

Projectile

The invention relates to a projectile, where necessary covered with a jacket, having a front-side core and
5 having a rear-side core, the external form of the projectile, viewed starting from the projectile nose, being of ogive-shaped configuration, transforming into a cylindrical middle region and ending in a conical rear region, the rear-side core bearing positively in a
10 centred manner against the front-side core and this rear-side core filling the entire cylindrical and the frustoconically configured rear region of the projectile.

15 Such a projectile is known, in the form of a jacketed projectile, from WO 99/10703, two-part projectiles having already been known for more than 60 years, for example from GB 601 686. The centric positive-locking matching of the rear-side core to the front-side core
20 allows a projectile designed according to WO 99/10703 to be offered good aerodynamic, ballistic and, above all, penetrative characteristics for sharpshooter applications.

25 From DE 100 05 412, a training projectile is known which has a reduced range. It comprises a projectile nose connected by predetermined breaking points to a rear core. When the projectile is fired, it breaks up as a result of the inertia of mass of the projectile
30 nose, so that only a reduced range is achieved.

US 6,263,798 describes a projectile which is produced at elevated temperature yet below the sintering temperature, so that, upon impact, it fragments
35 directly and completely into powder form. This publication indicates that this method is also suitable for the manufacture of lead-free training ammunition.

The said training ammunitions according to the prior .

art are expensive to make and their firing behaviour does not correspond, at higher ranges, to that of combat ammunition.

5 Starting from this prior art, the object of the invention is to define a projectile which can be manufactured more cheaply, and also in a lead-free manner, as training ammunition.

10 A further object consists in improving the ricochet behaviour when the projectile designed as a training ammunition makes a non-frontal impact, i.e. in more reliably eliminating the danger to third parties posed by ricocheting and onward travel of the projectile.

15 Finally, an object of the present invention is to define a training ammunition which can be used at the same distances as combat ammunition, i.e. which has essentially the same ballistic characteristics up to
20 the point of impact.

This object is achieved for a projectile of the type defined in the introduction by the characterizing features of Claim 1.

25 The fact that the projectile leaves the gun barrel as a one-piece element allows flight behaviour to be achieved which, in terms of velocity and flight path, is similar to that of combat ammunition. The
30 fragmentation of the projectile into two, for example, approximately equal-sized parts upon impact at more or less any ricochet angle removes the danger to third parties, without having to resort to the disintegration of the training ammunition into powder form or similar.
35 By designing the ammunition as a pure steel projectile, manufacturing costs are reduced. Furthermore, special functions such as light trace, etc., can be easily integrated.

Advantageous embodiments are characterized in the subclaims.

5 The invention is now described in greater detail with reference to the single figure, which represents an exploded view of a projectile.

10 The single figure shows a two-part projectile 10, which is here configured without a jacket. It possesses a front-side core 1 and a rear-side core 2. The external form 3 of the projectile 10, viewed starting from the projectile nose 4, is of ogive-shaped configuration and transforms into a cylindrical middle region 5 and ends in a conical rear region 6. The middle region 5
15 possesses a circumferential rounded groove 7. The two cores 1 and 2 consist of solid material.

Here, the rear-side core 2 is mounted positively, in a centred manner, on the front-side core 1 with the aid
20 of a contact zone, bearing the reference symbols 11 and 12. The size relationships of front-side core 1 and rear-side core 2 are here such that this rear-side core 2 fills the whole of the cylindrical middle region 5 and the frustoconically configured rear region 6 of the
25 projectile 10. The connection between the two cores 1 and 2 can be a press fit, which here means, for example, that the two cores 1 and 2 cannot be separated by the simple impartment of shearing forces by a user. The fits can be specified with suitable precision
30 according to ISA. To this extent, other fits, too, are possible. Of fundamental importance is the action of joining together the projectile 10, which gives rise to a joint which does not weaken under gravitational force. It is also possible for the connection of the
35 projectile halves to be a clamped joint and/or a frictional engagement, provided that the parts are guaranteed to come apart only in the event of an impact, even at a narrow angle. The fact that, in use, the projectile 10 is substantially acted upon by forces

in the longitudinal direction helps to hold the projectile together.

If, on the other hand, the projectile 10, fired from a gun, does not hit frontally upon a surface, for example upon a surface which stands, for example, at an angle of between 5 and 30 degrees to the direction of flight, i.e. the longitudinal axis 20, of the projectile 10, then sufficient shearing forces act upon the projectile 10 and it splits into the two cores 1 and 2, whereby the further danger zone after the ricochet shot is severely diminished. When the projectile 10 impacts upon a surface oriented in any chosen manner relative to the firing direction 20, the projectile 10 is thus split into two less dangerous projectile parts.

Suitable embodiments of the contact zones of the two cores 1 and 2 comprise a central truncated cone 11 of the front-side core 1 with an angle of between 1 and 20 degrees, preferably between 2 and 10 degrees, more particularly of 3 degrees, relative to the longitudinal axis 20 of the projectile 10, and a complementary cone 12 of the rear-side core 2, which cone 12 is suitable for the press fit or a clamped joint. This advantageously has almost the same angle as, in particular a somewhat smaller angle than, the truncated cone 11, for example an angle which is 0.2 to 1 degree smaller, in particular 0.5 degree smaller, i.e. here an angle of 2.5 degrees relative to the longitudinal axis 20 with a 0.03 millimetre smaller inner diameter of the rear-side frustoconical core cone 12, when the two stop faces 13 of the two cores 1 and 2 are forced together, with the result that no air gap exists at the faces 13.

In the illustrative embodiment which is represented here, the thickness of the wall 14 of the rear-side core cone 12 at the stop face 13, i.e. in the cylindrical middle region 5, measures 1.17 millimetres, at an outer diameter of 10.884 millimetres. In

particular, the wall thickness of the frustoconical hollow cone 12 can measure between $1/5$ and $1/3$ of the diameter of the projectile 10 in its cylindrical portion.

