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(58) Field of search

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(54) Incendiary and fragmentation projectile

(57) A sub-calibre projectile for automatic guns has a high velocity and flat trajectory for use against airborne targets. The projectile body 12 comprises a stack of pyrophoric discs 20 and high density discs 22 positioned around an axial high density mount 16 secured to a base 18 carried by a sabot and propulsive cage assembly 14. On impact with a target the projectile fragments through predetermined fracture lines 30, 32 in the discs. The projectile does not include explosive charges or detonators. The high density and pyrophoric materials may be, respectively, a tungsten-based substance and zircon; depleted uranium performs both functions.

FIG. 1.

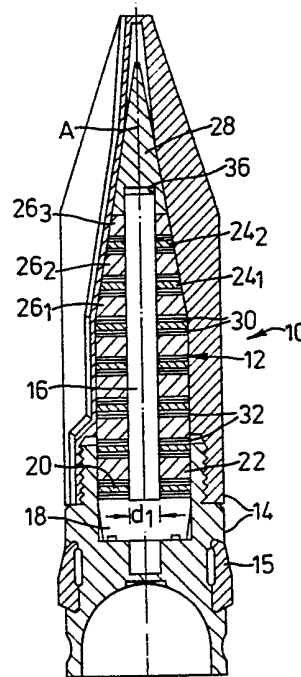


FIG. 1.

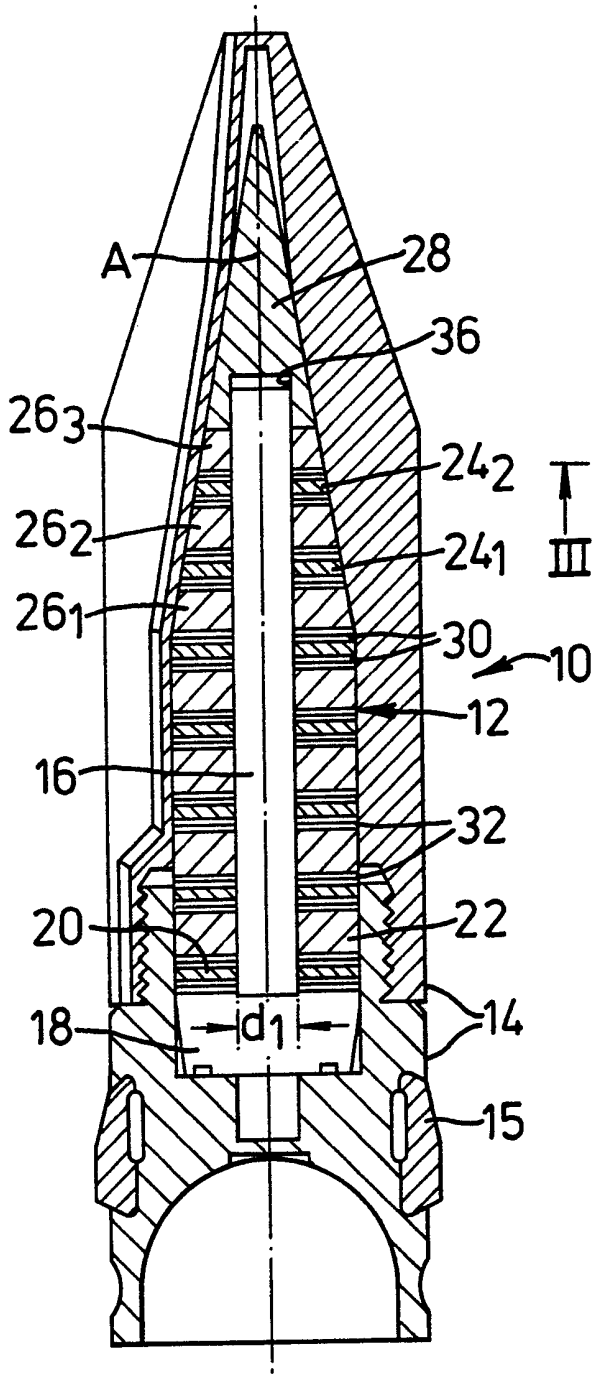


FIG. 2.

