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(54) SUBSONIC, EXPANDING AND LEAD-FREE PROJECTILE

(57) The invention relates to a subsonic, expanding and lead-free projectile (10), which comprises a projectile body (20) and a tip part (30), which projectile body (20) of the subsonic, expanding and lead-free projectile (10) is a solid projectile body and made of copper composition, most advantageously extremely pure copper composition, which subsonic projectile tip (30) of the subsonic, expanding and lead-free projectile (10) is made of brass, in which the projectile body (20) has a hollow opening (22) extending around imaginary axis of the projectile body (20), and which hollow opening (22) is cylindrical. The projectile tip (30) is shorter in axial direction than depth of the hollow opening (22), that the projectile body (20) comprises a uniform ring (23) formed at front part of the projectile body (20) and the projectile body (20) comprises axially extending slots (21), which slots (21) extend a distance of 15-20 mm, advantageously about 18 mm, from back edge of the ring (23) in the front part of the projectile body (20) and in between the axially extending slots (21) expanding parts (25) of the projectile body (20) are configured to form.

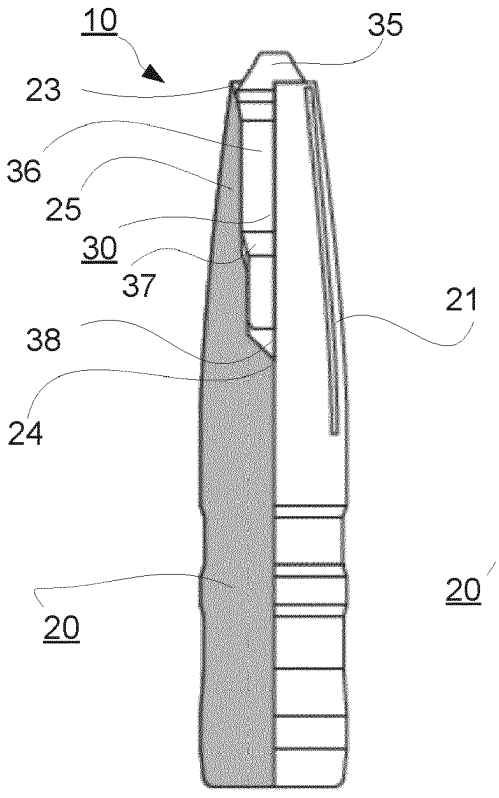

Fig. 5B

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Description

Technical field

[0001] The present invention relates to subsonic projectiles. In particular, the present invention relates to a subsonic, expanding and lead-free projectile according to the preamble of claim 1.

Background

[0002] Different kinds of subsonic projectiles are known from prior art. Typically, subsonic projectiles are designed to operate in such velocities that the supersonic shockwave is avoided i.e. at velocities at least below the speed of sound, which is 343 m/s at 20 °C but depends on temperature such that in lower temperatures the velocity limit for the supersonic shockwave is lower. Often the subsonic projectiles have heavier bullet weights to retain as much energy as possible at the lower velocities.

[0003] Different kinds of expanding projectiles are also known from prior art. Typically, expanding projectiles are designed to expand on impact and they are used as hunting bullets. In patent publication EP2965038 is disclosed a bullet comprising a body made of solid-material metal and having on its nose and in the center axis thereof a cavity comprising at least two consecutive cavity parts. The diameter of the nose of the bullet is arranged to mushroom under the effect of a pressure directed to it as it hits its target. In the direction away from the nose, the diameter of each cavity part is smaller than the preceding one in such a manner that the consecutive cavity parts are formed in such a manner that in the direction away from the nose, the diameter of the next cavity part is clearly smaller than the diameter of the preceding cavity part, thus forming a step-shaped discontinuity area, and the consecutive cavity parts are of a length, in which the length of the cavity part on the nose side is clearly longer than the length of the next cavity part.

[0004] In patent publication DE 102014224715··B1 is disclosed a subsonic cartridge with a projectile in caliber .308 and .300, which projectile has a projectile body and a cover forming the tip of the projectile. The body of the projectile body is made of copper or a lead-free copper alloy. In the projectile body, there is a hollow, cylindrical opening, which is open at the front i.e. at the projectile tip of the projectile body and has a depth of 20 - 30 mm. The projectile body is also provided with slots extending in the axial direction from the opening towards the rear part of the projectile body, which slots extend only over a part of the length the hollow opening. The projectile body is also provided with predetermined breaking points designed as weakening in the wall thickness of the hollow opening. The wall thickness of the breaking point increases continuously from front to back. The projectile tip has a front part with projecting forward beyond the projectile body and has a larger cross-section than the hollow opening at the front. The projectile tip also has a rear part which is inserted into the hollow opening.

