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(54) **BULLET FOR A FIREARM**

GESCHOSS FÜR EINE SCHUSSWAFFE

BALLE POUR UNE ARME À FEU

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## Description

### Field of Application

**[0001]** In its most general aspect, the present invention relates to the sector of firearms.

**[0002]** In particular, the present invention relates to a bullet for firearms, such as in particular, but not exclusively, a rifle and the like having a rifled barrel.

### Prior art

**[0003]** As it is known, the bullets for rifled-barrel firearms are made of lead which is very often coated with a jacket made of a harder material such as a zinc-copper alloy. The jacket provides protection to the bore made of lead which is softer with respect to corrosion and external deformation.

**[0004]** During the shot, the bullet made of jacketed lead is squashed inside the barrel and, by deformation, adheres to the barrel section which thereby, due to the presence of helical rifling, gives the rotatory motion required for the stabilization of the flight of the projectile.

**[0005]** Bullets of this kind are usually satisfactory for hunting and/or sport use and also have the advantage of having a relatively small cost.

**[0006]** However, lead is toxic and, considering that the weight of each bullet almost entirely consists of lead, the use of said bullets implies the dispersion of large amounts of this toxic metal, thereby resulting highly harmful to the environment.

**[0007]** In this sector has therefore become very important the need to make lead-free bullets for firearms, also in consideration of the fact that the new European regulations will aim at the abolition of lead in ammunition for hunting or sport use.

**[0008]** A more eco-friendly solution, alternative to the use of lead, could be to make copper bullets.

**[0009]** However, a copper bullet is considerably harder than an analogous lead bullet. This implies a greater wear due to the friction of the barrel when the projectile is thrown into it and, in the case of rifled barrels, the damaging of the rifling inside the barrel.

**[0010]** Moreover, if the bullet has a driving band system for the engagement of the barrel rifling and for sealing of propulsive gases, it has to be considered that the material constituting the driving bands undergoes a spreading along the longitudinal axis of the bullet in the direction opposite to that of advance of the projectile inside the barrel.

**[0011]** A result thereof is the formation of considerable deposits of residues of the material (for example copper) which constitutes the driving bands inside the barrel, therefore requiring frequent interventions of cleaning and maintenance of the barrel.

**[0012]** Italian patent application No. MI20122004 A1 discloses a projectile having an outer shape with rotational symmetry with a longitudinal axis which comprises

a distal portion continuously tapered up to a distal end, a proximal portion continuously tapered up to a proximal end opposite the distal end, an intermediate portion formed between the distal portion and the proximal portion (5), an external surface forming in said intermediate portion: a plurality of sealing rings projecting radially outwards and having an external sealing diameter, one or more annular grooves interspaced between the sealing rings and having a groove bottom diameter, a centering ring projecting radially outwards and formed between the distal portion and a more distal sealing ring of said sealing rings. This projectile is characterized by the fact that the centering ring has a centering outer diameter greater than the groove bottom diameter and smaller than the sealing outer diameter.

**[0013]** WO 2016/007212 discloses a projectile apparatus having a cylindrical body portion having a diameter, a front nose section tapering from a most proximal point of the projectile to the cylindrical body portion, and a rear tail section connected to the body portion and extending to the most distal point of the projectile, in which the front nose portion comprises a plurality of twisting depressions forming troughs.

**[0014]** DE 20317717 discloses a low friction projectile comprising a front section, and an adjoining cylindrical section with field caliber shaft ring bead guide bands. The projectile is non-ferrous and the guide bands have a resistance which is less than that of a lead mantle projectile of similar caliber. The projectile has front and rear rounded sections, a base and a base rounded section.

**[0015]** The main aim of the present invention is to provide a bullet for firearms, wherein said bullet is made of a lead-free material so as to have a lesser environmental impact, and at the same time has high performances, in particular in terms of shooting precision, in the scope of hunting and/or sport use, so as to meet the demands of the users and/or of the market. Another aim of the present invention is to provide a bullet as described above which allows to reduce the deposits of residues inside the barrel, in particular inside a rifled barrel, so as to increase the precision of the flight of the projectile.

**[0016]** A further aim of the present invention is to provide a bullet as described above which can be produced in a simple manner and at low cost.

### Summary of the Invention

**[0017]** Said aims are reached by a bullet for a firearm according to claim 1 comprising a solid body extended along a longitudinal axis X and made of copper or an alloy thereof or of tin or an alloy thereof, the body comprising a tapered front section and a guide section connected to the tapered front section, the guide section having a plurality of circumferential projections (full spaces) which are alternated with circumferential grooves (empty spaces), said projections having a front portion and a rear portion which have both a curved profile and are both bevelled, characterized in that said curved-profile

front portion has a radius of curvature which is greater than the radius of curvature of said curved-profile rear portion (12).