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The dimensions of the stop faces 15, on the other hand, are identical at both the cores 1 and 2. Like the faces 13, the stop faces 15 run in a plane perpendicular to the longitudinal direction 20 of the projectile 10. The
10 depth and height, respectively, of the cones 11 and 12 is preferably identical, so that, when the cores 1 and 2 are forced or pressed together, a projectile 10 is obtained which is perfectly aligned on the outer side. In this illustrative embodiment, the height of the
15 front-side core cone 11 measures 4 millimetres and thus between $1/4$ and $1/8$, here $1/6$, of the length of one of the two cores 1 or 2.

In place of the cones 11 and 12 of the cores 1 and 2,
20 substantially complementary cylindrical elements can also engage in one another.

The cores 1 and 2 are here advantageously formed from identical material. In particular, the two cores 1 and
25 2 both consist of steel of similar hardness or the same steel, so that a single-material joint, clamped joint or press fit is obtained. Compared to the projectiles according to the prior art, manufacture is very simple. In particular, the hard front-side core 1, and then the
30 soft rear-side core 2, does not have to be pressed into a jacket of the projectile 10.

The length of the front-side core 1 measures 24 millimetres, for example, whilst the length of the
35 rear-side core 2 measures, for example, 23 millimetres. Due to the outer form of the cores 1 and 2, therefore, an equal weight distribution is given. Upon impact of the projectile 10, therefore, two substantially equal-sized and equal-weight fragments are formed. The length

or the weight ratio of the cores 1 and 2 one to the other can be chosen, for example, between 1:3 and 3:1, advantageously between 1:2 and 2:1, and even more preferably, between 1:1.3 and 1.3:1.

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In another illustrative embodiment of the invention, the projectile 10 can also be designed as a jacketed projectile, in which case the jacket of the projectile 10 only exhibits guidance characteristics in the barrel and is thus designed sufficiently thin that the jacket in no way interferes with the destruction of the projectile 10 when the projectile 10 hits a target. In the manufacture of such a jacketed projectile, the two-part cores 1 and 2 represented in the figure are then advantageously first forced together, before a jacket is pressed over the projectile 10 thus formed. This jacket can, in particular, be crimped into the groove 7.

20 In place of a truncated cone 11 on the front-side core 1 and a hollow truncated cone 12 on the rear-side core 2, the two-part projectile 10 can also be constructed precisely the other way round, in which case the walls 14 are configured on the front-side core 1.

WHAT IS CLAIMED IS:

1. A projectile having

a front-side core comprising a projectile nose, a contact face and a first contact zone and

a rear-side core comprising a second contact zone, a contact face, a cylindrical middle region and a frustoconical rear region;

wherein an external form of the projectile, viewed starting from the projectile nose, is of ogive-shaped configuration, transforming into the cylindrical middle region and ending in the frustoconical rear region;

wherein the rear-side core is positively fitted in a centred manner against the front-side core, and wherein the rear-side core fills the entire cylindrical region and the frustoconically configured rear region of the projectile;

wherein said first and second contact zones allow the projectile to be joined together in a joint which does not weaken under gravitational force, wherein a perfectly aligned external form of the projectile is obtained;

wherein the contact faces of the cores directly touch one another, substantially without a clearance or gap over the whole of the contact faces; and

wherein both front-side and rear-side cores consist of steel.

2. Projectile according to claim 1, wherein the projectile comprises a jacket, which is sufficiently thin that the jacket in no way interferes with the destruction of the projectile when the projectile hits a target.

3. Projectile according to claim 1 or 2, wherein one of the first and second contact zones is a frustoconical cone and the other of the first and second contact zones is a frustoconical hollow cone.

4. Projectile according to claim 3, wherein the frustoconical cone is configured with an angle of between 1 and 20 degrees and wherein the frustoconical hollow cone has an angle which is 0.2 to 1 degree smaller than the angle of the frustoconical cone.
5. Projectile according to claim 3, wherein the frustoconical cone is configured with an angle of between 2 and 10 degrees and wherein the frustoconical hollow cone has an angle which is 0.2 to 1 degree smaller than the angle of the frustoconical cone.
6. Projectile according to claim 3, wherein the frustoconical cone is configured with an angle of 3 degrees and wherein the frustoconical hollow cone has an angle which is 0.2 to 1 degree smaller than the angle of the frustoconical cone.
7. Projectile according to any one of claims 4 to 6, wherein the frustoconical hollow cone has an angle which is 0.5 degree smaller than the angle of the frustoconical cone.
8. Projectile according to any one of claims 3 to 7, wherein a wall thickness of the frustoconical hollow cone (12) measures between $\frac{1}{5}$ and $\frac{1}{3}$ of the diameter of the projectile (10) at its cylindrical portion.
9. Projectile according to any one of claims 3 to 8, wherein a height of the central truncated cone measures between $\frac{1}{4}$ and $\frac{1}{8}$ of a length of one of the front-side and rear-side cores.
10. Projectile according to any one of claims 3 to 8, wherein a height of the central truncated cone measures $\frac{1}{6}$ of a length of one of the front-side and rear-side cores.
11. Projectile according to any one of claims 1 to 6, wherein the cylindrical region possesses a circumferential groove, for crimping of a projectile jacket.

12. Projectile according to any one of claims 1 to 7, wherein a length or weight ratio of the front-side and rear-side cores one to the other measures between 1:2 and 2:1.

13. Projectile according to any one of claims 1 to 8, wherein the front-side and rear-side cores of the joined-together projectile stand in a clamped joint, in a frictional engagement or in a press fit one to the other.