

Self-propelling projectile having a penetrator core

The present invention relates to a self-propelling projectile in accordance with the preamble to claim 1 or 2.

5 In the case of so-called peace-keeping measures, it turns out that currently none of the multinational troops possesses suitable weapon systems. For example, a single sniper behind cover can at present be attacked only with heavy weapons if he has taken protective measures against tear gas and so on.

10 The tactical leaders of such offensives have therefore called for weapon systems that specifically penetrate bunker targets without totally wiping out the subject.

15 Tests by Denel (Pty) Ltd, Firgrove, Republic of South Africa, have shown that it is possible to shoot an explosive dart, also known as an explosive penetrator, through bunker targets such as concrete, light metal-reinforced armouring and sand bags, even when the speed on impact on the target is below the speed of sound. It has also proved successful to fragment the explosive dart at the target, that is, behind the armouring, by means of its central explosive charge and to cause, relatively speaking, a great deal of destruction there.

20 The development of a special weapon system for heavy interventions by police (against bunker targets) is not financially justifiable, since the logistics as a whole of conventional combat troops would have to be modified at the same time.

25 The object of the present invention is therefore to use a dart-like projectile, especially an explosive dart, in such a way that an effect restricted locally to the target is achieved.

The dart-like projectile is intended to pierce conventional walls of overground buildings, bullet-proof glass and also dugouts of reinforced concrete, light-armoured vehicles having panels of aluminium alloys, or barricades, especially of sandbags, and to put persons located behind them out of action or to render equipment
5 inoperative.

Furthermore, the subject matter of the invention is intended to utilise existing conventional weapon systems and/or concepts and above all to be useable via their launching devices (platforms).
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The invention is intended to be suitable both for interventions having a non-lethal and for those having a lethal outcome.

That object is achieved by the solution according to the features of claims 1 or 2.
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Surprisingly, a penetrator core pierces a bunker target and the like, without itself sustaining damage, so that active substances that have been made up for a pre-selected action can be introduced into the target area.

20 If such a penetrator core according to claim 2 is used, this allows the use of existing weapon systems, and especially their existing platforms.

By simply replacing a warhead by a projectile jacket of similar exterior ballistics, a very specific effect can be achieved, without, for example, troop training and
25 logistics having to undergo significant modification.

Advantageous constructions of the subject matter of the invention are characterised in the dependent claims.

For police actions in particular, a non-lethal active substance is appropriate, which, for example, during raids or during instances of hostage-taking, puts one or more persons temporarily out of action, see claim 3.

- 5 It is especially easy to introduce strong tear-producing active substances behind a wall or behind bullet-proof glass when they are of the kind according to claim 4.

The construction of a projectile according to claim 5 produces a weapon that has a lethal action in a relatively large space. The formation of fragments is effected by
10 known means.

A stepped tip in accordance with claim 6, which passes virtually intact through even heavily reinforced concrete walls, has proved especially successful.

- 15 A taper of the dart shank in accordance with claim 7 is advantageous, since this reduces frictional resistance during penetration.

By means of suitable notch-type grooves, claim 8, for example, in the axial direction, the penetrator core can be opened from the inside using minimal force.
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A mechanical connection between the penetrator core and the container for the non-lethal active substance ensures automatic distribution thereof; claim 9.

- Either simultaneous or separate inclusion of smoke-forming active substances in
25 accordance with claim 10 is of great tactical importance.

Exemplary embodiments of the subject matter of the invention are illustrated in the accompanying Figures, in which:

- 30 Fig. 1 shows, in sectional view, a penetrator core,

Fig. 2 shows a so-called bazooka projectile having an integrated penetrator core for non-lethal interventions,

Fig. 3 shows, in sectional view, the ballistic casing of a bazooka projectile
5 according to Fig. 2, and

Fig. 4 shows the characteristic velocity profile of the bazooka projectile shown in Fig. 2 on its trajectory to the target.