**[0018]** Preferably, the bullet is made of copper or an alloy thereof. Preferred copper alloys for the use in making a bullet according to the invention include copper-zinc alloys (for example brass), copper-tin alloys (for example bronze) and copper-tellurium alloys.

**[0019]** Further features and advantages of the present invention will result from the following description of some preferred embodiments, said description being given by way of a non-limiting example with reference to the accompanying figures.

#### Brief description of the figures

**[0020]** In the figures:

- Figure 1 shows a side view of a bullet according to an embodiment of the present invention;
- Figure 2 shows an enlargement of a portion of the bullet of Fig. 1 delimited by box A in Fig. 1;

#### Detailed description

**[0021]** With reference to Figures 1 and 2, a bullet according to a first embodiment of the present invention is referred to as a whole with reference number 1.

**[0022]** The bullet 1 has an elongated solid body extended along a longitudinal axis X and comprises a front section 2 and a guide section 3. The section 2 has a diameter D1 at its cylindrical base portion 4 which gradually decreases to a tip 5. It is to understand that the front section 2 may have a variety of forms, e.g., by way of a non-limiting example, a hollow or an ogive form, and the tip portion 5 may be flat or round.

**[0023]** The guide section 3 has external surfaces 6 and is connected to the front section 2, terminating at the opposite end of the front section 2 with a tail portion 7 through a bevelled rear edge 7a.

**[0024]** More particularly, the guide section 3 has a diameter D2 which is slightly greater than the diameter D1 at the base portion 4 of the front section 2, so that the external surfaces 6 and the base portion 4 are connected through a transition surface 8.

**[0025]** A plurality of circumferential grooves 9 are defined on the external surfaces 6 at a predetermined distance from each other and are alternated with a plurality of circumferential projections 10 (full spaces), also known as driving bands.

**[0026]** Projections 10 provide a suitable seal to gases between the bullet 1 and the hole of the barrel of the firearm in such a way to prevent or limit leaks of forward-directed propulsive gases resulting from powder combustion upon firing of the bullet. Grooves 9, on the other hand, allow to receive the material of the projections 10 which, when the bullet is thrown into the barrel, is de-

formed and compressed by the projections (rifling) of the hole of a rifled barrel and undergoes a spreading in the direction opposite to the travel direction of the bullet.

**[0027]** According to an aspect of the present invention, each of the projections 10 has a front portion 11 and a rear portion 12, both bevelled, which are separated from each other by a more external intermediate portion 13 whose external surface corresponds to a more external surface 6 of the guide section 3.

**[0028]** In particular, the front portion 11 and the rear portion 12 of projections 10 are both sloping with respect to the external surface of the intermediate portion 13 and terminate at the bottom surface 14 of respective adjacent grooves 9.

**[0029]** In that way, the grooves 9 between the projections or driving bands 10 of the bullet 1 take a substantially truncated-conical geometry (instead of conical).

**[0030]** This allows to reduce the friction resistance which is created during the flight of the bullet 1 due to the pressure which is created at the front portion 11 of the projections 10. In fact, a space is created adjacent to the driving bands, which is suitable to receive the displaced material and, because the angle of the cone increases in the opposite direction to that of advancement of the bullet 1, aerodynamics is also improved. Moreover, due to the fact that the rear portion 12 of the projections 10 is bevelled with slope to the bottom surface 14 of the grooves 9, the amount of turbulence which is created behind the projections 10 and which would tend to slow down the bullet 1 is reduced.

**[0031]** According to another aspect of the present invention, the front portion 11 and the rear portion 12 of the projections 10 descend from the surface of the intermediate portion 13 to join to the bottom surface 14 of respective adjacent grooves 9 according to a curved, preferably concave, profile of predefined radius.

**[0032]** The choice of a curved sloping profile for the front and rear portions 11 and 12 of the projections 10 advantageously allows a further improvement or an optimization of the aerodynamics with respect to analogous front and rear portions 11 and 12 of the projections 10 having a rectilinear sloping profile, since turbulence phenomena during the flight of the bullet, which are attributable to the presence of fillet corners of the front and rear portions 11 and 12 having a rectilinear sloping profile with the intermediate portion 13 and with the respective adjacent grooves 9, are eliminated or at least are reduced.

**[0033]** A further advantage to the improvement or the optimization of the aerodynamics may be obtained by making the front portion 11 of the projections 10 with curved profile with a radius of curvature R1 greater than the radius of curvature R2 of the rear portion 12 of the projections 10 with curved profile.

**[0034]** It is further to be noted that the bottom surface 14 of the grooves 9 may be sloping with respect to the longitudinal axis X in the forward direction (i.e. in the direction of advancement of the bullet 1).