Summary

[0005] An objective of the invention is to create a subsonic, expanding and lead-free projectile, in which the disadvantages and problems of the corresponding projectiles known from prior art are eliminated or at least minimized.

[0006] Another objective of the invention is to create an improved subsonic, expanding and lead-free projectile, in which improved expandability is achieved.

[0007] In order to achieve the above objects and those described later the subsonic, expanding and lead-free projectile according to the invention is mainly characterized by the features of claim 1. In the dependent claims additional advantageous features and aspects of the invention are defined.

[0008] According to the invention the projectile tip is shorter in axial direction than the depth of the hollow, cylindrical opening. Thus, the projectile tip is not supported onto the bottom of the hollow, cylindrical opening. This provides the possibility of the projectile to pass through a thin obstacle, for example a window glass, before expanding.

[0009] According to the invention a uniform ring is formed at the front part of the projectile body. This provides for slowing down spreading of the expanding parts of the projectile body during expanding of the projectile.

[0010] According to the invention the projectile body comprises axially extending slots, which slots extend a distance of 15-20 mm, advantageously about 18 mm, from the back edge of the ring in the front part of the projectile body. Thus, the slots begin to extend only after the uniform ring and do not provide a breaking point for the expanding parts of the projectile body but instead open the expanding parts of the projectile body during expanding of the projectile.

[0011] According to an advantageous feature of the invention the projectile tip has several different cross-sectional diameters, and its greatest diameter is located at the position, which is configured to be located just below the front part of the hollow opening of the projectile body such, that the outer surfaces of the projectile body and the projectile tip form a substantially uniform contour line. This provides further improvement in opening of the projectile tip, as thus, the projectile tip guides in contact the soft tissue material sideways and thus, spreads the expanding parts of the projectile body.

[0012] According to an advantageous feature of the invention the hollow, cylindrical opening has a stepwise from front part of the projectile towards the back part of the projectile decreasing diameter, which provides for beginning of the spreading of the projectile from the front part with low impact energy and for durability even if the projectile hits the target in sonic speed. Advantageously, the stepwise from front part of the projectile towards the

back part of the projectile decreasing diameter is constructed with a smooth variation angle to minimize the notch effect as thus a fracturing point does not form to the expanding parts as the diameter changes.

[0013] According to an advantageous feature of the invention the depth of the hollow opening of the projectile body is 10 - 15 mm, most advantageously about 14,4 mm.

[0014] According to an advantageous feature of the invention the bottom of the hollow opening has a round-up, which decreased the notch effect and improves durability of the projectile.

[0015] According to an advantageous feature of the invention the weight of the projectile is 12,5 - 13,5 grams, most advantageously about 12,96 grams. Thus, opening in subsonic velocities is ensured.

[0016] According to an advantageous feature of the invention the length of the projectile body without the projectile tip is 35 - 40 mm, most advantageously about 37,8 mm.

[0017] According to an advantageous feature of the invention the total length of the projectile body with the projectile tip mounted is 38 - 42 mm, most advantageously about 39,3 mm.

[0018] According to an advantageous feature of the invention the material of the projectile body is a solid body projectile body and made of lead-free metal, advantageously of copper, most advantageously extremely pure copper.

[0019] According to an advantageous feature of the invention the material of the projectile body has tensile strength (Rm) of 290-360 N/mm^2 and yield strength (0,2 %) of at least 250 N/mm^2.

[0020] According to an advantageous feature of the invention the material of the projectile body has hardness of HV 100-120.

[0021] According to an advantageous feature of the invention the material of the projectile tip is brass.

[0022] According to an advantageous feature of the invention the weight of the projectile tip is at least about 0,82 grams.

[0023] According to an advantageous feature of the invention the material of the projectile tip has hardness of about HV 150.

[0024] According to an advantageous aspect of the invention the slots and the ring at the front of the projectile body are configured to significantly decrease the spreading resistance. The uniform ring holds the expanding part together during mounting of the projectile tip and controls spreading of the expanding parts such that the velocity of the projectile in soft tissue is configured to decrease to a level, in which no fracturing occurs in the expanding parts and thus, the projectile remains in one part. Additionally the uniform ring slows down spreading of the projectile, when it hits a hard obstacle, for example glass.

[0025] According to an advantageous aspect of the invention the wedge shaped part of the projectile tip remaining inside the hollow opening of the projectile body guides the material of the soft tissue outwards and thus improves spreading of the expanding parts.

