

The invention relates to a safety arrangement for a spin projectile detonating device in accordance with Claim 1.

A rotor safety means for a spin projectile detonating device is known from DE-A 20 09 988. Both the firing speed and the spin are necessary for take-off safety. The resulting forces are applied onto a U-shaped expandable retaining ring. The retaining ring sits in an annular step of the rotor. The sliding plane for the retaining ring is of conical structure in the direction of the rotor centre. In this way, the retaining ring must assume a forward position which is offset in relation to a radial groove on the casing side.

Function faults may occur as a result of the unequal masses of the U-shaped retaining ring. During the return and opening stroke, the firing speed and spin may tilt the retaining ring in the radial groove in such a way that the flanks prevent the rotor from absorbing the spin necessary for function.

Moreover, if the projectile is handled roughly, the retaining ring can be jammed in its rear position, if knocked unintentionally, and lock the rotor in safe position. In both cases, there are highly explosive blind shells present after firing.

A safety arrangement for a spin projectile detonating device in accordance with the preamble in Claim 1 is known from EP-A2 0 068 534, in which a corrugated retaining ring with a slot is divided into segments by incisions with deformable webs, thus having a substantially groove-like profile. The segments abut on alternate sides against the detonator casing and the rotor. Because of the narrow webs of the retaining ring, it cannot be excluded in a drop test on a shell equipped therewith that the webs are permanently

deformed, and therefore it is not assured that the detonator can be made safe again.

The object of the invention is to provide a rotor safety device for a spin projectile detonator device which operates safely when the spin projectile is fired by releasing the rotor, and which assures that the rotor can be made safe again even after rough handling.

This object is achieved in accordance with the characterising features of Claim 1.

Advantageous embodiments of the invention are specified in the sub-claims.

Essential aspects of the invention are the retaining ring abutting the rotor without radial bias, the ease of assembly of the retaining ring on the rotor and the free axial mobility of the retaining ring as a result of the provided compression spring in the provided area of the detonator casing.

The retaining ring has a small gap in the centripetal and centrifugal direction of the respective abutment surfaces. This prevents material fatigue such as occurs in the retaining rings according to prior art, for example. Hence, function faults resulting therefrom cannot occur.

The retaining ring, which is freely movable in axial direction against spring force, allows the rotor to be made safe again, e.g. in the case of drop tests or impact stresses when handling the projectile.

The necessary function safety is apparent as a result of the invention during acceleration of the projectile in the weapon barrel, i.e. with respect to two releasing criteria: 1. safety during acceleration of the projectile and 2. safety during increase in spin.

The virtually closed retaining ring supports the rotor in radial direction on the detonator casing. In the case of lateral shock stresses, the mass forces of the rotor are deflected by the retaining ring into the detonator casing. No adverse deformations of the retaining ring can occur as a result of its relatively high resistance moment.

An embodiment of the invention is described in the drawing together with the advantages.

Figure 1 shows a cross-section through a detonator;

Figure 2 shows a section II-II according to Figure 1;

Figure 3 shows the detonator according to Figure 1 after a projectile has been fired;

Figure 4 shows the detonator according to Figures 1 and 3 during increase in spin;

Figure 5 shows a section IV-IV according to Figure 4.

A safety arrangement 1 assures that a retaining ring 2 is centred on the one side by a conical compression spring 3 in an annular groove 4 of the rotor 5 and on the other side by a wall 6 of a detonator casing 7 via annular gaps 8.

The annular groove 4 has a base 10 and a face side 11.

The rotor 5 is provided in a known manner with a detonator 15 and a locating cone 16 for an axially movable safety sleeve 17. The detonator casing 7 houses the safety sleeve 17 and a firing pin 18. Additionally, the detonator casing 7 houses the already described rotor 5 in a spherical recess 20. Arranged in a counter-position thereto, a corresponding spherical recess 21 is provided in a charge casing 22. These recesses 20, 21 form a slide bearing for the rotor 5. In this case, the compression spring 3 firmly holds the rotor 5 in the recess 20 by means of the retaining ring 2. No additional bearing is provided in a recess 8 in the detonator casing 7.

The retaining ring 2 according to Figures 2 and 5 is provided with a spline profile, thus providing support lugs 25 with recesses 26 located between them. The support lugs 25 have supporting surfaces 27 curved in keeping with the annular groove 4. A ring 28 supports the support lugs 25, the ring 28 being divided by a slot 29.

The detonator casing 7 has a radial groove 30, the base 31 of which is located lower by distance 32 than the wall 6 of the detonator casing. The two faces 33, 35 are located far enough from one another to allow the retaining ring 2 to be positioned with ample axial play. An inclined surface 34 optionally assists adjustment of the expanding retaining ring 2.

A recess 40 with an edge 41 on the peripheral side is provided on the charge casing 22 to receive the base 48 of the compression spring 3. Additionally, the charge casing 22 is provided with a booster charge in a manner not shown in the drawing.

