for each of which a different driving spring is in position to cooperate with the balance, by means of a rack carrying a detonator, the said springs having different characteristics, in order to afford different trajectory securities.

The accompanying drawing illustrates, by way of example, an embodiment of the fuse according to the invention.

FIG. 1 is an axial section, along 1-1 in FIG. 2.

FIG. 2 is a cross-section along 2-2 in FIG. 1.

FIG. 3 is a cross-section along 3-3 in FIG. 1.

FIG. 4 is a cross-section along 4-4 in FIG. 1.

FIG. 5 is a fragmentary axial section, along 5-5 in FIG. 3.

The fuse shown in the drawing comprises a body 1 on which a cap 2 may rotate without axial movement. In order to retain the cap axially on the body, the following means are provided: A segment 3 when relaxed is completely withdrawn within a peripheral groove 4 formed in the body 1. By means of a set-screw 5 engaged in the cap, the two ends of the segment 3 (one of which is visible at 6 in FIG. 1) are forced to move apart, which produces an increase in diameter of the segment so that the latter engages partially in an inner groove 7 of the cap 2. In this working position, the segment is also partially engaged in the groove 4, so that it prevents any relative axial movement of the cap 2 in relation to the body 1. A seal 8 is provided between the body and the cap. The cap comprises at its forward end, in a well known manner, a piston 9 urged forwardly by a compression spring 10. This piston is integral with a percussion rod 11, destined to move downwardly in FIG. 1 when the impact occurs. This is due to the fact that the piston 9 can effect a limited movement within a chamber 12 of the cap 2, against the action of the spring 10. The spring 10 bears against a platen 13 which is angularly and axially secured to the cap 2. At 14 may be seen a ring clip retaining this platen.

The fuse comprises trajectory security means comprising a balance 15, spring actuated, as will be seen further on, through a train of gears formed of the following members: A rack 16 diametrically movable within a chamber 17 provided in a housing 18 of cylindrical shape disposed within an axial chamber 19 of the body 1. The teeth 20 of the rack mesh (FIGS. 4 and 5) with a pinion 21 integral with a coaxial gear wheel 22 meshing in its turn with a second pinion 23 integral with an escapement wheel 24 with which it is coaxial. It is this escapement wheel 24 which cooperates with the balance 15. The various wheels

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mentioned pivot on the one hand in the housing 18 and on the other in a platen integral with the latter. The assembly formed by this platen 25 and the housing 18 is normally maintained spaced a certain distance from another platen 26 axially fixed within the body 1, and this by means of a corrugated washer 27 disposed between the platens 25 and 26. The platen 26 is held immovably in the axial direction against a shoulder of the body 1 by a ring clip 28. The assembly formed by the housing 18 and the platens 25, 26 together with the described gear trains and the rack 16 can, as will be seen, rotate about the axis of the fuse within the chamber 19. To effect this a driving finger 29 is provided, which is secured in the platen 13 and the end of which is engaged in an opening 30 provided in the platen 25. It will be understood that when the gunner causes the cap 2 to effect an angular rotation in relation to the body 1, he simultaneously causes a rotation of the housing 18 and of the members carried by the same, owing to the cooperation of the driving finger 29 with the platen 25. A stop finger 31, integral with the cap 2, limits the relative angular displacement of the cap 2 in relation to the body 1 when it abuts against the one or the other of the ends of a groove 32 of the body 1, in which groove it may move. In FIG. 2 this groove 32 may be seen with its ends 33, 34 against which the stop finger 31 abuts when it reaches the end of its travel. A securing strip 35 retains the rack 16 within the chamber 17.

The parts are shown in the locked position of the fuse, in which the stop finger 31 is more or less midway of its travel between the stops 33, 34. When the cap is rotated until the finger 31 abuts against the stop 34, the medial plane of the rack 16 is then in coincidence with the axis of a driving spring 36 disposed within a hollow screw 37 radially screwed into the body 1, as may be seen best in FIG. 4. The spring 36 is destined then to exert a pressure on the end 38 of the rack, through a head 39. In the locked position (FIG. 4), the head 39 is in contact with part of the periphery of the housing 18.