[0026] According to an advantageous aspect of the invention the stages of operation of the projectile, when it hits a hard obstacle, for example a glass window are:

- the hard projectile tip of brass breaks the surface tension of the obstacle
- the projectile tip breaks the uniform ring of the projectile body and the wedge-shaped projectile tip of brass sinks into the projectile body due to the impact pressure and spreads the expanding parts
- fast spreading of the expanding parts begins at the front of the projectile body provided with the thinner wall thickness
- the projectile tip reaching at the bottom of the hollow opening it supports the projectile body during passing through the obstacle
- the back part of the hollow opening controls the spreading of the projectile body and due to the thicker wall thickness towards the bottom of the hollow opening the expanding parts remain as parts of the projectile body.

[0027] It is to be noted that first hitting a hard obstacle is not required for operation of the projectile.

[0028] According to an advantageous aspect of the invention the wedge-shaped projectile tip of brass improves the spreading of the projectile in two ways in cases when the projectile hits directly to soft tissue:

- the projectile tips wedges the expanding parts outwards during its sinking into the projectile body and the soft tissue material guided sideways spreads the expanding parts as at this stage the hard projectile tip of brass is below (behind) the lower edge of the ring (the immersion length is about 0,7 mm). Advantageously, the projectile tip also improves symmetrical spreading of the expanding parts. Additionally advantageously, the projectile tip protects the expanding parts during passing a hard obstacle as the back end of the projectile tip backs at the bottom of the hollow opening

[0029] According to an advantageous aspect the weight of the projectile tip of brass increases the total weight of the projectile and transfers the center of mass of the projectile frontwards.

[0030] The exemplifying embodiments of the invention presented in this patent application are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" and its derivatives are used in this patent application as an open limitation that does not exclude the existence of also unrecited features. The features described hereinafter are mutually freely combinable unless explicitly stated otherwise.

Brief description of the drawings

[0031] Aspects of the invention, however, together with additional objects and advantages thereof, will be best understood from the following description of some example embodiments when read in connection with the accompanying drawings and in the following the invention is described in more detail referring to the accompanying drawing, in which

[0032] in figure 1 is schematically shown as a side view an advantageous example of projectile body of a subsonic, expanding and lead-free projectile according to the invention,

[0033] in figure 2 is schematically shown as a partially cut view the advantageous example of the projectile body of the subsonic, expanding and lead-free projectile according to figure 1,

[0034] in figure 3 is schematically shown a side view an advantageous example of a projectile tip of a subsonic, expanding and lead-free projectile according to the invention,

[0035] in figure 4 is schematically shown as partial, partially cut view a front end of the advantageous example of the subsonic, expanding and lead-free projectile according to figures 1-3 before the projectile has first hit a hard obstacle and

[0036] in figures 5A - 5F is schematically shown an example of stages of operation of the projectile.

Detailed description

[0037] During the course of the following description like numbers and signs will be used to identify like elements according to the different views which illustrate the invention and its advantageous examples. In the figures some repetitive reference signs may have been omitted for clarity reasons.

[0038] In the figures 1-4 is shown a projectile 10 in accordance with an advantageous example of the invention. The projectile 10 comprises a projectile body 20 and a projectile tip 30. The projectile body 20 is a solid body projectile body and made of lead-free metal, advantageously of copper, most advantageously extremely pure copper. The projectile tip 30 is made of brass material.

[0039] The projectile body 20 comprises a cylindrical inner hollow opening 22, which is located at the imaginary center axis of the projectile body 20. The projectile body also is provided with slots 21, which are located radially spaced apart at the circumference of the inner hollow opening 22. Between the slots 21 expanding parts 25 of the projectile body 20 are located. The slots 21 extend to the outer surface of the projectile body 20 such, that they are open from the hollow opening 22 through the wall of the projectile body 20. In axial direction the slots 21 extend towards the bottom of the hollow opening 22 for a distance, which distance is shorter than the depth of the hollow opening 22. The projectile body 20 also comprises a uniform ring 23 formed at the front part of the projectile body 20.

[0040] The hollow opening 22 has a stepwise from front part of the projectile towards the back part of the projectile decreasing diameter, D1, D2. Advantageously, the stepwise from front part of the projectile towards the back part of the projectile decreasing diameter D1, D2 is constructed with a smooth variation angle by conical parts C1, C2, C3. The bottom 24 of the hollow opening 22 has a rounding R24.The depth of the hollow opening 22 of the projectile body 20 is 10 - 15 mm, most advantageously about 14,4 mm.

[0041] The projectile body 20 has thus at the circumferential area around the hollow opening 22 correspondingly altering wall thickness. Advantageously, the wall thickness increases from the tip to the opposite end of the projectile.