10 In Figure 1, the reference numeral 1 denotes a dart-like penetrator core. This comprises a cavity 2, which tapers towards the tip and there merges seamlessly into a spherical cap. An active charge 3, in this particular case a stabilised high-power explosive, is stored free from voids in the front-end part of the cavity 2. Behind the active charge 3 there is a compensating spring 7 having a central ignition channel
15 8; an initial charge 4, which together with a detonator 5' of an autonomous ignition device 5 forms an ignition chain known *per se*, is arranged behind the spring 7. At the rear of the penetrator core 1 there is a mounting flange 6, which permits easy integration of the core 1 with a propulsion means A, not shown here.

20 The tip 10 of the penetrator core 1 is stepped towards the rear end. A relatively obtuse dart angle α_1 changes into a more acute angle α_2' in an adjoining taper shank 11; the cylindrical dart shank 12 tapers by a small angle β towards the rear region, which facilitates penetration of the dart at the target.

25 The form of a penetrator core 1 shown in Fig. 1 has a good penetration capacity, surprising even the expert, even in a velocity range of 160 – 240 m/s. The hard tip 10 having a dart angle α_1 , on which a characteristic energy of 50,000 joules acts, obviously "clears away" most materials. There is no exact physical explanation for the phenomenal action of the penetrator core 1.

The illustration according to Fig. 2 shows in simplified form a rocket in the characteristic form of a bazooka projectile to be launched from a barrel 22. The launch velocity v_0 amounts to a maximum of 300 m/s. The propulsion means A is of a conventional form, likewise the tail stabilisers 21. Unlike the conventional bazooka projectile, the penetrator core 1, which contains a non-lethal active substance 3b, is placed behind a two-part ballistic casing 20 on the propulsion means A.

10 Further details of this construction are apparent from Fig. 3.

In contrast to the illustration in Fig. 1, Fig. 3 relates to a purely lethally effective penetrator core 1. In the cavity 2 there is an explosive charge 3a, in which additionally a fragmentation ring 3c (fragmentation matrix) is incorporated; on detonation, the fragmentation ring, together with the fragmenting core 1, forms a plurality of fragments of different size.

The mounting flange 6 is here screwed with a positive fit into the casing 20. In the middle part of the casing 20 there is arranged a supporting ring 23, which merges into a centring ring 24 and symmetrically centres the penetrator core 1 axially. An additional weight 25 shifts the centre of gravity 9, shown symbolically, into the same position as in a conventional bazooka projectile. The further construction, such as the closure cap 27 (called a spike dummy) and the rear-end adapter 26 ensure a trouble-free attachment of the entire head to the propulsion means A. The resulting exterior ballistics are identical with those of the conventional bazooka projectile, which, as is well known, contains a hollow charge.

Fig. 4 shows the velocity profile of a device according to the invention as a function of the trajectory (shot distance) D from launch to impact on the target a_0 and detonation a_z .

- 5 An ignition device is important for correct functioning and safety in use of the subject matter of the invention; from the secured state, via an acceleration-unlocking stage A-E and a retardation-unlocking stage R-E, the ignition device swings the detonator 5' into the armed position shown in Figs 1 and 3.
- 10 Suitable ignition devices having an integrated ignition generator, safety elements and a high-capacity detonator are commercially available (EMS-Patvag AG, CH-7013 Domat/Ems; type PEPZ-05). This igniter is intended to have a shock resistance of 100,000 g. The mode of operation of such igniters is described in detail in EP-A-0 104 138, in conjunction with US-Patent 5,269,223. From these
- 15 publications it can be deduced that the ignition devices can be adapted to virtually every use conceivable with the subject matter of the invention.

The penetrator core 1 is advantageously manufactured from an alloyed quenched and tempered steel according to DIN 34CrNiMo6 and is likewise commercially

20 available (Gebr. Böhler & Co. AG, CH-8034 Wallisellen; type V155). In the preferred embodiment, the angle α_1 is 70°; the angle α_2 is 30° and the angle β (taper) is 1.4 ‰. For obvious reasons, the hardness profile of the penetrator core 1 is adjusted to decrease from the tip to the rear.