**[0035]** Since the projections 10 are bevelled (sloping)

in their front portion 11 and in their rear portion 12, the grooves 9 take a truncated-conical geometry and this implies a reduction of their depth compared to a conical geometry resulting from grooves 9 free of bevelled portions. In order to compensate for this depth reduction, the grooves 9 are made wide enough to accommodate inside them the spread material of the projections 10 during the crossing of the bullet 1 inside the barrel. In particular, the grooves 9 have a width along the direction of the X axis which is greater than the width of the intermediate portion 13 of the projections 10.

**[0036]** According to another aspect of the present invention, it is to be noted that the bullet 1 according to the invention is lead-free since it is made in a solid body made of copper or an alloy thereof, in particular bronze, brass or a copper tellurium alloy, or in a solid body made of tin or an alloy thereof according to turning methods in themselves conventional.

**[0037]** A bullet made of these materials is sufficiently hard but at the same time "malleable" so as to take the form of the barrel, deforming itself at the projections 10 when they engage the rifling of the barrel hole, thereby obtaining an improvement of the filling inside the barrel and without damaging the bullet itself or damaging or wear of the helical rifling inside the barrel hole.

**[0038]** In the light of the above, the bullet according to the invention attains the predetermined aims and achieves numerous advantages compared to the bullets of the prior art.

**[0039]** In fact, due to the fact that the projections of the bullet are bevelled to join the grooves between them, during the crossing of the bullet inside the barrel the displacement of the hard material (for example copper) of the projections in the spaces created in the adjacent grooves is facilitated and its deposit inside the barrel is reduced. This supports, once the propelling charge is exploded, the constancy of the harmonic vibrations inside the barrel which are necessary for the precision of the implemented arm system.

**[0040]** These advantages are clear especially in semi-polygonal barrels, because the contact area is larger.

**[0041]** In fact, with the bullet according to the invention, the material of the projections of the bullet is advantageously in correct and constant dragging from the full spaces (projections) of the rifled barrel, thereby preventing that the material itself creates inconstant obstruction pressures, depositing also inside the barrel, which, by accumulating material, would gradually vary its inner conditions and performances.

**[0042]** Vice versa, with the use of the bullet according to the invention, a considerable precision of the flight of the projectile is achieved, whose most important prerequisite is the constancy of functioning, which results in the constancy of impact point, being this a particularly important requirement for the hunting or sport practice.

**[0043]** A person skilled in the art may make numerous modifications and changes to the bullet according to the invention, which, however, are all within the scope of pro-

tection of the annexed claims. For example, the intermediate portion 13 of the projections 10 may have any profile, flat or curvilinear, and may be filleted to the front portion 11 and to the rear portion 12 of the projections 10 also according to a single curve (single curvilinear profile) of predefined radius.

## Claims

1. Bullet (1) for a firearm comprising a solid body extended along a longitudinal axis (X) and made of copper or an alloy thereof or of tin or an alloy thereof, the body comprising a tapered front section (2) and a guide section (3) connected to the tapered front section (2), the guide section (3) having a plurality of circumferential projections (10) which are alternated with circumferential grooves (9), said projections (10) having a front portion (11) and a rear portion (12) which have both a curved profile and are both bevelled, **characterized in that** said curved-profile front portion (11) has a radius of curvature (R1) which is greater than the radius of curvature (R2) of said curved-profile rear portion (12).
2. Bullet (1) according to claim 1, wherein said bevelled front portion (11) and said bevelled rear portion (12) are separate from each other by a more external intermediate portion (13) having a flat or curvilinear profile.
3. Bullet (1) according to claim 2, wherein said front portion (11) and said rear portion (12) of the projections (10) are both sloping with respect to the external surface of the intermediate portion (13) and terminate at the bottom surface (14) of respective adjacent grooves (9).
4. Bullet according to any of the previous claims, wherein said front portion (11) and said rear portion (12) of the projections (10) have both a concave profile.
5. Bullet according to any of the previous claims, wherein the bottom surface (14) of said grooves (9) is sloping with respect to the longitudinal axis (X) in the forward direction.
6. Bullet according to any of the previous claims 2 to 4, wherein said grooves (9) have a width along the longitudinal axis (X) which is greater than the width of the intermediate portion (13) of said projections (10).
7. Bullet (1) according to any of the previous claims, wherein said body is made of copper or a copper alloy.

8. Bullet (1) according to claim 7, wherein said body is made of bronze or brass.

Bronze oder Messing hergestellt ist.