[0042] The slots 21 the slots extend a distance of 15-20 mm, advantageously about 18 mm, from the back edge of the ring 23 located in the front part of the projectile body 20. Thus, the slots 21 begin to extend only after the uniform ring 23. The slots 21 limit the expanding parts 25 along the circumference of the projectile body 20.

[0043] The projectile tip 30 comprises a tip end part 35, which is wedge-shaped, cylindrical mid parts 36 and tapered parts 37, 38 at the back end of the projectile tip 30. The projectile tip 30 is shorter in axial direction than the depth of the hollow opening 22 of the projectile body 20. Thus, the projectile tip 30 is not supported onto the bottom of the hollow opening, when mounted to its place before using the projectile 10. The projectile tip 30 has several different cross-sectional diameters Ct, C1t, D1t, C2t, D2t and its greatest diameter Dmax is located at the position, which is configured to be located just below the front part of the hollow opening 22 of the projectile body 20 such, that the outer surfaces of the projectile body 20 and the projectile tip 30 form a substantially uniform contour line. This provides further improvement in opening of the projectile tip, as thus, the projectile tip guides in contact the soft tissue material sideways and thus, spreads the expanding parts of the projectile body.

[0044] The projectile tip 30 is inserted into the inner hollow opening 22 of the projectile body 20 such that the tip end part 35 of the projectile tip 30 remains outside the projectile body 20 and forms thus the outer tip of the projectile 10. The projectile tip 30 has the tapered tip end part 35.

[0045] The weight of the projectile 10 is 12,5 - 13,5 grams, most advantageously about 12,96 grams.

[0046] The length of the projectile body 20 without the projectile tip 30 is 35 - 40 mm, most advantageously about 37,8 mm and the total length of the projectile body 20 with the projectile tip 30 mounted before using is 38 - 42 mm, most advantageously about 39,3 mm.

[0047] The slots 21 and the ring 23 at the front of the projectile body 20 are configured to significantly decrease the spreading resistance. The uniform ring 23 holds the expanding parts 25 together during mounting of the projectile tip 30 and controls spreading of the ex-

panding parts 25 such that the velocity of the projectile 10 in soft tissue is configured to decrease to a level, in which no fracturing occurs in the expanding parts 25.

[0048] As can be seen from figure 4 the main stages of operation of the projectile 10, when it hits a hard obstacle, for example a glass window are:

- the hard projectile tip 30 of brass breaks the surface tension of the obstacle
- the projectile tip 30 breaks the uniform ring 23 of the projectile body 20 and the wedge-shaped part 35 sinks into the projectile body 20 due to the impact pressure and spreads the expanding parts 25
- fast spreading of the expanding parts 25 begins at the front of the projectile body 20 provided with the thinner wall thickness
- the projectile tip 30 reaching at the bottom 24 of the hollow opening 22.

[0049] The wedge shaped part 35 of the projectile tip 30 guides the material of the soft tissue outwards and thus improves spreading of the expanding parts 25, as shown by arrows in figure 4.

[0050] In figures 5A - 5F is shown an example of the stages of the operation of the projectile. In figure 5A is shown the projectile 10 from outside before it hits an obstacle. Corresponding stage is shown in figure 5B but as a partially cut view of the projectile 10. In figure 5C is shown the stage, when the projectile 10 hits the obstacle and the hard projectile tip 30 of brass breaks the surface tension of the obstacle causing the projectile tip 30 to break the uniform ring 23 of the projectile body 20 and the wedge-shaped projectile tip 30 of brass to sink into the projectile body 20 due to the impact pressure. At this stage the hard projectile tip 30 of brass is below (behind) the lower edge of the ring 23. This causes the expanding parts 25 to begin to spread and as the projectile tip is reaching at the bottom 24 of the hollow opening it supports the projectile body 20 during passing through the obstacle, as shown in figure 5D. As the back part of the hollow opening controls the spreading of the projectile body 20 and due to the thicker wall thickness towards the bottom 24 of the hollow opening the expanding parts 25 remain as parts of the projectile body 20. After this stage the projectile tip 30 detaches from the projectile body 20 as shown in figures 5E-5F.

[0051] In the description in the foregoing, although some functions have been described with reference to certain features, those functions may be performable by other features whether described or not. Although features have been described with reference to certain embodiments or examples, those features may also be present in other embodiments or examples whether described or not. Above the invention has been described by referring to some advantageous examples only to which the invention is not to be narrowly limited. Many modifications and alterations are possible within the invention as defined in the following claims.