The compression spring 3 abuts a surface 12 of the retaining ring 2 with its head section 9, whereas the base 48 of the compression spring 3 is supported by the charge casing 22. The charge casing 22 is connected to the detonator casing 7 via a threaded joint 23.

With respect to function:

The safety arrangement 1 of a spin detonator (not shown in detail) reacts to the firing acceleration acting in the direction of arrow 50 by an axial stroke of the retaining ring 2 against the force of the compression spring 3 according to Figure 3. The retaining ring 2 is in its outermost axial stroke position, since the compression spring 3 cannot be compressed further. In this position, the retaining ring 2 is flush with the radial groove 30. The retaining ring 2 can expand into the radial groove 30 as shown in Figure 4 - after increase in spin of a projectile in the weapon barrel.

The retaining ring 2 is made of a beryllium bronze. This material ensures that the retaining ring 2 abuts fully against the base 31 of the radial groove 30 because of the centrifugal forces acting predominantly on the support lugs 25. In this case, the webs 14 located between the support lugs 25 are plastically, i.e. permanently, deformed.

The rotor 5 released from the retaining ring 2 arranges itself in the position shown in Figure 4 because of its centre of gravity position, in which case the safety sleeve 17 is shifted back by the locating cone 16. The rotor 5 is locked in the active position shown in this figure by means which are not shown. On conclusion of the acceleration phase of the projectile, the compression spring 3 places the retaining ring 2 against the face 33.

If a detonation criterion is evident, then the firing pin 18 strikes against the detonator 15 in a known manner. Its detonating energy then triggers a transfer charge. If the safety arrangement 1 is subjected to impact in the direction of arrow 50 in Figure 3 in a drop test or during rough handling, then the retaining ring 2 lifts from the rotor 5 according to Figure 3, but after impact will assume its position again on the rotor 5 as shown in Figure 1. Any axial displacement of the bore diameter 45 in relation to diameter 46 of the annular groove 4 is prevented by the virtually equal journal diameter 47 of the charge casing 22.

The safety sleeve 17 ensures that the rotor 5 in the safe position according to Figure 1 remains in the phase in which the retaining ring 2 is lifted from the rotor 5.

If during acceleration in the weapon barrel a projectile is subjected to spin which does not reach the prescribed magnitude, in the case of a virtually discharged weapon barrel, for example, then the rotor 5 is once again secured after the projectile has left the weapon barrel. The centrifugal forces exerted on the retaining ring 2 have not reached the magnitude sufficient to plastically deform the webs 14, see Figure 5, which means that the retaining ring 2 retains its unchanged size as shown in Figures 1 and 2.

The resilient mounting of the rotor 5 as a result of the compression spring 3 is also of advantage. The compression spring 3 causes a gap 49 to be formed by pressing the rotor 5 into the recess 20 of the detonator casing 7. In the case of shock stresses, the compression spring 3 and gap 49 give the rotor 5 the ability to shift position inside the recess 8 cushioned by the spring. In this way, the detonation threshold of the detonator 15 is substantially lower in the

case of shock stresses than is the case with detonators according to the prior art.

Aluminium or steel are also suitable materials for the retaining ring 2. The material characteristics required are high breaking strength and high toughness.



Patent Claims:

1. Safety arrangement (1) for a spin projectile detonating device, with a detonating device casing (7) and a bearing body (22), in which a spherical rotor (5) is mounted to allow rotational movement and a radial groove (30) is formed, wherein said rotor (5) has a hole with a detonator (15) disposed therein and in a peripheral area has an annular groove (4), which extends in a plane displaced axially to the radial groove (30) and in which an expandable retaining ring (2) is inserted, which only releases the rotor (5) held in safe position after the projectile has been fired by shifting axially under the effect of axial and spin forces and by expanding radially to allow the rotor (5) after its release to swing into active position with the detonator (15), and wherein said retaining ring (2) has support lugs (25) with supporting surfaces (27) and a radially extending slot (29) as well as deformable webs (14), characterised in that when the rotor (5) is in safe position, the retaining ring (2) abuts the face side (11) of the annular groove (4) via a spring (3) on the casing side, in which case the groove profile of the retaining ring (2) is constructed in the form of a spline profile in that the support lugs (25) are arranged internally and are distributed uniformly, whereas an outer ring (28) of the retaining ring is provided with the slot (29) and several permanently deformable webs (14) with the same cross-section, and the retaining ring (2) is held with an inner and outer radial annular gap (19) between the base (10) of the annular groove (4) and the detonating device casing (7).



2. Safety arrangement according to Claim 1, characterised in that the spring is constructed in the form of a spherical compression spring (3) and lies with its base (48) in a recess (40) on the casing side to abut against a peripheral edge (41), whereas its head section (9) abuts against the retaining ring (2) so as to be freely movable in the radial directions.
3. Safety arrangement according to Claim 1, characterised in that the spring (3) acts as a stop at the maximum firing acceleration of a projectile, and it fixes the retaining ring (2) in this stop in axial direction inside the two faces (33, 35) of the radial groove (30).