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(54) Improvements to impact igniters.

(57) The disclosure relates to an impact igniter for projectiles rotating in their trajectory, the igniter being secured against unintentional initiation prior to firing of the projectile in that the detonating cap (15), initiated by the firing pin on a hit in the target, is disposed in a bore in a rotor (14) that is asymmetric in terms of weight rotatably disposed in relation to the main portion of the igniter (1), the rotor being secured in a position obliquely inclined in relation to the longitudinal axis of the projectile and a firing pin disposed in the same direction, in which position the rotor is blocked by means of specific safety functions characteristic of the present invention, these functions including a pin fixedly connected to the rotor and projecting therefrom.

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IMPROVEMENTS TO IMPACT IGNITERS

TECHNICAL FIELD

The present invention relates to an impact igniter for projectiles rotating in their trajectory. The impact igniter according to the present invention is equipped with several mutually supplementing and to a certain degree overlapping safety functions which give it an extremely high safety profile, while at the same time the igniter is highly functionally reliable in the course of its actual release function, which is based on old and thoroughly proven functional elements.

BACKGROUND ART

A very common method of making an impact igniter safe for transport is to place its detonating cap in a rotor that is asymmetric in terms of weight and which rotates about an axis that runs perpendicularly across the longitudinal axis of the igniter, and which, in the safe position, has been turned sideways so that the spring-loaded firing pin of the igniter disposed in the longitudinal direction thereof and restrained against release function by one means or other cannot reach the detonating cap. Such impact igniters also include one or more safety functions which prevent the rotor from being turned to the release position at the wrong time, i.e. with the detonating cap in alignment with the firing pin. In such instance, the firing pin is often employed, directly or indirectly, to initially block the rotation of the rotor. The firing pin may in turn be blocked by means of a separate blocking device in order to impart to the igniter an initial masking safety, while its release function could, for instance, comprise the very common latch and self-release function which consists of a number of axially displaceable balls journalled in the firing pin or its extension. On rotation of the igniter, the balls are forced outwardly to the side by centrifugal force and in this instance are displaced towards an interiorly truncated conical plane, the firing pin being urged slightly backwards against the action of the impact spring and then releasing the rotor which, in its turn, is rotated by its own weight assymetry so that the detonating cap becomes aligned with the firing pin. On a hit on the target, the balls are no longer capable of withstanding the pretensioned impact spring, for which reason the impact igniter is triggered and the detonating cap initiated. The same applies when the rotation becomes so slow that centrifugal force is no longer capable of holding out the balls and retaining the firing pin in the tensioned state. Hence, this latter makes for a reliable self-release function.

One problem inherent in many igniters of the above-outlined general type is that the rotor, i.e. the detonating cap safety device, is not directly connected to the masking safety device and is not locked throughout the entire masking safety distance.

One method of obviating this problem is, as was mentioned above, to lock the firing pin for a brief time in the initial position, i.e. in the position where it in turn prevents rotation of the rotor. Such a method may be put into effect, for instance, by means of a hard wound tape which, during rotation of the projectile, is progressively unwound and releases the firing pin. In this case, such a specific masking safety function does act indirectly on the rotor via the firing pin.

SUMMARY OF THE INVENTION

The present invention now relates to a novel type of impact igniter in which the masking safety function acts directly on the rotor and positively prevents rotation thereof. Since the igniter cannot be initiated without the rotor having first been turned to the arming position, a safety function which directly blocks the rotor must be considered as entailing increased safety.

The apparatus designed in accordance with the present invention thus consists of an impact igniter for projectiles rotating in their trajectory, the impact igniter being secured against unintentional initiation before firing in that its detonating cap, initiated by a firing pin on a hit in the target, is disposed in a bore in a weight ratio asymmetric rotor which is pivotal in relation to the main portion of the igniter, the ignition body. In a first safety position, the rotor is obliquely positioned in relation to the longitudinal axis of the projectile - along which the firing pin is disposed - such that the detonating cap is inaccessible to the firing pin and in which position the rotor is initially blocked against rotation by one or more masking and transport safety devices. Moreover, the rotor, once the masking and transport safety devices cease to act thereon after firing of the projectile and a predetermined masking safety distance, is turned by its own asymmetry under the action of centrifugal forces, to a second arming position in which the firing pin and detonating cap are in alignment with one another ready for initiation on impact on the target. A particular characterizing feature of the impact igniter according to the present invention is that the rotor displays a projecting pin fixedly secured to the rotor and

disposed transversely of the bore provided for the detonating cap, while the ignition body also displays, in addition to the journal for the rotor, a groove adapted for this pin along which the pin is displaced on rotation of the rotor from a first safety position axial with the firing pin to a second arming position outwardly angled on rotation of the projectile by centrifugal force transversely of the longitudinal direction of the projectile, at which position the detonating cap is brought into alignment with the firing pin.

