

FIELD OF THE INVENTION

The present invention relates to anti-personnel ammunition.

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BACKGROUND OF THE INVENTION

Anti-personnel ammunition and other ammunition for soft targets has long been known in the art. Several types of anti-personnel ammunition include a plurality of submunitions in a single casing which are scattered when the casing is opened.

10 In US Patent 3,956,990, there is shown anti-personnel ammunition containing axially arranged layers of fin stabilized flechettes in a projectile casing, shot from tanks on a flat trajectory. Due to the flat trajectory, this ammunition is not effective against soldiers behind any shelter, soldiers in fox holes or trenches, or soldiers on a rear slope. Its effectiveness against soldiers lying down is limited.

15 There is also known anti-personnel ammunition with a time delay fuse which explodes in the air. This ammunition has very small area coverage in the longitudinal direction. The main errors which occur with this ammunition, which are errors in the direction of fire, lead to very low chance of hitting the target, especially personnel targets which are difficult to identify and for which there is no accurate range finding.

20 In addition, there are known explosive rounds having a percussion fuze. These rounds are actuated by hitting the ground, and have no capability of attack from above. In addition, due to their flat trajectory, their accuracy of hitting the target is very low.

Accordingly, there is a long felt need for anti-personnel ammunition which includes many submunitions, and has a flat trajectory, but is capable of attack from above, and it would be very desirable to have such ammunition which operates like a proximity fuze.

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SUMMARY OF THE INVENTION

According to the present invention, there is provided a projectile including a plurality of submunitions in the projectile, means for ejecting the submunitions substantially simultaneously from the casing, and means for detonating each submunition in the air at a different time.

According to a preferred embodiment of the invention, the means for detonating includes a time delay fuze in each submunition, each time delay fuze having a different time delay.

Further according to a preferred embodiment, the projectile has a flat trajectory. Generally, flat trajectories are considered as a superelevation of not more than approximately 15° between launcher and target.

According to an alternative embodiment of the invention, the submunitions are coupled to one another, and the means for detonating includes means for separating one submunition after another from the remaining submunitions, and means actuated by the means for separating for detonating the separated submunition.

There is also provided in accordance with the present invention a method of attacking a target including the steps of shooting a projectile including a plurality of submunitions over the target, substantially simultaneously ejecting the submunitions from the projectile, and sequentially detonating the submunitions.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further understood and appreciated from the following detailed description taken in conjunction with the drawings in which:

5 Fig. 1 is a schematic sectional illustration of anti-personnel ammunition constructed and operative in accordance with one embodiment of the invention;

Fig. 2 is a schematic illustration of the ammunition of Fig. 1 during deployment;

Fig. 3 is a side sectional view of a submunition constructed and operative in accordance with one embodiment of the invention;

10 Fig. 4 is a sectional view of a fuze operative in the submunition of Fig. 3;

Fig. 5 is a side sectional view of a submunition constructed and operative in accordance with an alternative embodiment of the invention;

Fig. 6 is a sectional view of a fuze operative in the submunition of Fig. 5; and

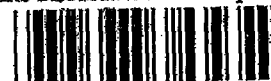
15 Figs. 7a, 7b, and 7c are schematic illustrations of the operation of the ammunition of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to anti-personnel ammunition including a plurality of submunitions which, while having a flat trajectory is capable of attack from above, so as to
20 eliminate soldiers behind a barrier, in trenches, or lying down. As stated above, a flat trajectory is a superelevation of not more than approximately 15° between launcher and target.

The anti-personnel ammunition is provided with a different time delay for deployment of each submunition, thereby providing deployment over a long area in the line
25 of flight. It is a particular feature of the invention that, due to the method of operation, the submunitions explode or burst above the target. Thus, the effect of a proximity fuze can be achieved by using less expensive time delay or range fuzes. For ease of description, the invention will be described herein with regard to time fuzes for expulsion of the submunitions, which are the most common at present. It will be appreciated, however, that
30 any other fuze can alternatively be used, including a range fuze.

The anti-personnel ammunition of the present invention is particularly useful in the following types of weapons: flat trajectory barrel type weapons; rocket-type flat trajectory



weapons; cruise missiles and flat trajectory ground to ground missiles. It is particularly useful as a tank shell against infantry targets.

Referring now to Fig. 1, there is shown a schematic sectional illustration of anti-personnel ammunition 10, constructed and operative in accordance with one embodiment of the invention. Ammunition 10 includes a projectile 12 and a cartridge 14. Projectile 12 has a nose 16 and a base 18, with an optional tracer 19. Cartridge 14 includes a primer 15 and propellant 17, as known.

A plurality of submunitions 20 are disposed in the projectile 12 and held in place by base 18. A time fuze 22 is disposed in nose 16 and is coupled to an expulsion charge 24 for expelling submunitions 20 from projectile 12 by means of a piston 26.

Operation of the ammunition of the present invention is as follows, with reference to Figs. 1 and 2. The tank (or other weapon firing the projectile) measures the range to the target. The range is loaded into time fuze 22, either manually or by means of an electronic setter. The round is fired. When the time comes to eject submunitions 20, time fuze 22 ignites the expulsion charge 24 in the ejection cup. This creates high pressure in the ogive, which pushes the piston 26. Piston 26 transfers the force to the base 18 of the projectile through the submunitions 20. Base 18 of the projectile is sheared, and the submunitions are ejected from the projectile 12, and continue to fly.

The detonation of the submunitions can be accomplished in a number of ways (pyrotechnic, mechanical, electronic, and others). Two possible ways are described below, by way of non-limiting example only.