#### Patentansprüche

1. Projektil (1) für eine Schusswaffe, die einen massiven Körper aufweist, der sich entlang einer Längsachse (X) erstreckt und aus Kupfer oder einer Legierung davon oder aus Zinn oder einer Legierung davon hergestellt ist, wobei der Körper einen kegelförmigen Vorderabschnitt (2) und einen Führungsabschnitt (3), der mit dem kegelförmigen Vorderabschnitt (2) verbunden ist, umfasst, wobei der Führungsabschnitt (3) mehrere umlaufende Vorsprünge (10), die sich mit umlaufenden Nuten (9) abwechseln, aufweist, wobei die Vorsprünge (10) einen vorderen Teil (11) und einen hinteren Teil (12) aufweisen, die beide ein gekrümmtes Profil aufweisen und beide angeschrägt sind, **dadurch gekennzeichnet, dass** der vordere Teil (11) mit dem gekrümmten Profil einen Krümmungsradius (R1) aufweist, der größer ist als der Krümmungsradius (R2) des hinteren Teils (12) mit dem gekrümmten Profil.
2. Projektil (1) nach Anspruch 1, wobei der angeschrägte vordere Abschnitt (11) und der angeschrägte hintere Abschnitt (12) durch einen weiter außerhalb liegenden Zwischenteil (13), der ein ebenes oder kurvenförmiges Profil aufweist, voneinander getrennt sind.
3. Projektil (1) nach Anspruch 2, wobei der vordere Teil (11) und der hintere Teil (12) der Vorsprünge (10) in Bezug auf die äußere Oberfläche des Zwischenteils (13) geneigt sind und an der unteren Oberfläche (14) der jeweiligen benachbarten Nuten (9) enden.
4. Projektil nach einem der vorhergehenden Ansprüche, wobei der vordere Teil (11) und der hintere Teil (12) der Vorsprünge (10) beide ein konkaves Profil aufweisen.
5. Projektil nach einem der vorhergehenden Ansprüche, wobei die untere Oberfläche (14) der Nuten (9) in Bezug auf die Längsachse (X) in der Vorwärtsrichtung geneigt ist.
6. Projektil nach einem der vorhergehenden Ansprüche 2 bis 4, wobei die Nuten (9) eine Breite entlang der Längsachse (X) aufweisen, die größer ist als die Breite des Zwischenteils (13) der Vorsprünge (10).
7. Projektil (1) nach einem der vorhergehenden Ansprüche, wobei der Körper aus Kupfer oder einer Kupferlegierung hergestellt ist.
8. Projektil (1) nach Anspruch 7, wobei der Körper aus

#### Revendications

1. Balle (1) pour une arme à feu comprenant un corps plein étendu selon un axe longitudinal (X) et réalisé en cuivre ou en alliage de celui-ci ou en étain ou en alliage de celui-ci, le corps comprenant une section avant effilée (2) et une section de guidage (3) reliée à la section avant effilée (2), la section de guidage (3) ayant une pluralité de saillies circonférentielles (10) qui sont alternées avec des rainures circonférentielles (9), lesdites saillies (10) ayant une portion avant (11) et une portion arrière (12) qui ont toutes deux un profil courbé et sont toutes deux biseautées, **caractérisée en ce que** ladite portion avant à profil courbé (11) a un rayon de courbure (R1) qui est supérieur au rayon de courbure (R2) de ladite portion arrière à profil courbé (12).
2. Balle (1) selon la revendication 1, dans laquelle ladite portion avant (11) biseautée et ladite portion arrière (12) biseautée sont séparées l'une de l'autre par une portion intermédiaire (13) plus externe ayant un profil plat ou curviligne.
3. Balle (1) selon la revendication 2, dans laquelle ladite portion avant (11) et ladite portion arrière (12) des saillies (10) sont toutes deux penchées par rapport à la surface externe de la portion intermédiaire (13) et se terminent au niveau de la surface basse (14) de rainures adjacentes (9) respectives.
4. Balle selon l'une quelconque des revendications précédentes, dans laquelle ladite portion avant (11) et ladite portion arrière (12) des saillies (10) ont toutes deux un profil concave.
5. Balle selon l'une quelconque des revendications précédentes, dans laquelle la surface basse (14) desdites rainures (9) est penchée par rapport à l'axe longitudinal (X) dans la direction vers l'avant.
6. Balle selon l'une quelconque des revendications 2 à 4 précédentes, dans laquelle lesdites rainures (9) ont une largeur selon l'axe longitudinal (X) qui est supérieure à la largeur de la portion intermédiaire (13) desdites saillies (10).
7. Balle (1) selon l'une quelconque des revendications précédentes, dans laquelle ledit corps est réalisé en cuivre ou en alliage de cuivre.
8. Balle (1) selon la revendication 7, dans lequel ledit corps est réalisé en bronze ou en laiton.



**REFERENCES CITED IN THE DESCRIPTION**

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