The most manifest advantage inherent in this design is that the pin may be utilized directly as an engagement for a safety function which may, for instance, consist of a helically wound tape of per se known type which unwinds on rotation of the projectile and which in turn surrounds a slit fold-out or alternatively divisible bushing which in turn surrounds the pin and thereby prevents rotation of the rotor as long as the tape tightly surrounds the bushing. However, as soon as the tape has been fully unwound, centrifugal force will open the bushing and eject the pin from its safety to its arming position.

To prevent the tape and bushing from moving prior to firing (in rough handling, for example air-dropping of ammunition), the firing pin is employed, and is forced by the impact spring against the bushing with a flange edge which surrounds the firing tip proper.

The firing pin is further designed with a combination release function on impact on the target and a self-destruct function in the form of freely movable balls disposed in bores in the firing pin, these being forced out, on rotation of the projectile, towards an interiorly truncated conical plane, whereupon the firing pin is forced slightly backwards against the action of the impact spring. At this point, the pressure of the firing pin on the bushing is eased and the firing pin is held ready for initiation of the detonating cap as soon as this has been turned by the rotor to the firing position. The reason for this is that the pertinent ball lock for the firing pin (the fundamental principle of which is of an old, well-known and extremely reliable design) is incapable of restraining the firing pin in the event of a hit, or, in the event of a miss, once the rotation of the projectile has had time to decrease too much for the centrifugal force to be capable of withstanding the impact spring.

The pin, which is a characterizing feature of the invention, may be bolted, soldered or riveted into place in an aperture in the rotor instead of being manufactured integrally with the rotor. It may also suitably be provided with a groove or recess adapted for the tip of the firing pin.

With the exception of the pin and two planar surfaces disposed in parallel therewith, the rotor is defined by a truncated global defining surface. In addition, also provided is the bore for the detonating cap which, through the centre of the rotor, is disposed at right angles to the pin and parallel with the planar guide surfaces. These latter prevent the rotor from turning in an undesirable manner, since the ignition body displays corresponding abutment surfaces. The ignition body, moreover, features a groove for movement of the pin from in alignment with the firing pin and out towards the side of the ignition body. The pin is provided with cylindrical abutment surfaces against the edges of the groove in order to give the least possible friction against these edges.

BRIEF DESCRIPTION 0F THE ACCOMPANYING DRAWINGS

The impact igniter according to the present invention has been defined in the appended Claims and will now be described in greater detail in connection the accompanying Drawings.

In the accompanying Drawings:

Fig. 1 is a longitudinal section through an impact igniter according to the present invention; and

Fig. 2 is an oblique projection of the rotor included therein, shown on a larger scale.

DESCRIPTION OF PREFERRED EMBODIMENT

In the longitudinal section shown in Fig. 1, the direction of movement of the projectile is assumed to be upwards in the figure, i.e. the figure shows an impact igniter disposed in the rear region of the projectile. However, it is immaterial where the impact igniter is placed.

In Fig. 1, reference numeral 1 indicates relevant parts of the ignition body and also the rear portion of the projectile, while reference numeral 1a indicates the bottom portion of the igniter in which a detonator 2 is disposed, and reference numeral 1b indicates the housing in which a rotor 14 (described in greater detail below) is journalled. Finally, reference numeral 1c indicates a spacer washer.

The main charge of the projectile is designated 3. The firing pin is designated 4 and its impact spring 5. The firing pin 4 is journalled in a firing pin journal 1d which may also be considered as a part of the ignition body 1. Bores 6 are provided in the firing pin 4 in which freely movable balls 7 are disposed. On rotation of the projectile and the associated impact igniter, the balls 7 are forced outwardly to the side by centrifugal force. In this instance, they will be urged outwardly and rearwardly towards the impact spring 5 along an interiorly

truncated conical plane 8 in the firing pin journal 1d, the impact spring being compressed and the firing pin being retracted somewhat. In the initial position, an annular flange 10 disposed about the tip 9 of the firing pin urges against a slit bushing 11 designed in a per se known manner which, in its turn, is surrounded by a masking safety tape 12 progressively unwound by the rotation of the projectile.

In turn, the bushing 11 surrounds both the forward portion of the firing pin and a pin 13 characteristic of the present invention which projects outside a rotor 14 in which is disposed a detonating cap 15 which, on impact on the target, is to be initiated by the firing pin 4.

