

DESCRIPTION

The invention relates to an explosive projectile having a projectile body in accordance with the definition of the species of claim 1.

A high-explosive incendiary shell is known from EP 0 068 533 B1. This has a projectile body and a ballistic cap arranged in front of the projectile body. An explosive charge with an incendiary charge arranged in front of the explosive charge is provided inside the projectile body.

A base fuze is arranged behind the explosive charge. The explosive charge has at its front end a conical tip, this tip is surrounded by an incendiary charge, the incendiary charge being arranged inside a conical recess of the projectile body. As a result of this arrangement, the incendiary charge is distributed over a relatively area by the explosive charge.

Furthermore, an explosive projectile having fragmentation effect is known from EP 0 101 795 B1. Preshaped splinters are arranged both in the projectile body and in the rear part of the nose fuze.

These splinter bodies are accelerated by an appropriately associated booster charge into the spatial angular regions lying directly in front of the nose of the projectile. However, what is disadvantageous about this is the fact that the nose fuze splitting apart upon the detonation of the explosive charge hinders the propagation of the splinters into the front angular region.

Known from DE-A1 34 24 238 is an explosive projectile in which a projectile body provided with splinters in the cylindrical region has at its conical tip a continuous axial aperture, so that a throughgoing detonation of a base fuze as far as an explosive charge arranged in a projectile cap is guaranteed. The projectile cap has peripherally preshaped splinters, these being arranged between two casings. Upon the detonation of the explosive there does indeed arise as a result of the splinters in the projectile cap a fragmentation effect in the direction of the axis of the projectile, but by reason of a splinter-free region, thus having no preshaped splinters, a comparatively large angle around the axis of the projectile will remain without splinters.

The problem of the invention is seen in proposing an explosive splinter projectile having depth effect in which the fragmentation effect also comes to bear in the firing direction.

This problem is solved by the invention indicated in patent claim 1.

Advantageous developments of the invention will become apparent from the sub-claims.

The explosive projectile in accordance with the invention is for tank guns with a fighting range up to about 3,500 m and for combatting so-called soft and semi-hard targets. The projectile trajectory has in known manner at this target range almost no trajectory deviation of any importance, so that 'per se' high accuracy of fire exists, which is necessary for combatting tightly restricted and smaller targets, such as for example portable or motorized anti-tank systems.

In the target region which is functionally covered by an appropriately designed projectile fuze, a high splinter density is achieved in the lateral and in particular in the forward region of the projectile. Even at fairly great fighting range and with the associated relatively great scatter of the detonation point in the firing direction a high probability of destruction is realised.

The matrix allows any desired shaping of the splinter body. The binding forces of the matrix are adequate for problem-free assembly and handling upon assembly. On the other hand, however, the binding forces are so low that upon detonation the unimpeded sundering and thus uniform distribution of the preshaped splinters exists. Also as a result of the matrix in the case of the splinter body the necessary stability of shape exists with respect to the feed shock into the ammunition chamber of the weapon and upon firing.

In accordance with claim 3, the available space for the splinter body within the cap is utilised in an optimum manner, without the aerodynamics of the projectile being impaired.

In accordance with claim 4, the shape of the splinter body as a truncated cone brings about a good spatial splinter distribution with good depth effect.

In accordance with claim 5, the plane front surface of the splinter body allows cost-favourable production. The plastics body by reason of the plane front surface of the splinter body fixes in a simple manner the splinter body inside the cap, on the other hand the plastics body by reason of its low density impairs neither the acceleration of the projectile nor the propagation of the splinters or the acceleration of the splinters.

In accordance with claim 6, a splinter body is proposed which is usable with great effect for a so-called sabot projectile. By reason of the smaller projectile cross-section, a relatively small volume is available for the splinter body. The chosen shape and design of the splinter body guarantees, assisted by the higher velocity of the

projectile, a high splinter density and splinter velocity at great ranges.

In accordance with claim 7, the splinter body of which is suitable for a full-calibre projectile, the explosive in the front, relatively small cylindrical portion brings about the necessary radial velocity component for an ideal spatial distribution of the splinters upon air detonation. Moreover, the cylindrical portion affords an additional utilisation of the space in the cap, e.g. by electronics components, such as e.g. sensors or components for the energy supply of the electronic base fuze. Such components can by reason of the cylindrical portions be supported, and also fastened, in an acceleration-free manner on the projectile body.