When the cap is caused to rotate in the opposite direction in order to bring the stop finger 31 in contact with the stop 33, the medial plane of the rack 16 then coincides with another driving spring 40 disposed in similar fashion within a hollow screw 40 radially screwed into the body 1. The spring 40 is destined to act on the rack through a head 42. In the locked position, this head bears against part of the periphery of the housing 18. The two springs 36 and 40 are of different force and are calculated in such a manner that each ensures the displacement of the rack between its initial position illustrated in the drawing and its final firing position in different times corresponding to trajectory securities which themselves are different.

The rack 16 comprises a blind hole 43 which, in the locked position of the parts, is placed exactly opposite the percussion member. This hole 43 is simply destined to allow the percussion member to engage within it if, owing to some accidental cause, the piston 9 is pushed into the cap 2, in order that the percussion member may run no risk of accidental damage. It is clear that this movement of the percussion member within the hole 43 has no effect with regard to the firing of the fuse.

In order to ensure the firing of the fuse, it is necessary to complete the pyrotechnic chain constituted by the three following chambers: 44 (provided in the rack 16), 45 (provided axially in the body 1) and 46 (provided in a

sheath 47 screwed to the base of the body 1). It will be seen that in the locking position, the chamber 44 containing the detonator is in an eccentric position and cannot be reached by the percussion member. In the cocked position, 44 is coaxial with the percussion member, so that firing occurs as soon as the percussion member is displaced following impact.

It will be remarked that the lower part of the percussion rod (in FIG. 1) slides within a hollow shaft 48 driven into the housing 18 and serving as a pivot for the balance 15.

The fuse comprises in addition the following components, belonging to its safety means:

A sleeve 49 is immovable in a boring of the housing 18. A hollow pin 50 can slide axially in this sleeve. A compression spring 51 is disposed within this hollow pin 50 and within the sleeve 49, and tends constantly to urge this pin to emerge from the sleeve. As a matter of fact, in the locking position, a shoulder 52 on the pin abuts against the bottom of a recess formed in the platen 25. The lower end (in the drawing) of the pin 50 is chamfered, as may be seen in 53 and faces a locking spring 54 carried by the sleeve 49. The upper part of the pin 50 (in FIG. 1) passes through an opening 55 in the platen 26 and terminates in a head 56. The opening 55 comprises an arcuate intermediate part 57, which is coaxial with the body of the fuse, forming a slot terminating at both ends in two circular parts of greater dimensions visible at 58 and 59. When the pin 50 is engaged in the intermediate part 57 of the opening 55, the head 56 limits the possible downward movement of the pin owing to the fact that the diameter of this head is greater than the width of this part 57. On the other hand, when the pin 50 is either in 58 or in 59, the head can pass freely through the openings 58, 59.

The described fuse operates as follows: The gunner begins by rotating the cap 2 in relation to the body 1 in order to bring it to one or the other firing positions of which the one corresponds to a short trajectory security and the other to a long trajectory security. Supposing for instance that when the rack 16 is facing the spring 36, the force of which is supposed to be greater than that of the spring 40, we are in the position of short trajectory security. Suppose that the gunner has brought the parts in this position and has placed the projectile with its fuse on the firing piece. As a preliminary remark it may be noted that if, in the course of this operation he lets the projectile drop, and that the piston 9 is pushed into the cap 2, this will be of no consequence because, as has already been seen, the percussion member will penetrate temporarily into the blind hole 43, and will then return to the position illustrated by the action of the spring 10. It is only when the round is fired that the following will occur:

Owing to its inertia, the hollow pin 50 will move downwardly in FIG. 1, thus compressing the spring 51 and causing the locking spring 54 to be pushed back into a recess of the sleeve 49. In the course of this recoil movement of the hollow pin 50, a peripheric groove 60 of this pin moves opposite the spring 54 which engages therein and from then on retains this pin in its lower position in FIG. 1. This downward movement of the pin was able to occur because the head 56 then coincided with the larger opening 58. Now, it is the pin 50 which, as may be seen in FIG. 3, kept the balance 15 from moving. As soon as this pin is in its lower position, its upper part, which is now level with the balance 15, being of smaller diameter, the balance is freed and the timing device begins to function. Under the action of the spring 36, of the train of gears and of the escapement mechanism, the balance 15 begins to oscillate and the rack 16 moves step by step towards the right in FIG. 1. At the end of a predetermined time interval depending on the force of the spring 36, the rack 16 reaches the end of

its travel and from that moment the detonator 44 disposed in the detonator carrying rack 16 is in alignment, on the one hand with the percussion member 11, and on the other with the chamber 45, so that from that moment the pyrotechnic chain is completed and firing is possible. This firing will occur on impact, that is when the projectile hits an obstacle directly and the piston 9 is pushed into the cap 2. At this moment the percussion member will strike the detonator disposed in 44 and firing will take place. If the impact is a glancing impact, eventually on soft ground or on the surface of a sheet of water, the impact does not occur on the piston 9 but on the cap 2. This results in a sudden slowing down of the projectile, which owing to inertia produces a forward movement of the housing 18 and of all the parts it carries. Firing will occur by the detonator 44 being projected against the percussion member, following the collapse of the washer 27.

If the stop 31 had been brought up against 33 instead of against 34, the operation would have been quite similar with the sole difference that the detonator carrying rack 16 would have reached the end of its travel after a longer time interval corresponding to a trajectory security which is itself longer.

In the described embodiment, there are only two different trajectory securities, and the gunner can cock the fuse when visibility is bad or even in darkness, as he only needs to rotate the cap in the required direction until the finger 31 reaches the end of its travel.

It will be remarked that in the case of a mortar, if owing to some error double loading occurs, the introduction of a second projectile into the mortar tube when the first has not yet left it and the collision of these two projectiles will not result in an explosion since at that moment the percussion member 11 is facing the blind hole 43 and not detonator.

It may be remarked that it is always possible to set back a fuse to its locked position after having selected a position of operation. The described construction ensures transport and parachuting security.

The seal 8 together with a similar seal 61 disposed between the piston 9 and the cap 2 ensure the protection of the interior of the fuse when it is stocked.

In a variant, more than two cocking positions could be provided corresponding to more than two values for the trajectory security. It would then be necessary to provide an additional stop for that or those positions which do not correspond to the end of travel in one direction or the other of the cap in relation to the body of the fuse.

What I claim is:

1. An impact projectile fuze in which a trajectory safety means is provided comprising a body, a balance rotatably mounted in said body, a spring driving said balance to control the arming of the fuze, locking means preventing said balance from functioning before firing and being released after the projectile is fired, a cap movable angularly with relation to said body, stop means cooperating with said cap, said stop means limiting two extreme angular positions of said cap each corresponding to one firing position, a detonator carrier, a rack carrying said detonator carrier, a driving member connected to said cap for simultaneously moving in rotation said detonator carrier and said rack for actuating said balance, two driving springs having different characteristics to afford two different safety trajectories to bias separately said rack when said rack has been displaced into alignment with one of said springs and said locking means comprising an inertia member locking said balance when the projectile is not fired.

2. An impact projectile fuze as set forth in claim 1 wherein a clock-work assembly is associated with said balance rotatably movable with said cap and which is

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capable of axial movement relative to said cap and body upon impact to ensure detonation.

3. An impact projectile fuze as set forth in claim 1 wherein said locking position for said locking means is in intermediate position between said two extreme angular positions of said cap. 5

4. An impact projectile fuze as set forth in claim 1 wherein said two driving springs and said detonator carrier are each housed in a plug radially screwed in said body at points angularly distant from one another. 10

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