In the position illustrated in the figure, the rotor 14 is in a secured state, in which the bushing 11 surrounds the pin 13 and is itself surrounded by the tape 12, while the firing pin 4 presses with its flange 10 against the bushing 11. As will be apparent from Fig. 2, the rotor 14 has a truncated spherical defining surface interrupted by the pin 13, the through channel for the detonating cap 15 and two mutually parallel planar guiding surfaces 16a (16b), of which only 16a is shown in the figure.

Corresponding contact surfaces for the spherical main surface of the rotor and the guide surfaces 16a (16b) are disposed within the ignition housing. Moreover, it will be apparent from this figure that the pin 13 is provided with a groove 13a for the tip of the firing pin. A specific groove 17 is provided in the ignition housing along which the pin 13 is displaced on rotation of the rotor.

Finally, there is provided a safety plate 18 of per se known type consisting of two robust shanks and a weaker web portion. This safety plate grasps about the rotor along a groove 19 and prevents rotation of the rotor. This is an extra safety device which, on rotation of the projectile, is released in that the shanks of the safety plate are forced outwardly by centrifugal force. In such instance, the rotor is released from this safety device but is still restrained by other safety functions. However, at the same time the firing pin is forced backwards against the impact spring in a manner previously described and the pressure of the firing pin 4 against the bushing 11 ceases while the tape 12 is progressively unwound. When the tape has been wholly unwound, the bushing 11 is buckled or parted and the rotor 14 turned by its imbalance under the action of centrifugal force so that the pin 13 is displaced along the groove 17, the detonating cap 15 being brought into alignment with the firing pin 4 and the igniter being made ready for release.

As a result of the above-outlined design, this embodiment of the impact igniter has been given multiple security against rough handling prior to firing, at the same time as its function on impact in a target has been ensured in that only thoroughly proven functional elements are included in the release function thereof.

The present invention should not be considered as restricted to that described above and shown on the Drawings, many modifications being conceivable without departing from the spirit and scope of the appended Claims.

Claims

1. An impact igniter for projectiles rotating in their trajectory, said impact igniter being secured against unintentional initiation before firing in that its detonating cap (15) initiated by firing pin on impact in the target is disposed in a bore in a rotor that is asymmetric in terms of weight and rotatably disposed in relation to the main portion (1) of the igniter, the igniter body, said rotor being, in a first safety position, obliquely positioned in relation to the longitudinal axis of the projectile such that the detonating cap (15) is inaccessible to the firing pin (4) and in which position the rotor (14) is initially blocked against rotation by one or more masking and transport safety devices (11, 12 and 18), and said rotor (14), once the masking and transport safety devices cease to influence same after firing of the projectile and a predetermined masking safety distance, being rotated by its own asymmetry and under the action of centrifugal force, to a second arming position where the firing pin (4) and detonating cap (15) are in alignment with one another ready for initiation on impact on the target, **characterized in that** said rotor (14) displays a projecting pin (13) fixedly connected to the rotor and disposed transversely of the bore adapted for the detonating cap (15), while the ignition body (1) also displays in addition to the journal for the rotor a groove (17) adapted for said pin, along which said pin is displaced on rotation of the rotor (14) from a first safety position disposed axially with the firing pin (4) to a second arming position outwardly angled transversely of the longitudinal axis of the projectile by the centrifugal force on rotation of the projectile, in which position the detonating cap (15) is brought into alignment with the firing pin.

2. The impact igniter as claimed in Claim 1, **characterized in that** the pin (13) is, in the safety position, employed as an engagement for a masking safety function (11, 12).

3. The impact igniter as claimed in Claim 2, **characterized in that** said masking safety function (11, 12) consists of a helically wound tape (12) of per se known type which is unwindable by the rotation of the projectile and which surrounds a slit fold-out or alternatively divisible bushing (11) which in turn surrounds the pin (13) in its safety position and

thereby prevents rotation of the rotor (14) as long as the tape (12) tightly surrounds the bushing (11).

4. The impact igniter as claimed in Claim 3, **characterized in that** the firing pin (4) directly acts on the bushing (11), by means of an annular flange (10) or edge disposed about its own tip intended to initiate the detonating cap, and transfers to said bushing the force of an impact spring (5), as long as the projectile has not been fired.

5. The impact igniter as claimed in Claim 4, **characterized in that** the firing pin (4) is provided with a combination release function acting against its impact spring (5) on a hit on the target, or a self-release function, respectively, on a miss, in the form of a per se known type locking function controlled by centrifugal force, which is in the form of a plurality of balls (7) freely movable in bores in the firing pin along an inwardly truncated conical plane (8) disposed at the projectile body, whereupon the firing pin (4) is forced, against the action of its impact spring (5) rearwardly to a pre-tensioned position, the pressure of the firing pin (4) against the bushing (11) being eased.

6. The impact igniter as claimed in Claim 5, **characterized in that** the pin (13) is provided with a central groove (13a) in which the tip of the firing pin (4) may project in the safety position without coming into contact with the rotor.

