

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
5 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 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
15 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
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
25 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
30 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.

35 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 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 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, 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 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 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 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.

Patent Claims

1. Projectile (10), where necessary covered with a jacket, having a front-side core (1) and having a rear-side core (2), the external form (3) of the projectile (10), viewed starting from the projectile nose (4), being of ogive-shaped configuration, transforming into a cylindrical middle region (5) and ending in a conical rear region (6), the rear-side core (2) bearing positively in a centred manner against the front-side core (1) and this rear-side core (2) filling the entire cylindrical and the frustoconically configured rear region (2) of the projectile (10), characterized in that a contact zone (11, 12) is respectively configured on the two cores (1, 2), which contact zone allows the projectile (10) to be joined together in a joint which does not weaken under gravitational force, a perfectly aligned external form (3) of the projectile (10) being obtained and the contact faces (15; 13; 11 to 12) of the cores (1, 2) directly touching one another, substantially without a clearance or gap over the whole of the contact face (15; 13; 11 to 12).

2. Projectile according to Claim 1, characterized in that the one contact zone is a frustoconical cone (11) and the other contact zone is a frustoconical hollow cone (12).

3. Projectile according to Claim 2, characterized in that the central truncated cone (11) is configured with an angle of between 1 and 20 degrees, preferably between 2 and 10 degrees, more particularly of 3 degrees, and in that the frustoconical hollow cone (12) has an angle which is 0.2 to 1 degree smaller, more particularly 0.5 degree smaller.

4. Projectile according to Claim 2 or 3, characterized in that the wall thickness of the frustoconical hollow cone (12) measures between 1/5 and

1/3 of the diameter of the projectile (10) at its cylindrical portion (5).

5 5. Projectile according to Claim 2, 3 or 4, characterized in that the height of the central truncated cone (11) measures between $\frac{1}{4}$ and $\frac{1}{8}$, in particular $\frac{1}{6}$, of the length of one of the two cores (1, 2).

10 6. Projectile according to one of Claims 1 to 5, characterized in that the cylindrical portion (5) possesses a circumferential groove (7), which can be used, in particular, for the crimping of a projectile jacket.

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7. Projectile according to one of Claims 1 to 6, characterized in that both cores (1, 2) consist of one and the same material, in particular in that the cores (1, 2) consist of steel.

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8. Projectile according to one of Claims 1 to 7, characterized in that the length or weight ratio of the cores (1 and 2) one to the other measures, for example, between 1:2 and 2:1.

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9. Projectile according to one of Claims 1 to 8, characterized in that the parts of the joined-together projectile (10) stand in a clamped joint, in a frictional engagement or in a press fit one to the
30 other.