One possibility, illustrated in Figs. 3 and 4, is that all the submunitions are ejected together from the shell while coupled to one another. After ejection from the projectile, sliders 34 in submunition fuze 32 of the rearmost submunition 30 (closest to the base) are armed. In the remaining submunitions (not shown), the fuzes remain unarmed, each fuze remaining safe because of the submunition attached behind it.

Due to the arming, the firing pins 36 are free to move, and they initiate the separation delay 38 and the detonation delay 40.

When the separation delay 40 burns down, the lead charge 42 explodes, which ignites the separation charge 44. High pressure is created in the combustion chamber 46, which causes separation of the rearmost submunition from the rest of the submunitions. As



a result of the separation, the safing of the fuze in the next submunition is cancelled, and its sliders are armed.

5 When the detonation delay ends, the lead charge 48 is detonated, which detonates the main explosive charge 50. At the end of the delay action, the submunition explodes, spraying fragments on the ground and creating a shock wave in the surrounding area.

10 In this way, each submunition, in turn, is released from the remaining submunitions and detonated at a different location along the line of flight of the projectile. Due to the time difference in igniting the detonation delay 40, the length of which is the same as the separation delay 38, each submunition explodes with a delay after the submunition before it. Due to the speed of flight of the submunitions, explosion at different times results in explosion over different locations. In this way, the explosions are distributed over a desired linear range.

15 The second method, illustrated in Figs. 5 and 6, involves expelling all the submunitions at one time, but not coupled to one another. After ejection from the projectile, sliders 52 in all the submunitions are armed, freeing firing pins 54 in each submunition. Firing pins 54 initiate the explosion delays 56 in all of the submunitions. When the explosion delay ends, the lead charge 58 explodes. Explosion of the lead charge 58 explodes
20 the booster 60, and booster 60 detonates the main charge 62.

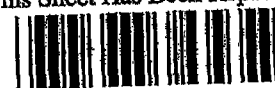
 The principle of operation of this embodiment is based on different pre-selected delay times for explosion of each submunition, rather than different initiation times. In each submunition, a different delay is installed, and this causes the submunitions to explode along a desired line.

25 It is a particular feature of the invention that the capability of attack from above leads to high effectiveness, as illustrated in Figs. 7a, 7b, and 7c, against soldiers who are lying down, soldiers behind shelter, soldiers in foxholes or trenches, and soldiers on a rear slope, for whom no other solution has been found in flat trajectory weapons. Furthermore, the sequential explosion of the submunitions can correct for range errors, since at least one
30 of the submunitions is likely to explode over the actual target. Thus, due to the attack from above, and the compensation for longitudinal errors, a high kill rate is achieved against infantry units.



It will be appreciated that the invention is not limited to what has been described hereinabove merely by way of example. Rather, the invention is limited solely by the claims which follow.

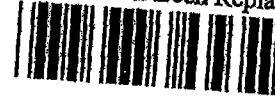
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What is claimed is:

CLAIMS

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1. A projectile comprising:
5 a plurality of submunitions mounted in the projectile;
a fuze for ejecting said submunitions substantially simultaneously from the
projectile; and
means for detonating said submunitions in the air one after another.
- 10 2. The projectile according to claim 1, wherein said means for detonating includes
pyrotechnic means.
3. The projectile according to claim 1, wherein said means for detonating includes
mechanical means.
- 15 4. The projectile according to claim 1, wherein said means for detonating includes
electronic means.
5. The projectile according to claim 1, wherein said means for detonating includes:
20 a time delay fuze in each submunition, each time delay fuze having a different time
delay.
6. The projectile according to claim 1, wherein said means for detonating includes:
a submunition delay fuze in each submunition, each submunition delay fuze having
25 the same time delay; and
means for initiating said submunition delay fuzes at different times.
7. The projectile according to claim 1, wherein:
said submunitions are coupled to one another; and
30 said means for detonating includes:
means for separating one submunition after another from the remaining
submunitions; and





means for detonating said separated submunition which is actuated by said means for separating.

8. The projectile according to any of the preceding claims, wherein said projectile has a flat trajectory.

9. A method of attacking a target comprising the steps of:
shooting a projectile including a plurality of submunitions over the target;
substantially simultaneously ejecting said submunitions from said projectile; and
sequentially detonating said submunitions in the air.

10. The method according to claim 9, wherein said step of sequentially detonating includes the steps of:
ejecting said submunitions from said projectile while said submunitions are coupled to one another;
separating one said submunition from the remaining submunitions; and
detonating said separated submunition.

11. The method according to claim 9, wherein said step of sequentially detonating includes the step of:
providing a submunition time fuze in each submunition, each submunition time fuze having a different time delay; and
initiating said submunition time fuzes at the time of ejecting said submunitions from said projectile.

12. The method according to claim 9, wherein said step of sequentially detonating includes the step of:
providing a submunition time fuze in each submunition, each submunition time fuze having the same time delay; and
initiating each said submunition time fuze at a different time.

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13. The projectile according to any of claims 1-8 and substantially as shown and described hereinabove with reference to any of Figs. 1-7.

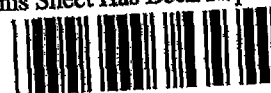
14. The projectile according to any of claims 1-8 and substantially as illustrated in any
5 of Figs. 1-7.

15. The method according to any of claims 9-11 and substantially as shown and described hereinabove with reference to any of Figs. 1-7.

10 16. The method according to any of claims 9-11 and substantially as illustrated in any of Figs. 1-7.

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