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Fuse device, in particular for a mortar shell

10 The invention relates to a fuse device, in particular for a mortar shell,
as set forth in the classifying portion of claim 1.

 The known mortar shells use fuse devices having a spring device
which is fitted into the respective fuse device in a mechanically biased
condition. Those known fuse devices are set from the safe position into the
15 armed or live position by means of the mechanically biased spring device.
The mechanical energy which is stored in the mechanically biased spring
device in the safe position influences the safety of the fuse device.

 In consideration of those factors, the object of the present invention
is to provide a fuse device of the kind set forth in the opening part of this
20 specification, in which preferably no or only a relatively small amount of
mechanical energy is stored in the spring device in the safe position, so
that the safety properties in the safe position of the fuse device are
substantially improved.

 In accordance with the invention, in a fuse device of the kind set
25 forth in the opening part of this specification, that object is attained by the
features of the characterising portion of claim 1. Preferred configurations
and developments of the fuse device according to the invention are
characterised in the appendant claims.

 The fuse device according to the invention has the advantage that no
30 or only a very small amount of mechanical energy is stored in the spring
device in the safe position of the fuse device so that the safety properties
are at their optimum. The mechanical biasing of the spring device which is
necessary to set the fuse device from the safe position into the armed
position is effected only after leaving the barrel from which the mortar shell
35 is launched, by means of the fan wheel provided on the mortar shell, by

virtue of a suitable operative connection of the fan wheel to the spring device which can be in the form of a coil torsion spring.

Further details, features and advantages will be apparent from the description hereinafter of an embodiment by way of example illustrated in the drawing of the fuse device according to the invention for a mortar shell
5 which is shown in section. In the drawing:

Figure 1 is a view in longitudinal section through the fuse device,

Figure 2 is a view in cross-section through the fuse device,

Figure 3 is another view in cross-section through the fuse device,
10 that is to say a cross-section along another section plane,

Figure 4 is a view in longitudinal section similar to Figure 1 to show the safe position of the fuse device, and

Figure 5 is a view in longitudinal section similar to Figure 4 to show the armed position of the fuse device.

15 Figure 1 shows a rear end portion of a mortar shell 10 which in a receiving space 12 provided for that purpose has a fuse device 14 with a safety device housing 16. The safety device housing 16 is combined with a plate 18 having a central sleeve 20. The central sleeve 20 of the plate 18 and a cover 22 which closes the receiving space 12 serve to support a fan
20 wheel or impeller shaft 24 connected to a fan wheel or impeller (not shown) of the mortar grenade 10. The fan wheel shaft 24 is provided at its end portion remote from the fan wheel with a wedge-shaped slot 26 into which a wedge-shaped coupling portion 28 of a worm 30, the coupling portion 28 corresponding to the wedge-shaped slot 26, projects in positively locking
25 relationship, in the safe position of the fuse device. The worm 30 is supported with a mounting trunnion 32, remote from the wedge-shaped coupling portion 28, in a blind hole in an entrainment member 34. The entrainment member 34, formed with a radially outwardly projecting nose 36, is supported in a sleeve 38 provided with a slot 40. The nose 36 of the
30 entrainment member 34 is disposed in the slot 40 in the sleeve 38 in the armed position of the fuse device 14.

A toothed sleeve 44 of an arming drive is rotatably supported in a mounting space 42 of the safety device housing 16. The toothed sleeve 44 has a female screwthread portion 46 and two external gear rings 48 and

50. A screwthread portion 52 of an arming shaft 54 is screwed into the female screwthread portion 46. The arming shaft 54 extends, in a condition of being prevented from rotating, through a through hole 56 in the safety device housing 16 in the safe position into a blind hole 58.

5 As can be seen from Figure 2 the worm 30 is operatively connected in torque-transmitting relationship with the external gear ring 48 of the toothed sleeve 44 of the arming drive by means of a connecting device 60 which at the one end portion of a connecting shaft 62 has a worm gear 64 meshing with the worm 30 and at the other end portion remote therefrom a
10 worm 66 which meshes with the external gear ring 48 on the toothed sleeve 44.

 An output drive gear 68 which is supported at the central sleeve 20 of the plate 18 is in meshing engagement with the second external gear ring 50 of the toothed sleeve 44 of the arming drive. The output drive gear
15 68 is formed for example with an arcuate slot 70 which is concentric with respect to the fan wheel shaft 24 and which can have an arcuate opening angle of about 30 degrees of angle. Projecting into the arcuate slot 70 is an end portion 72 of a spring device 74 which is in the form of a coil torsion spring. The second end portion of the spring device 74 is fixed to the
20 central sleeve 20.

 A first arming pin 76 and a second arming pin 78 are axially movably mounted in the safety device housing 16. The first arming pin 76 is urged towards the plate 18 by means of an associated coil compression spring 80 and the second arming pin 78 is similarly urged by means of an associated
25 coil compression spring 82. The second arming pin 78 extends through a safety plate member 84 between the safety device housing 16 and the plate 18 and through the plate 18 into a blind hole 86 in the cover 22.