- 25 It has been shown that modern explosives (PBXN-9 of the firm DYNO Defence Products, NO) withstand the impact shock at target and yet require no additional pre-charge 4 for ignition.

The subject matter of the invention allows a completely new manner of combating

30 crime:

If, for example, a hostage-taker has barricaded himself in the service-counter area of a bank, then by mobile radiotelephone determination (position fixing), a penetrator core 1 containing capsaicin 3b can be shot towards the hostage-taker when no visual contact is available. A projectile suddenly piercing a wall or enclosure will paralyse him with fright, so that no resistance can be presented; within the next second the core 1 detonates; a relatively large amount of capsaicin is atomised and puts the hostage-taker completely out of action for a relatively long period of time, so that in parallel to this the police can enter the building unharmed and carry out their duty.

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So that third parties are not endangered, when using non-lethal active substances such as tear gas, smoke, etc., only small amounts of explosive are incorporated in the cavity 2. By suitable notches in the inner wall, even slight centripetal forces are sufficient to cause the active substance to escape from a bursting penetrator core or to cause it to be atomised, especially when there is a mechanical connection (adhesion) between the active substance container and the penetrator core.

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Depending on the ignition device, explosive charge of lethal or non-lethal active substances and additional active charges used, an individual and safe combating of targets of different danger potentials can be effected from a faraway range. The projectile and the penetrator core are accordingly of modular and exchangeable construction, and can be optimised in respect of collateral damage and threat. As a rule, the result will be merely a hole of the size of the calibre of the penetrator core in the target or the wall to be pierced, so that the consequential damage of an intervention is minimal.

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Claims

1. Self-propelling projectile having a maximum launch speed of less than 300 m/s, a penetrator core and a charge at least partially fragmenting the same at the target, having an autonomous ignition device, having an ignition generator and an acceleration-dependent safety element with integrated detonator, characterised in that the penetrator core (1) has a stepped tip (10), which changes from a relatively small dart angle (α_1) into a relatively large acute angle (α_2)³ and has a dart shank (12) that tapers towards the rear end by the angle (β), in that, at least at its rear, the penetrator core (1) comprises a coaxial cavity (2) in which a non-lethal active substance (3b) is incorporated next to an explosive charge (4; 3a) serving to open the cavity (2).
2. Self-propelling projectile having a maximum launch speed of less than 300 m/s, a penetrator core and a charge at least partially fragmenting the same at the target, having an autonomous ignition device, having an ignition generator and an acceleration-dependent safety element with integrated detonator, characterised in that the penetrator core (1) has a stepped tip (10), which changes from a relatively small dart angle (α_1) into a relatively large acute angle (α_2) and is inserted in the central axis of a projectile jacket (20), this projectile jacket (20) having the same exterior ballistics as that of a projectile provided with a hollow charge or with a large-calibre explosive charge with fragmentation jacket, and in that in the coaxial cavity (2) of the penetrator core (1) there is incorporated at least one explosive charge (4; 3a) that opens the cavity at the target.
3. Self-propelling projectile according to claim 2, characterised in that additionally a non-lethal active substance (3b) is incorporated in the cavity (2).
4. Self-propelling projectile according to claim 1 or 3, characterised in that the non-lethal active substance (3b) is capsaicin or tear gas.

5. Self-propelling projectile according to claim 1 or 2, characterised in that the penetrator core (1) is fragment-forming and/or in that a fragment-forming ring (3c) is provided in the cavity (2).
6. Self-propelling projectile according to claim 1 or 2, characterised in that notch-like grooves are provided in the inner walls of the cavity (2), which notch-like grooves cause the penetrator core (1) to break open in a predefined manner on detonation.
7. Self-propelling projectile according to claim 4, characterised in that the capsaicin is stored in a plastics capsule which externally is mechanically connected to the inner walls of the cavity (2).
8. Self-propelling projectile according to claim 1 or 3, characterised in that smoke-producing substances, such as smoke-forming pyrotechnics, are incorporated in the cavity (2).