In accordance with claim 8, the conical tip protruding from the splinter body promotes the propagation of the pressure wave of the explosive for the early splitting-apart of the cap.

In accordance with claim 9, the full-calibre projectile is suitable for larger target surfaces.

In accordance with claim 10, by reason of the ballistically more favourable projectile relatively high projectile velocities can be realised. Thus, at relatively great range tightly restricted, smaller targets can be combatted with high accuracy of fire.

In accordance with claim 11, it is ensured that the splinter body is adequately protected upon the stresses during feeding and firing.

In accordance with claim 12, by reason of the ballistic cap consisting of steel it is guaranteed that on the one hand upon the firing of the projectile the splinter body retains stability of shape, on the other hands the cap supplements by relatively large splinters - for instance of the size of the shaped splinters - the fragmentation effect of the said splinter body and of the splinters arranged at the periphery of the projectile.

In accordance with claim 13, the free space in the cap is utilised to increase considerably the splinter density in the firing direction.

Important for the invention is the large number of splinters in front of the front surface of the projectile body and the relatively extensive conical portions of the projectile body. Thus, upon the exclusive air detonation, i.e. at on average about 10 m above ground, the so-called blind splinter region (see also the description with drawing) is covered with relatively high splinter density and splinter energy. In the collaboration of the frontal splinter body with the proportion of splinters arranged at the periphery on the projectile body a high fragmentation

effect exists over a relatively large spatial angle.

The invention will be explained in more detail hereinafter with reference to the drawings.

- Fig. 1 shows a full-calibre projectile;
- Fig. 2 shows the fragmentation effect of the projectile in accordance with Fig. 1;
- Fig. 3 shows a sub-calibre projectile;
- Fig. 4 shows part of a further projectile;
- Fig. 5 shows the fragmentation effect of the projectile in accordance with Fig. 4.

In accordance with Fig. 1, a projectile 1 designed in a full-calibre manner consists of a projectile body 2, a driving band 3, a projectile fuze 4, an explosive charge 5, a cap 6, a plastics body 7 made of polyurethane foam and a splinter body 8.

Spheres 20 made of heavy metal are embedded in a cylindrical portion 25 of the projectile body 2. The projectile body which is closed at the front and which is designed as a cone 21 has a cylindrical portion 22 with a conical tip 23. The wall thickness of the cone 21 becomes, with decreasing diameter, smaller. The wall thicknesses further decrease over the cylindrical portion 22 as far as the tip 23. The splinter body 8 extends between the cap 6, the cone 21 and between the cylindrical portion 22. The conical tip 23 projects beyond a front surface 24 of the splinter body 8. The spheres 20 of the splinter body 8 lie in a matrix of polyurethane foam.

The plastics body 7 butts both against the front surface 24 of the splinter body 8 and against the inner surface of the cap 6.

Operation:

The projectile 1 is fired from a tank gun which is not shown and flies on a trajectory 26 which forms an angle 27 of about 1° relative to the horizontal 49. Above a target area 50, (with a fighting range of about 2,500 m) at a height 53 of about 10 m, the projectile 1 detonates. The projectile portion 25 produces a splinter cone 31 with an angle of about 40° .

The splinter body 8 produces a subsequent splinter cone 28 with an angle of about 30° . A relatively small central region 29 of about 5° has relatively few splinters. The total region 52 with great probability of destruction amounts with regard to the horizontal to about 75° . Stationary targets, such as vehicles, as well as targets shielded by an earth wall 51 are thereby included.

In accordance with Fig. 3, a projectile 30 designed in a sub-calibre manner consists of a projectile body 32 with

embedded spheres 20, a base fuze 34, an explosive charge 35, a cap 36, a plastics body 37 and a splinter body 38.

The projectile body 32 is arranged in known manner in a propelling pot 40.

The projectile body 32 has a closed tip in the shape of a cone 45. The splinter body 38 completely covers the cone 45 and projects beyond this by the distance 46, which corresponds to about 30% of the outside diameter 47 of the splinter body. The residual volume of the cap 36 is filled up by the plastics body 37 made from polyurethane foam.

The mode of operation corresponds in principle to the full-calibre projectile 1, as described with regard to Figure 2. The corresponding splinter cones are somewhat smaller. The more accurate projectile 30 is therefore used for relatively tightly restricted targets.

