March 7, 1939. E. H. SCHENK 2,149,469

TIMING AND RELEASE MECHANISM FOR MECHANICAL TIME FUSES

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Fig. 2

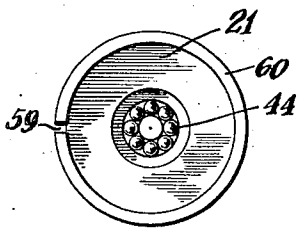


Fig. 3

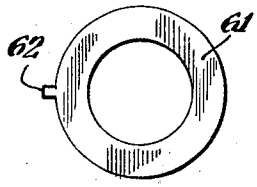


Fig. 1

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TIMING AND RELEASE MECHANISM FOR MECHANICAL TIME FUSES

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4 Claims. (Cl. 102—36)

The present invention relates to mechanical time fuses having a hollow body formed by a fixed base and an adjustable setting cap, a rotary timing member set in angular position before the fire by means of said setting cap, a motor to drive said timing member in opposite direction during the flight of the projectile, a clock mechanism to govern the speed of said motor and a spring-pressed striker normally held in armed position and released after a predetermined time of flight by means of a release mechanism controlled by said timing member. In these fuses, the driving force controlling the action of the timing and release mechanism during the flight of the projectile is applied by either a spring motor, or a weight submitted to the centrifugal action due to the spin of the shell, or a vane which is withheld from spinning with the shell by air resistance. My invention is applicable to mechanical fuses having any of these three types of motor above indicated, and it consists in a novel construction and arrangement of the timing and release mechanism, which determines, with the help of the clock mechanism of the fuse, the length of time which shall elapse between the firing of the projectile and its bursting.

For convenience of illustration and explanation, I have shown, and will hereinafter describe, my present invention as applied to a mechanical time fuse having a spring motor, a clock mechanism actuated by said motor and an external setting cap, of essentially the type and character of that disclosed and illustrated in my pending applications for Letters Patent of the United States Number 38,012 filed August 27, 1935, and No. 41,990 filed September 25, 1935, although without intending thereby to indicate any limitation of the invention thereto.

So far as the protection which I desire to secure in the patent to be issued upon the present application is concerned, I desire to state that this invention is applicable to any type of mechanical time fuse having an exterior setting cap and, an interior clock mechanism and a rotary timing member coupled to said cap during the setting operation and actuated by said clock mechanism during the flight of the projectile, and is limited to the novel and peculiar timing and release mechanism hereinafter set forth.

I will now proceed to a detailed description of the invention in connection with the drawing, in which:

Figure 1 is a partial side elevation and a partial axial section of a mechanical time fuse provided with an embodiment of this novel timing and release mechanism, and Figures 2 and 3 are elevations of detached parts of this mechanism.

In this drawing, 1 represents the base of the fuse, 2 the usual setting slot for engagement with a corresponding pawl and lug of the setter and 3 the usual scale graduated in seconds provided on the upper edge of said base.

4 indicates the setting cap, or brass cap, which is frictionally and rotatably mounted into the base 1, the amount of friction being made adjustable by means of three set screws 40, pressing against a friction ring 41, made of the best fitting material. This setting cap is likewise provided with the usual setting slot 5 and with the index 6, marked on its lower edge, opposite the scale 3. 7 shows the usual nose cap screwed into the cap 4.

According to my invention the timing organ is constituted by the cylindrical casing 21 containing all the moving parts of the clock mechanism of the fuse. As said clock mechanism is not a part of the invention, it has not been shown on the drawing.

This cylindrical casing 21 is rotatably mounted in a corresponding bore of the setting cap 4 and is normally coupled to said cap by means of four balls 42, lodged partly in four corresponding spherical sockets provided in the outside periphery of the casing 21 and partly in four opposite sockets provided in the inside periphery of the setting cap 4. Four radial escape holes 43 are cut through the wall of said cap under these sockets to allow for the escape of the balls 42 under the action of the centrifugal force when the casing 21 sets back by inertia as will be now more fully described.

The cylindrical casing 21 pivots in the axis of the fuse inside the cap 4 between two ball bearings: an upper one (not shown) and a lower one 44, the lower race 45 of which leans upon a percussion spring 46 so as to act as a shock absorber. Upon the firing of the projectile, the casing 21 sets slightly back by inertia until this lower bearing 45 meets the upper edge of a cylindrical guide 48 carrying a firing pin 47.

The coupling balls 42 are thus brought opposite the radial holes 43 and are then free to escape under the action of the centrifugal force developed by the spin of the projectile, thus uncoupling the casing 21 from the cap 4 at the end of the acceleration of the projectile.

49 indicates a cylindrical bore cut in the base 1 according to the axis of said base, along which

the firing pin 47 is guided by means of its carrier 48. This latter is provided with a concave annular rim 50, which cooperates with a locking ball 51, lodged at the inner end of a radial escape hole 52, cut into the base 1. The outer end of said hole is closed by a plug 53, screwed into the base 1.

The locking ball 51 is normally held in its operative position by the periphery of a release shaft 54, provided with a spherical notch 55 and submitted to the action of a spring 56, bearing upon a plug 57, screwed into the base 1. This release shaft 54 is provided with an upper flat projection 58, which cooperates with a release notch 59, cut into an annular rim or projecting edge 60, provided at the lower end of the casing 21.

This rim constitutes at the same time the timing ring of the fuse and the rotary organ controlling the release of the firing pin 47.

