

Mortar fuse with a fan wheel

The invention relates to a mortar fuse comprising a fan wheel as set forth in the classifying portion of claim 1.

The usual mortar fuses have a fan wheel generator which, by means of the fan wheel which rotates in the flow of air, serves to generate the energy for the fuse and to drive the safety device. Fan wheel generators of that kind suffer from the disadvantage that the energy generated is dependent on the speed of rotation of the fan wheel generator, which can fall to zero at the apogee of the trajectory of the mortar shell. That can result in an energy failure or at least adverse effects in terms of reliability of the fuse. A further problem is that the fan wheel can ice up during the flight and come to a stop, also with the problem of energy failure.

US-A-2 403 567 discloses a fuse comprising a fan wheel for generating electrical firing energy. An activation wheel which is driven by the fan wheel is displaced along a spiral by virtue of the rotation of the fan wheel and pierces an acid container of an activatable battery. An electrically active activation wheel is not disclosed.

The object of the present invention is to propose a highly reliable mortar fuse in which the energy supply of the fuse does not depend on continuous rotation of the fan wheel.

The invention attains that object in accordance with the features of the invention as set forth in the main claim.

The invention is therefore based on the point that the use of a per se known activatable battery during flight provides for activation of an activation wheel driven by the fan wheel, with a predetermined time delay between launch of the projectile and attainment of the actuation position. Depending on the respective type of battery used, activation again



requires a certain period of time before the battery is fully operational. It is at the latest from that moment in time that the speed of rotation of the fan wheel is no longer an important consideration in terms of operability of the fuse.

5 In accordance with a development of the invention, to produce the time of activation of the battery, it is provided that the activation wheel can be displaced along a spiral on the shaft of the rotating fan wheel and can be brought into contact with the activatable battery.

10 In a development of the invention, it has been found particularly desirable that the activatable battery comprises a battery container with the battery cells and an acid container which is directly adjacent but separate therefrom, which acid container can be pierced by the activation wheel whereby acid flows into the battery container.

15 In accordance with a further configuration of the invention, to increase the fail-safe nature of the fuse, it is provided that the activation wheel has a magnet which, upon rotation thereof, moves past a coil and generates energy.

20 That energy serves during the activation phase of the battery to supply power to the fuse and in particular serves for the supply of energy for a counter which controls the time function of the fuse.

25 Finally, a further configuration of the invention provides that there is an emergency power supply which includes one or more capacitors and which co-operates with the activation wheel and which ensures operation of the counter in the event of a possible power failure in respect of the battery. The emergency power supply can also be used when using a fan wheel generator.

The invention will be described in greater detail hereinafter by means of two embodiments. In the drawing:

Figure 1 shows a first embodiment of the invention,

30 Figure 2 shows a second embodiment of the invention, and

Figure 3 shows a block circuit diagram of an emergency power supply.

Figure 1 is a highly diagrammatic view of the component units of a mortar fuse, which are essential in connection with the invention.
5 Reference 1 denotes a fan wheel, reference 2 a battery, reference 3 a safety device, reference 4 the electronic system and reference 5 the fuse.

The battery 2 comprises a battery container 6 and battery cells 7. No acid is contained in the battery container in the rest condition of the fuse, that is to say in the condition of not having been launched. The
10 battery is therefore not yet operational. Disposed above the battery container is an acid container 8 which, in the activation situation, after launch, is destroyed so that the acid can be emptied into the battery container disposed therebeneath.

The battery container and the acid container are each of an annular
15 configuration and form a cylindrical space through which the shaft 9 of the fan wheel passes. Provided on the shaft 9 is a spiral 10 on which in turn a gear 11 can longitudinally slidably move. When the fan wheel 1 rotates the gear 11 moves upwardly along the spiral 10 and destroys the acid container 8.

20 Disposed in the cylindrical space of the battery container, at the wall surfaces thereof, is an electric coil 12 which co-operates with a magnetic coating 13 on the gear 11 and in which, upon rotation of the gear, energy is generated for the power supply for the fuse and an emergency power supply if required.

25 The mode of operation of this arrangement is as follows. Upon launch of the projectile carrying the mortar fuse, the fan wheel which is disposed in the head of the fuse at the tip of the projectile begins to rotate. At the same time the gear 11 rotates and with its magnet 13 generates in the coil 12 energy which activates the electronic firing system
30 4 of the fuse and in particular the time counter thereof. The gear 11 moves upwardly along the spiral 10 and finally reaches the inwardly

projecting edge of the acid container 8. Due to the pressure of such impingement the acid container is destroyed and the content thereof pours into the battery container 6. After a short time the battery is ready for operation and from then on takes over the power supply for the electronic fuse system 4. The gear 11 has left the region of the coil 12 and is no longer producing any energy. For the further power supply for the electronic fuse system, it is now immaterial whether the speed of rotation of the fan wheel decreases by virtue of the decreasing speed of the projectile and the fact that the projectile has passed beyond the apogee of its trajectory. The drive for the safety device by the fan wheel is not the subject-matter of the invention and is not described herein. The same applies for the arming of the fuse by the electronic fuse system.