 The worm 30 is formed with a bevel surface 88 against which the safety plate member 84 bears in positively locking relationship in the safe
30 position of the fuse device 14 in order to prevent rotary movement of the worm 30.

 The mode of operation of the fuse device 14 is as follows:

1. Safe position:

In the safe position the first and second arming pins 76 and 78 and the arming shaft 54 are in the positions shown in Figure 1. The spring device 74 is in a non-stressed condition, that is to say no energy is stored in the spring device 74. The safety plate member 86 blocks the fan wheel shaft 24 by means of the second arming pin 78.

As can be seen from Figure 4, arranged in the safety device housing 16 in a receiving space 80 provided for that purpose is an impact weight 92 with a detonator.

10 A firing pin 96 associated with the detonator 94 is provided on the plate 18.

In the safe position the impact weight 92 is held fast at a spacing from the firing pin 96 by means of a resilient safety lever 98 (see Figure 4), that is to say by means of a safety lever 98 and a safety spring (not shown) in the receiving space 90 of the safety device housing 16.

2. Armed position:

When the mortar shell 10 is fired from a barrel, firstly the first arming pin 76, due to inertia, moves in opposite relationship to the associated coil compression spring 80 so that the ball 100 between the first and second arming pins 76 and 78 can move towards the right in Figure 1. That releases the second arming pin 78, that is to say, due to inertia, subsequently to the first arming pin 76, it can move in opposite relationship to its associated coil compression spring 82. When that happens, the second arming pin 78 moves out of the blind hole 86 in the cover 22 and out of the plate 18 and out of the safety plate member 84 and releases the safety plate member 84. That means that the fan wheel shaft 24 is no longer prevented from rotating but is released. The fan wheel shaft 24 can therefore rotate and stresses the spring device 74. With that rotary movement of the fan wheel shaft 24, at the same time the arming shaft 54 is moved out of the blind hole 58 so that the safety device housing 16 in the receiving space 12 is no longer prevented from rotating but is released. That gives a bore-safe safety condition.

The safety device housing 16 rotates into the armed position shown also in Figure 5, with the impact weight 92 being armed by the safety lever 98 (see Figure 4).

By way of example, the fan wheel (not shown), that is to say the fan wheel shaft 24, performs about 600 revolutions, during which the spring device 74 is mechanically stressed. When the safety device housing is in the armed position, that is to say it assumes the live position, the worm 30 and the entrainment member 34 are axially displaced and thus uncoupled. In the uncoupled condition shown in Figure 5 the positively locking connection between the wedge-shaped slot 26 in the fan wheel shaft 24 and the wedge-shaped coupling portion 28 of the worm 30 is disengaged so that the fan wheel shaft 24 can rotate freely. The operative connection between the safety device housing 16 and the spring device 74 is disengaged in the armed condition. In the armed condition the entrainment member 34 arrests the safety device housing 16.

The arcuate slot 70 in the output drive gear 68 serves to ensure an improved start-up performance on the part of the fan wheel shaft 24 because the spring device 74 is only mechanically stressed after the output drive gear 68 has rotated for example through about 30 degrees of angle.

Another possible option provides for example that the spring device 74 is suitably pre-stressed or biased in the opposite direction of rotation, upon installation. In that case the end portion 72 of the spring device 74 can be fixed to the output drive gear 68. The start-up performance can also be improved as desired by such a slight mechanical biasing effect in the opposite direction of rotation; in that case however, as in known fuse devices, the spring device is mechanically biased, even if relatively slightly.

CLAIMS

1. A fuse device for a mortar shell, which is settable from a safe position into an armed position by means of a spring device (74), characterised in that

the mortar shell (10) has a fan wheel which is provided for biasing the spring device (74) in order to set the fuse device (14) from the safe position into the armed position,

a safety device housing (16) has first and second arming pins (76, 78) and an arming shaft (54), wherein a safety plate member (84) is provided between a fan wheel shaft (24) connected to the fan wheel, and the second arming pin (78), and

the fan wheel shaft (24) in the safety position is coupled in torque-transmitting relationship to a worm (30) operatively connected to a toothed sleeve (44) of an arming drive, by means of which the safety device housing (16) can be released into a bore-safe position by an arming shaft (54).

2. A fuse device according to claim 1 characterised in that the arming drive has an output drive gear (68) provided for biasing the spring device (74).

3. A fuse device according to claim 2 characterised in that the output drive gear (68) is provided with an arcuate slot (70) which is concentric with respect to the fan wheel shaft (24) and in which is provided an end portion (72) of the spring element (74).

4. A fuse device according to claim 1 characterised in that the spring device (74) is fixed with an end portion to the drive wheel (68) and is biased in the counter-rotation direction.

5. A fuse device according to any one of the preceding claims characterised in that provided in the safety device housing (16) is an impact weight (92) which in the safe position is spaced from a firing pin (96) by means of a resiliently stressed arming lever (98).

6. A fuse device according to any one of the preceding claims characterised in that the worm (30) arrests the safety device housing (16) in the armed position by means of an entrainment member (34).