Claims

1. A subsonic, expanding and lead-free projectile (10), which comprises a projectile body (20) and a tip part (30), which projectile body (20) of the subsonic, expanding and lead-free projectile (10) is a solid projectile body and made of copper composition, most advantageously extremely pure copper composition, which subsonic projectile tip (30) of the subsonic, expanding and lead-free projectile (10) is made of brass, in which the projectile body (20) has a hollow opening (22) extending around imaginary axis of the projectile body (20), and which hollow opening (22) is cylindrical, **characterized in that** the projectile tip (30) is shorter in axial direction than depth of the hollow opening (22), that the projectile body (20) comprises a uniform ring (23) formed at front part of the projectile body (20) and that the projectile body (20) comprises axially extending slots (21), which slots (21) extend a distance of 15-20 mm, advantageously about 18 mm, from back edge of the ring (23) in the front part of the projectile body (20) and in between the axially extending slots (21) expanding parts (25) of the projectile body (20) are configured to form.

2. A subsonic, expanding and lead-free projectile according to claim 1, **characterized in that** the projectile tip (30) has several different cross-sectional diameters, and greatest diameter (Dmax) is located just below the front part of the hollow opening (22) of the projectile body (20) such, that the outer surfaces of the projectile body (20) and the projectile tip (30) are configured to form a substantially uniform contour line.

3. A subsonic, expanding and lead-free projectile according to claim 1 or 2, **characterized in that** the hollow opening (22) has a stepwise from the front part of the projectile body (20) towards the back part of the projectile body (20) decreasing diameter.

4. A subsonic, expanding and lead-free projectile according to any of claims 1-3, **characterized in that** depth of the hollow opening (22) of the projectile body (20) is 10 - 15 mm, most advantageously about 14,4 mm.

5. A subsonic, expanding and lead-free projectile according to any of claims 1-4, **characterized in that** bottom (24) of the hollow opening (22) has a roundup (R24).

6. A subsonic, expanding and lead-free projectile according to any of claims 1-5, **characterized in that** weight of the projectile (10) is 12,5 - 13,5 grams, most advantageously about 12,96 grams.

7. A subsonic, expanding and lead-free projectile according to any of claims 1-6, **characterized in that** length of the projectile body (20) without the projectile tip (30) is 35 - 40 mm, most advantageously about 37,8 mm.

8. A subsonic, expanding and lead-free projectile according to any of claims 1-7, **characterized in that** total length of the projectile body (20) with the projectile tip (30) mounted is 38 - 42 mm, most advantageously about 39,3 mm.

9. A subsonic, expanding and lead-free projectile according to any of previous claims, **characterized in that** material of the projectile body (20) has tensile strength (Rm) of 290-360 N/mm^2 and yield strength (0,2 %) of at least 250 N/mm^2.

10. A subsonic, expanding and lead-free projectile according to any of previous claims, **characterized in that** the weight of the projectile tip (30) is at least about 0,82 grams.

11. A subsonic, expanding and lead-free projectile according to any of previous claims, **characterized in that** material of the projectile tip (30) has hardness of about HV 150.