7. The impact igniter as claimed in one or more of Claims 16, **characterized in that** the rotor (14) displays truncated spherical abutment surfaces (16a, 16b) which abut against corresponding journal surfaces in the ignition body and along which the rotor may move while it is locked against rotation in an undesired direction by planar guide surfaces (16a, 16b) which outwardly define the truncated spherical abutment surfaces and which in their turn abut against corresponding planar guide surfaces in the ignition body.

8. The impact igniter as claimed in Claim 7, **characterized in that** the pin (13) makes substantially a right angle with the bore for the detonating cap (15); **and that** the groove (17) for the pin in the ignition body runs along a symmetric plane of division in the ignition body from the intersection by the centre axis of the plane of division to that point where the pin is located when it is wholly flared at a right angle to the projectile axis.

9. The impact igniter as claimed in Claim 8, **characterized in that** the pin (13) is separately manufactured and is fixedly connected to the rotor (14) by means of bolting, riveting, welding or brazing.

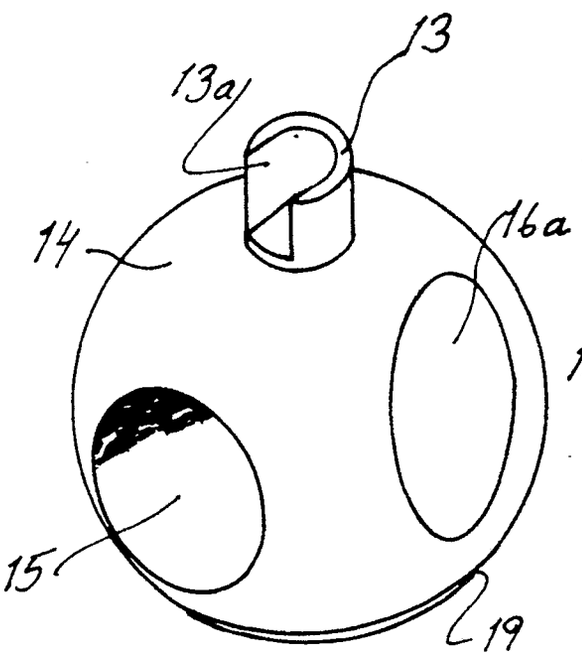

Fig. 2

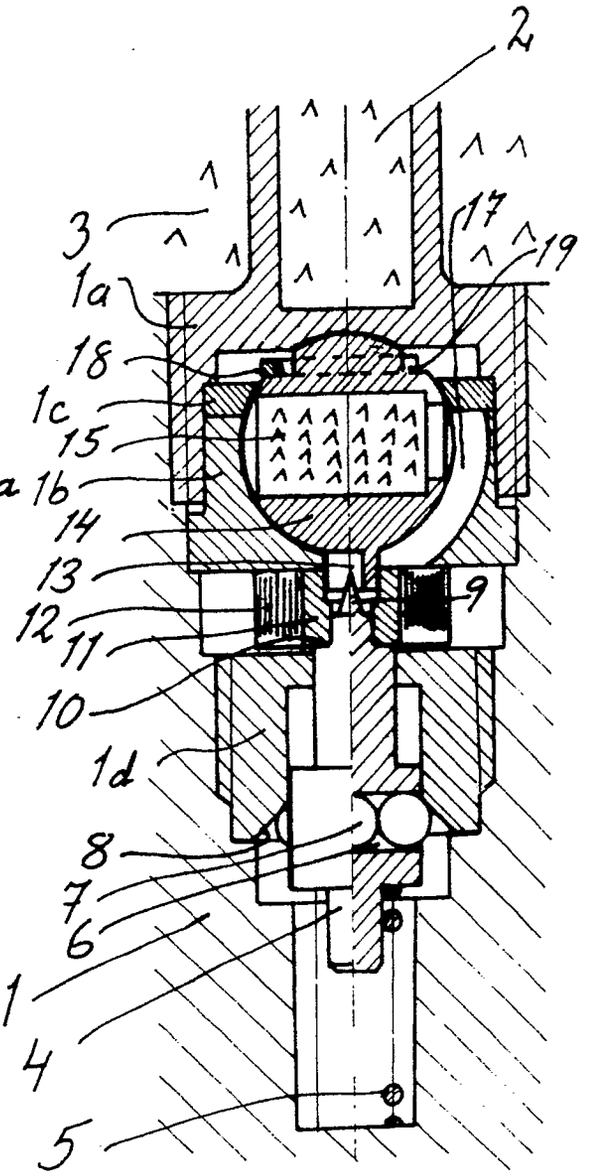

Fig. 1