In accordance with Fig. 4, a splinter body 59 of a projectile 60 in the firing direction 61 inside the cap 36 has a narrowing portion 62. This portion 62 has the form of a cone which is flattened at its front. Other shapes can also be chosen for the portion 62. Important for the splinter body 59 is the increase in the splinter density in the firing direction 61 as compared with the splinter bodies 8; 38 already described.

This splinter body 59 is usable both in the case of the full-calibre projectile 1 and in the case of the sub-calibre projectile 30.

In accordance with Fig. 5, the effect of the splinter body 59 in accordance with Fig. 4 in the case of a sub-calibre projectile 70 is evident. The detonation of the projectile 70 above the target area 50 is effected at a height 71 of about 5 m.

The splinters 20 of the splinter body 59 are located in the region 74. Assuming the number of the spheres 20 is increased by reason of the narrowing 62 by about 20% as compared with the splinter body 38, this then leads to an intensification of the splinter density in the firing direction 61, namely by about 50% in an angular region 75 of 0 up to a maximum of 10° .

The splinters 20 of the projectile body 32 lie in the region 72.

The angular region 71 corresponds to about 20° , the angular region 72 corresponds to about 45° and an angular region 73 corresponds to about 15° .

With appropriate, known 'per se', selective detonation of the explosive 5; 35 shown in Figures 1, 3 and 4, the depicted splinter regions are directed exclusively at the ground, i.e. only at the target area 50.

PATENT CLAIMS

1. An explosive projectile (1, 30, 60, 70) having a projectile body (2, 32) and a ballistic cap (6, 36) which is arranged in front of the projectile body (2, 32) and which surrounds a head (21, 45), designed in a cone-shaped manner and terminating in a closed tip, of the projectile body (2, 32), an explosive charge (5, 35) arranged inside the projectile body (2, 32), and a base fuze (4), in which respect preshaped splinters (8) are arranged between the head (21, 45) designed in a cone-shaped manner and the ballistic cap (6, 36), and the projectile body (2, 32) likewise has preshaped splinters (20) in its cylindrical portion, characterised in that the explosive projectile (1, 30, 60, 70) above the head (21, 45), designed in a cone-shaped manner, of the projectile body (2, 32) and inside the cap (6, 36) surrounding this head (21, 45) contains a splinter body (8, 38, 59) which is formed from splinters (20) embedded in a matrix and which butts against the cone (21, 45) and against the inner surface of the cap (6, 36).
2. An explosive projectile according to claim 1, characterised in that the matrix consists of a material having low binding powers, such as polyurethane foam.
3. An explosive projectile according to claim 1, characterised in that the splinter body (8) has a recess corresponding to the tip (21 to 23, 45) of the projectile body (2, 32) and an outer shape corresponding to the inner shape of the ballistic cap.
4. An explosive projectile according to claim 3, characterised in that the splinter body (8, 38, 59) is designed as a truncated cone.
5. An explosive projectile according to claim 4, characterised in that the splinter body (8, 38) has a plane front surface (24), against which there butts a plastics body (7, 37) having low density, which for its part fills the remaining hollow space in the cap (6, 36).
6. An explosive projectile according to claim 1, characterised in that the projectile body (2, 32) closed at the front is designed as a cone (45) and is surrounded by the splinter body (8, 38, 59), the height (46) of the splinter body (38) above the cone (45) amounting to about 30% of its outside diameter (47).
7. An explosive projectile according to claim 1, characterised in that the tip of the projectile body (2) has a cylindrical portion (22) small in relation to the diameter of the projectile (1) and having a conical point, and the tip is relatively thin-walled in design.
8. An explosive projectile according to claim 7, characterised in that the conical tip (23) protrudes from the



splinter body (8).

9. An explosive projectile according to claim 1, characterised in that the projectile is designed as a full-calibre projectile (1).

10. An explosive projectile according to claim 1, characterised in that the projectile is designed as a sub-calibre projectile (30).

11. An explosive projectile according to claim 5, characterised in that the ballistic cap (6, 36) in the immediate region of the splinter body (8, 38) has a greater wall thickness than the wall thickness in the region of the plastics body (7, 37).

12. An explosive projectile according to claim 1, characterised in that the cap (6, 36) consists of tough-elastic splinter-forming steel.

13. An explosive projectile according to claim 1, characterised in that the splinter body (59) of the explosive projectile (60) in the firing direction (61) inside the cap (36) has a narrowing portion (62), and a plastics body (63) having low density fills the remaining hollow space in the cap (36).