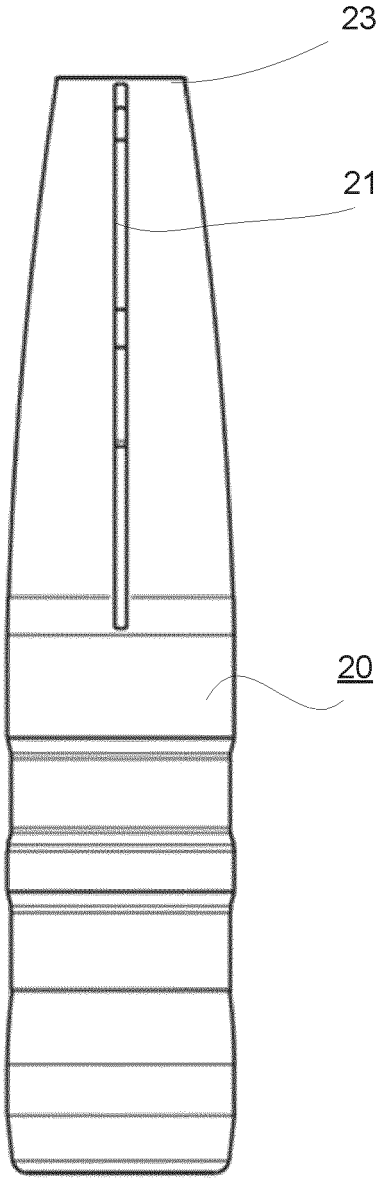

Fig. 1

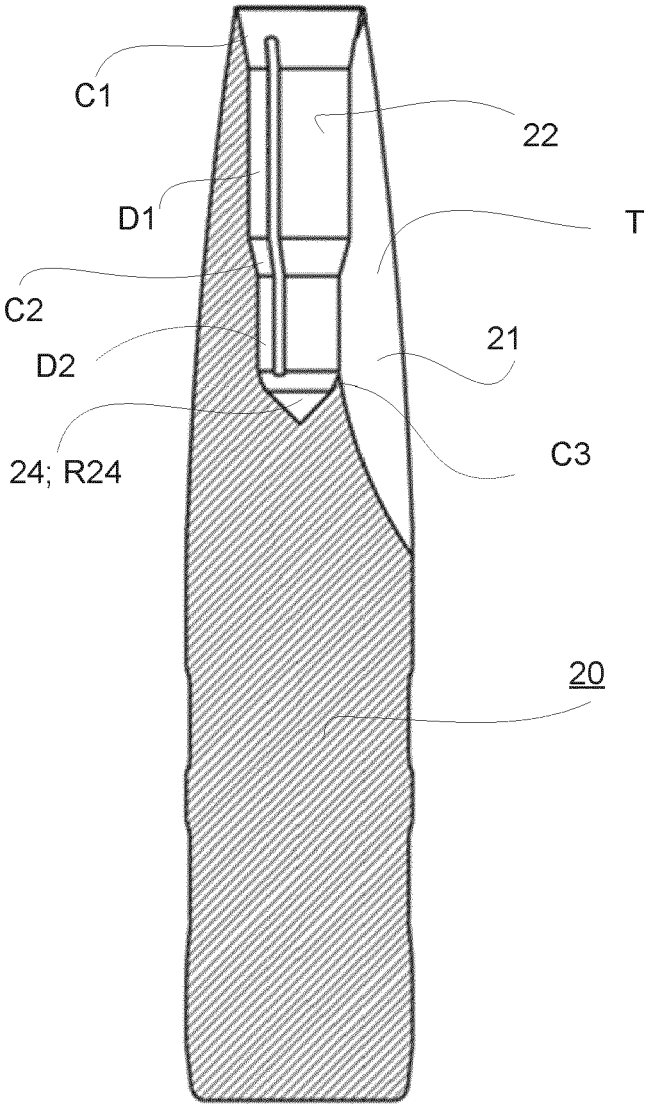

Fig. 2

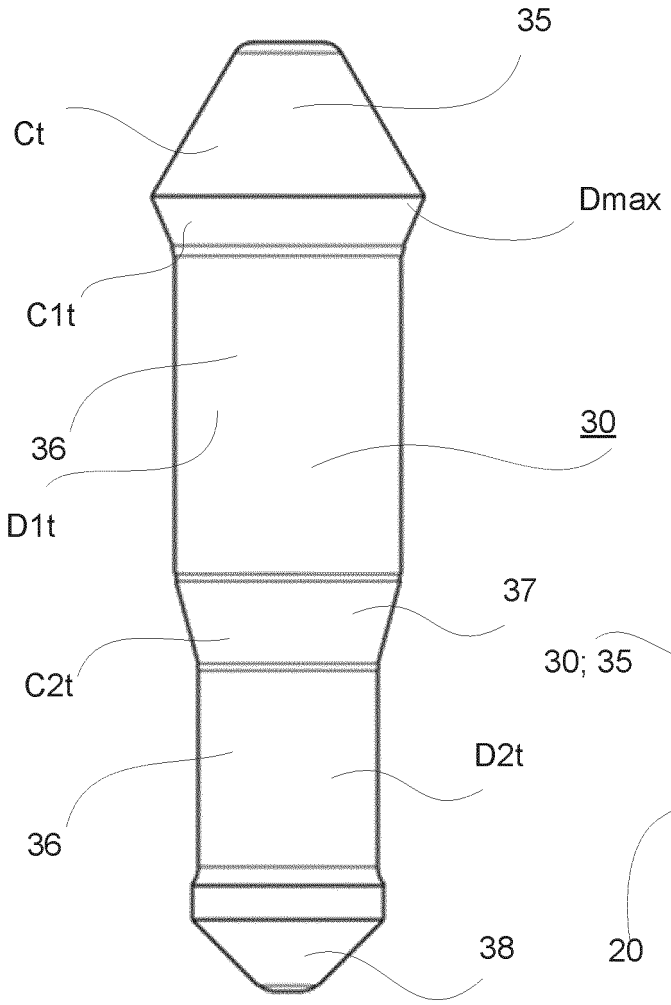

Fig. 3

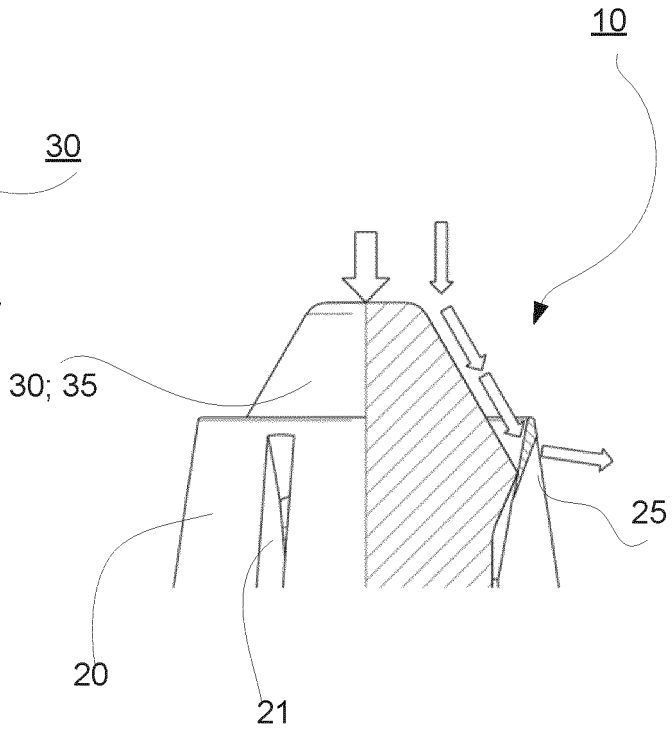

Fig. 4

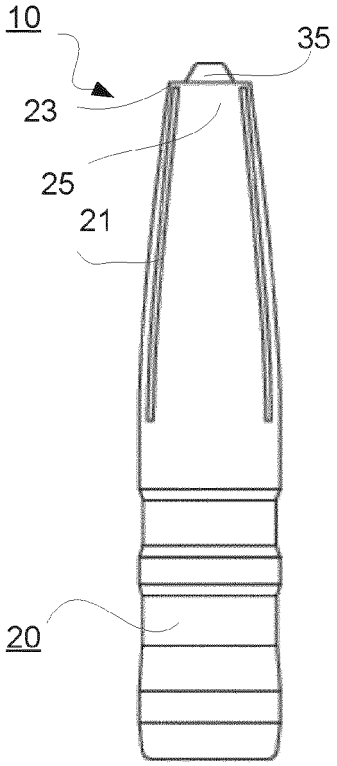

Fig. 5A

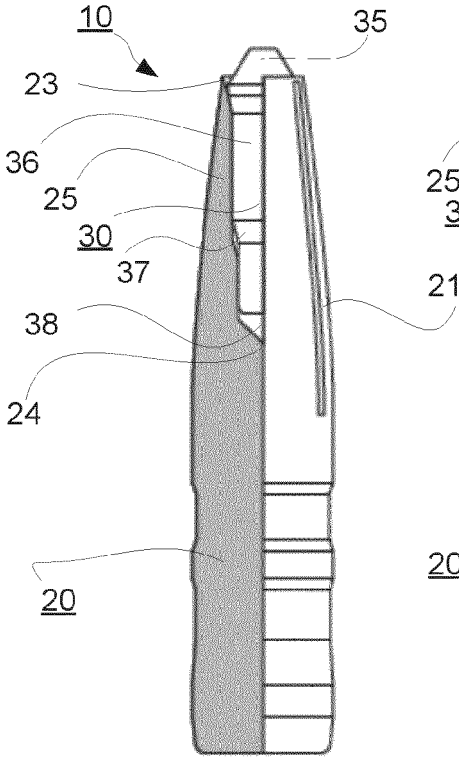

Fig. 5B

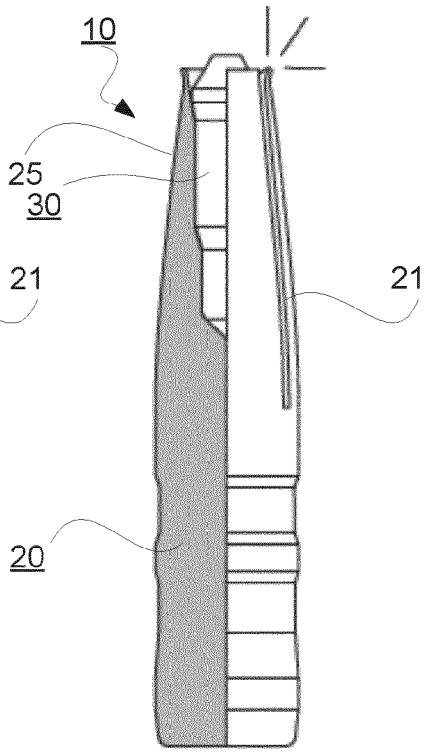

Fig. 5C

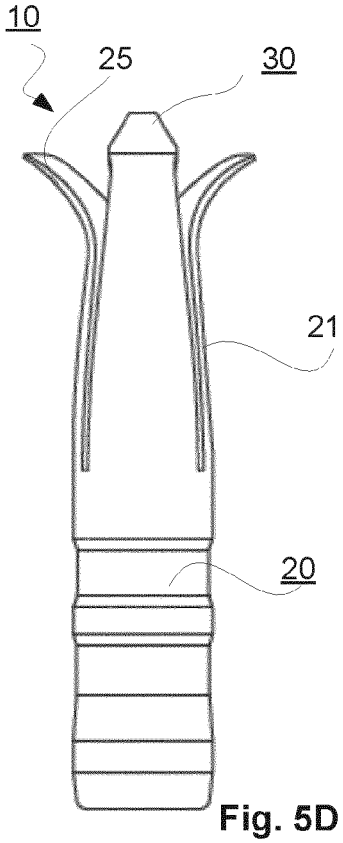

Fig. 5D

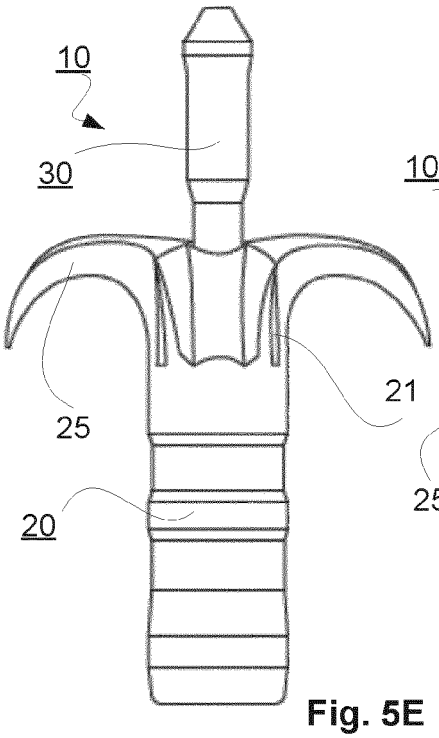

Fig. 5E

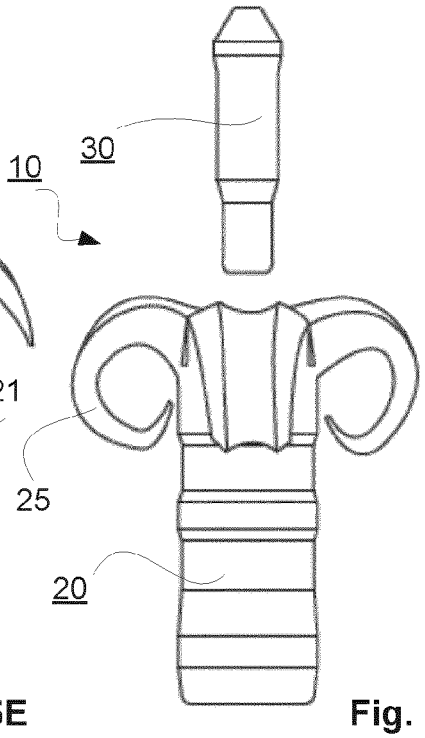

Fig. 5F

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 6267

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2015/354930 A1 (FRICKE DAVID B [US]) 10 December 2015 (2015-12-10) * abstract * * paragraphs [0022], [0026] * * figures 1A-6B *	1-11	INV. F42B12/34 F42B12/74
X,D	DE 10 2014 224715 A1 (METALLWERK ELISENHÜTTE GMBH [DE]) 4 May 2016 (2016-05-04) * abstract * * paragraphs [0011], [0012], [0020], [0029], [0031] - [0035] * * figures 1-2 *	1-11	
A	US 4 776 279 A (PEJSA ARTHUR J [US]) 11 October 1988 (1988-10-11) * figures 1,3 *	1-11	
A	DE 20 28 238 A1 (PEJSA ARTHUR J) 16 December 1971 (1971-12-16) * figures 1-3 *	1-11	TECHNICAL FIELDS SEARCHED (IPC)
A	US 2016/216090 A1 (FRICKE DAVID B [US]) 28 July 2016 (2016-07-28) * abstract * * paragraphs [0018] - [0026] * * figures 1A-5D *	1-11	F42B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 October 2022	Menier, Renan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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21-10-2022

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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