In the position shown on the drawing, which is the normal position of rest of the fuse, though the notch 59 is aligned with the flat head 58 of the release shaft 54, this release of the firing pin 47 cannot occur because a tooth 62 of a lead washer 61 closes then the notch 59.

The lead washer 61 is normally frictionally held into the rim 60, but when the casing 21 sets back by inertia upon the firing of the projectile, this washer is empaled upon four steel points 63, fixed in the base 1 and is thus uncoupled from the casing 21 and coupled to the base 1 when, at the end of the acceleration of the projectile, this casing rebounds forward under the action of the spring 46. 64 and 65 show respectively the usual primer and booster of the fuse.

The operation of this timing and release mechanism is as follows:

Normally the parts of this mechanism are in the position shown in the drawing, i. e., the strong spring 46 holds, on one hand, the casing 21 in its forward position coupled to the setting cap 4 by means of the balls 42, and, on the other hand, the firing pin pressed against the locking ball 51. The spring 56 holds the release shaft flat head 58 pressed under the tooth 62 of the lead washer 61.

When the fuse is set, the setting cap 4, the casing 21, coupled to this cap by the coupling balls 42 and the lead washer 60, coupled to the casing 21 by the tooth 62, are solidarily rotated to the desired angular position, in accordance with the fuse range data, by the fuse setter pawls engaging the slots 2 and 5, respectively of the base 1 and of the cap 4.

The release shaft 54 is then held in its operative position, shown in the drawing, by the annular rim 60, the bottom of which is flush with the lower face of the tooth 62, instead of being held by this latter.

Upon the firing of the projectile, the casing 21 and the release shaft 54 set back by inertia against the action of, respectively, the springs 46 and 56, until the race 45, acting as a shock absorber, meets the top of the firing pin carrier 48, while the lead washer 61 is empaled on the steel points 63 and the coupling balls 42 escape in the holes 43 under the action of the centrifugal force developed by the spin of the projectile. As long as the acceleration of this latter lasts, the casing 21 remains momentarily coupled to the base 1 through the intermediary of the lead washer 61, which prevents any unsetting by angular inertia of said casing.

At the end of the acceleration, the casing 21 and the release shaft 54 rebound forward under the action of, respectively, the springs 46 and 56, while the lead washer 61 remains hooked or empaled on the points 63. The casing 21 is then free to start its back motion under the action of the clock mechanism until the release notch 59 comes opposite the flat head 58 of the release shaft 54. As the tooth 62 does no more interfere with the release mechanism, this shaft 54 is now free to be pushed by its spring 56, its flat head 58 entering into the release notch 59. The locking ball 51, under centrifugal action and considerable side pressure from the firing pin 47, 48, enters then into the spherical notch 52, thus releasing the firing pin 47 at the instant the release shaft head 58 enters into the release notch 59.

Driven by the percussion spring 46, the firing pin 47 then strikes the primer 64, and successively detonates the tetryl pellets in the booster 65 and finally the bursting charge in the projectile.

The main advantages of this timing and release mechanism are that the fuse may be set in either direction for a range of settings varying between 1 and 100 seconds, as there are no abutment limiting the angular displacement of the setting cap 4 and that the friction of the release shaft flat head 58 under the rim 60 is reduced to a minimum due to the fact that the spring 56 is much weaker than the percussion spring 46.

What I claim and desire to secure by Letters Patent is:

1. In a timing and release mechanism for artillery projectile fuses having a setting cap with an axial bore and a base having a radial as well as a longitudinal bore; a firing pin slidably and axially mounted in the base of the fuse, a spring acting on said firing pin, a locking ball slidably mounted in the radial bore of said base and normally restraining said firing pin against the action of said spring, a release shaft slidably mounted in the longitudinal bore of said base and normally holding said ball immovable, a spring acting on said release shaft and tending to force it to a position to release said ball, a cylindrical clockwork casing rotatably and slidably mounted in the axial bore of said setting cap, a timing rim formed in the bottom of this casing, a release notch provided in this timing rim, safety means carried inside this timing rim by said casing and normally holding this release shaft in the position whereby it holds said ball immovable, releasable means to couple positively this casing to said setting cap before the firing of the projectile and means frictionally mounted in said timing rim and actuated by the setback of this casing due to firing of the projectile to hold this casing momentarily coupled to said base during the acceleration of the projectile, said casing, following said momentary coupling, being actuated to position said release notch in line with said release shaft, whereby said release shaft is moved to release said locking ball and said firing pin.

2. A timing and release mechanism according to claim 1 in which the last mentioned coupling means comprises a washer normally held by mere friction into the timing rim of the clockwork casing of the fuse while the safety means consists of a tooth, formed at the periphery of this washer, which closes the release notch of this timing rim until the end of the acceleration of the projectile.

3. A timing and release mechanism according to claim 1, in which the last mentioned coupling means comprises a washer of soft metal normally held by mere friction into the timing rim of the clockwork casing of the fuse and a circular series of steel points fixed to the base of the fuse under this washer.

4. A timing and release mechanism according to claim 1 in which the first mentioned releasable coupling means comprises at least a spherical socket provided in the outer periphery of the clockwork casing, a corresponding half-socket provided in the inner periphery of the setting cap, a radial bore provided through the setting cap slightly under said sockets, at least a coupling ball normally held into these two sockets by the action of the firing pin spring and actuated by the setback of the clockwork casing against the action of said spring so as to escape under centrifugal action in said radial bore upon the firing of the projectile.

EDOUARD H. SCHENK.