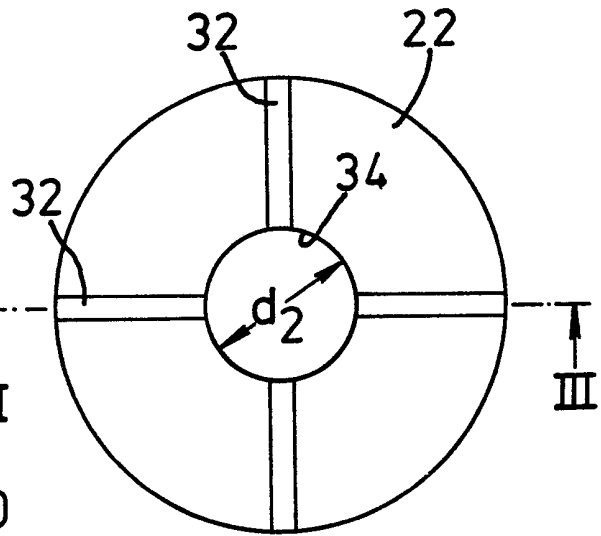
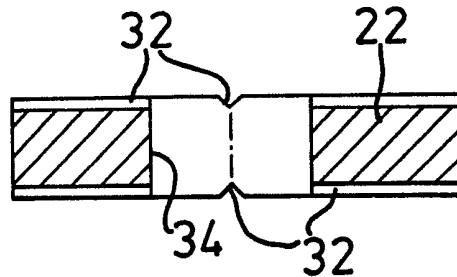


FIG. 3.



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TITLE

Spin stabilized projectile.

This invention relates to a spin stabilized projectile and is primarily concerned with a projectile having a sabot and of sub-calibre construction which is designed to fragment on impact with a target but which does not include explosive or detonator means. The projectile comprising a major proportion of a heavy metal and being intended for automatic guns.

It is of advantage to fire at fast moving targets, such as low-level aircraft and missiles whilst at maximum range, particularly those in a direct approach flight path. The probability of destruction increases with fire rate and accuracy of aim and the minimum possible transit time of the projectile is a decisive factor. This latter factor is conditional upon a high initial velocity and reduction of the velocity to the minimum.

Customary explosive incendiary ammunition of a calibre range useful in automatic barrel weapons, especially cannons has a limited initial velocity and a considerable velocity loss making it more difficult to hit the target.

A projectile is shown in DEQS2919807 having a core of a heavy metal with an axial channel which can contain an incendiary charge, a tracer composition and a

retarding composition serving to cause the core to self-disintegrate. The core is also intended to fragment when passing through comparatively thin plates and thus cause considerable damage, by giving-up more energy to the target than if it merely passed through it without fragmenting.

This system suffers from the disadvantage that the axial channel disadvantageously affects the average density of the projectile core. This leads to a serious decrease in velocity and a corresponding increase in the time of flight.

According to this invention there is provided a spin stabilized projectile comprising:

- (a) a central axially extending mount supporting a stack of rotationally symmetrical disc elements of which the peripheral surfaces form the outer periphery of the projectile,
- (b) some disc elements having pre-set break zones to initiate a disintegration of the projectile on impact with a target,
- (c) the mount and a first number of the disc-elements comprising a material of a high density,
- (d) a further number of the disc elements

comprising a pyrophoric material.

Since the limited quantity of explosive substance in the calibre range in question cannot be expected to provide a gas impact with any appreciable destructive effect, the said gas impact is dispensed with, in the ammunition according to the invention, in order to obtain a high average density for the projectile. The quantity of pyrophoric material incorporated into the projectile according to the invention likewise takes account of the requirement that a maximum average density is to be obtained.

The invention is explained further and in more detail with reference to a preferred embodiment shown in the accompanying drawings.

In the drawings:

Figure 1 shows a projectile according to the invention and in axial section,

Figure 2 shows an end view, to a larger scale of a heavy metal core, and

Figure 3 shows a section taken on III-III of the heavy metal core shown in Figure 2.

As shown in the drawings a projectile assembly 10 has a sub-calibre projectile part 12 in a propulsive cage 14 not described in detail. The part 12 is formed of a pre-selectable member of rotationally symmetrical elements interconnected in a manner to be described

later. A central mount 16, comprising a cylindrical mandrel with diameter d_1 , extends along the longitudinal axis A of the projectile. The mount 16 is connected with a rotationally symmetrical tail piece 18 and forms a piece unit therewith. Annular discs 20 made of a pyrophoric material alternate with annular discs 22 made of a material of high density and are arranged in a stack extending up from the tail piece 18. A front annular disc 20 is followed by a frusto-conical annular disc 26₁ made of a material of high density and followed by a conical circular annular disc 24₁ made of a pyrophoric material, and so forth. The tail piece 18 and the annular discs by their respective outer peripheral surfaces form the surface of the projectile 12. The front of the stack of discs carries the nose of the projectile 12 formed by a rotationally symmetrical pointed structure 26. All the elements 20 to 26 have a continuous central bore 34 of which the diameter d_2 corresponds to the diameter d_1 of the mount 16. This also applies to a blind hole 36 in the nose structure 28. In order to obtain a high average density for the projectile 12 the central mount 16 and tail piece 18 are made of a material of high density and the annular discs 22 and 26 occupy a greater volume than the annular discs 20 and 24. As shown in Figures 2 and 3,