In Figure 2, the same components as in the embodiment of Figure 1 are denoted by the same references. Reference 14 denotes a double pin which represents the primary safety system of the fuse, which is released upon launch and which thereby releases the fan wheel 1. That double pin arrangement is a component which is conventional practice in fuses and is not described in greater detail herein.

A worm gear 15 and a safety pin 16 serve for mechanically releasing the safety device 3. The worm gear meshes on the shaft 9 and co-operates with a spiral on a safety pin 16. When the shaft 9 rotates, the safety pin 16 is screwed out by way of the worm gear 15 and the safety device 3 which has a mechanical detonator 3a and a firing transmitter 3b is released into the armed position. A spring 13 serves for mechanical displacement of the safety device into the armed position.

The electronic firing system 4 comprises a firing circuit 4a and an electrical detonator 4b and is supplied with power by the battery or the coil 12.

The mode of operation of this arrangement is very similar to that of the arrangement shown in Figure 1. After launch of the projectile the double pin 14 in the head of the fuse is actuated and releases the fan

wheel 1 for rotation thereof. By way of the shaft 9 of the fan wheel 1, the gear 11 with the magnet 13 is rotated and generates current pulses in the coil 12. At the same time the gear 11 moves longitudinally slidably downwardly by way of the spiral 10, impinges against the acid container 8 and destroys same. The content thereof pours into the battery container 6 and activates the battery. The battery now takes over the power supply for the firing circuit 4a and the electrical detonator 4b.

At the same time the worm gear 15 is rotated by the axis 9 and in turn rotates the safety pin 16 out of its rest position, whereby the safety device 3 is released and urged into its armed position by the spring 3c. The fuse is now fully armed.

If the reliability of the mortar fuse is to be still further improved, it is possible to provide an emergency power supply as shown in Figure 3, as a precaution against the situation where the activatable battery or a fan wheel generator used fails. That emergency power supply is charged up by the current pulses generated in the coil 12 by the magnet 13 and stores the energy content thereof for the duration of the flight of the projectile. Arranged downstream of the coil 12 is a rectifier 17 to which are connected a first supply capacitor 18 for the energy supply for the downstream-connected electronic firing system 19 and a second supply capacitor 20 with a downstream-arranged time counter 21. A controller 22 serves to control the electronic firing system 19 and the time counter 21. If the speed of rotation of the fan wheel 1 and thus the output voltage of the coil 12 fall below a predetermined threshold value the controller 22 is switched off by way of the rectifier 17 and switches off the electronic firing system 19 and also itself. The counter 21 which is in the form of a so-called low-power counter manages with an extremely low level of power consumption and is fed from the charged-up supply capacitor 20. It is only when that time counter has reached a predetermined count condition that it causes the controller 22 to be switched on again, which is now fed by way of the supply capacitor 18,

and likewise the electronic firing system 19. The controller 22 is switched on again in that way only shortly before target impact; the energy stored in the supply capacitor 18 is sufficient for operation of the necessary component units for the fuse to operate properly at the target.

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CLAIMS

1. A mortar fuse comprising a fan wheel (1), an activatable battery (2) which can be brought into operation by an activation wheel (11) driven by the fan wheel (1),

the activation wheel (11) can be brought into operation,

the activation wheel (11) can be displaced along a spiral (10) of the rotating fan wheel (1) and can be brought into contact with the activatable battery (2),

characterised in that

the activation wheel (11) has a magnet (13) which upon rotation thereof moves past a coil (12) and generates energy therein.

2. A mortar fuse according to claim 1 characterised in that the activatable battery (2) comprises a battery container (6) with the battery cells (7) and an acid container (8) which is directly adjacent but separated therefrom and which can be pierced by the activation wheel (11), whereby acid flows into the battery container (6).

3. A mortar fuse according to claim 1 characterised in that a safety pin (16) is moved out of the safety position by the rotating fan wheel (1) and releases the safety device (3, 3a, 3b).

4. A mortar fuse according to claim 1 characterised in that the energy which the activation wheel (11) generates serves for the power supply of the fuse during the activation phase of the battery (2) and in particular for the energy supply for a counter (21) which controls the time function of the fuse.

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5. A mortar fuse according to claim 4 characterised in that there is provided an emergency power supply which includes one or more capacitors (18, 20) and which co-operates with the activation wheel (11) and which ensures functioning of the counter (21) in the event of a possible power failure of the battery or a fan wheel generator.

6. A mortar fuse according to claim 1 characterised in that there is provided a double pin (14) as a release device for the fan wheel (1).