the annular discs 22 (20) are provided with preset breaking points 32(30) of a triangular shape. The circular annular discs 24 and 26 are similarly provided with preset breaking points. In a manner not shown in detail the stacked elements 20 to 28 are in each case connected by an adhesive to respective adjacent elements, to the tail piece 18 and to the central mount 16. A suitable example of a material with high density is a tungsten based substance. Zircon is an example of a suitable pyrophoric base.

As a result of this structure the projectile 10 functions as follows:-

A guide ring 15 in cooperation with further means not shown in the drawing imparts to the propulsion cage 14 and projectile 12 a stabilized spin and a very high initial velocity. After leaving the barrel of the weapon the propulsion cage 14 detaches itself from the projectile 12 which then continues to the target over a generally linear flight path. This ensures the required short flight time and thus a high probability of hitting the target.

Impact with the target causes the preset breaking points 30 and 32 to take effect. As a result of high velocity and centrifugal forces produced by the spin a cone of fragments is formed having high penetrating

power and ensuring a high fragmentation density. This results in a destructive effect on structural parts and on fuel cells in the target.

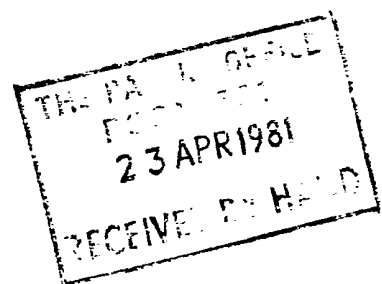
A projectile according to the invention provides good immunity from interference and has an effective spin action. With a short flight time and the good flight characteristics with limited loss of speed, good results have been obtained on compartmented aluminium targets and homogeneous armour plating at extremely small angles of impact incidence. The ammunition according to the invention is also particularly suitable for use against killer helicopters.

If the projectile according to the invention, with a structure similar to that described, is manufactured with a depleted uranium core, this provides the advantage of extremely high density, the material concerned also performing the function of the pyrophoric substance and, assuming the same mass for the projectile, for ballistic reasons, the projectile can be rendered more slender in the same length as in the version described. In this latter with a lower average density to obtain a preselected mass for the missile, the length-diameter ratio was a, a length-diameter ratio of b which is greater than a can be obtained for the same length and mass as before, in the second constructional version

described. This provides, with a very limited speed loss, a more elongated flight path and a shorter flight time. The propulsion bases, which are the same in their external shape, require only different mounting systems, adapted to the length-diameter ratios a and b respectively.

CLAIMS

1. A spin stabilized projectile comprising:
 - (a) a central axially extending mount supporting a stack of rotationally symmetrical disc elements of which the peripheral surfaces form the outer periphery of the projectile,
 - (b) some disc elements having pre-set break zones to initiate a disintegration of the projectile on impact with a target,
 - (c) the mount and a first number of the disc elements comprising a material of a high density.
 - (d) a further number of the disc elements comprising a pyrophoric material.
2. A projectile in accordance with Claim 1, wherein the material of high density comprises a tungsten based compound.
3. A projectile in accordance with Claim 1 or 2, wherein the central and the first number of disc elements comprise depleted uranium.
4. A projectile substantially as herein described with reference to and as shown in the accompanying drawings.



Amendments to the claims have been filed as follows

1. Ammunition for rifled barrel automatic weapons, the ammunition having a discarding sabot and a fuseless sub-calibre impact fragmentation projectile, the projectile comprising;

5 i) a material of high density, and

ii) a pyrophoric material,

the projectile having a central axially extending mount of material i) carrying a stack of rotationally symmetrical disc elements, some of material i) ^{and} some of 10 material ii) of which the peripheral surfaces form the outer periphery of the projectile, some at least of the disc elements having pre-set break zones to initiate fragmentation on impact.

2. Ammunition in accordance with Claim 1, wherein 15 the pyrophoric material (ii) comprises depleted uranium.

3. Ammunition in accordance with Claim 1, wherein materials (i) and (ii) are both depleted uranium.

4. Ammunition substantially as herein described 20 with reference to and as shown in the accompanying drawings.