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(54) **EXPANDING AND/OR PARTIALLY FRAGMENTING BULLET**

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(57) **ABSTRACT**

The present invention relates to a deformation and/or partial fragmentation projectile comprising a jacket and a two-part core arranged within the jacket and having a projectile front-sided core part and a projectile rear-sided core part, the core being attached to the jacket such that the projectile rear-sided core part is more strongly attached to the jacket than the projectile front-sided core part.

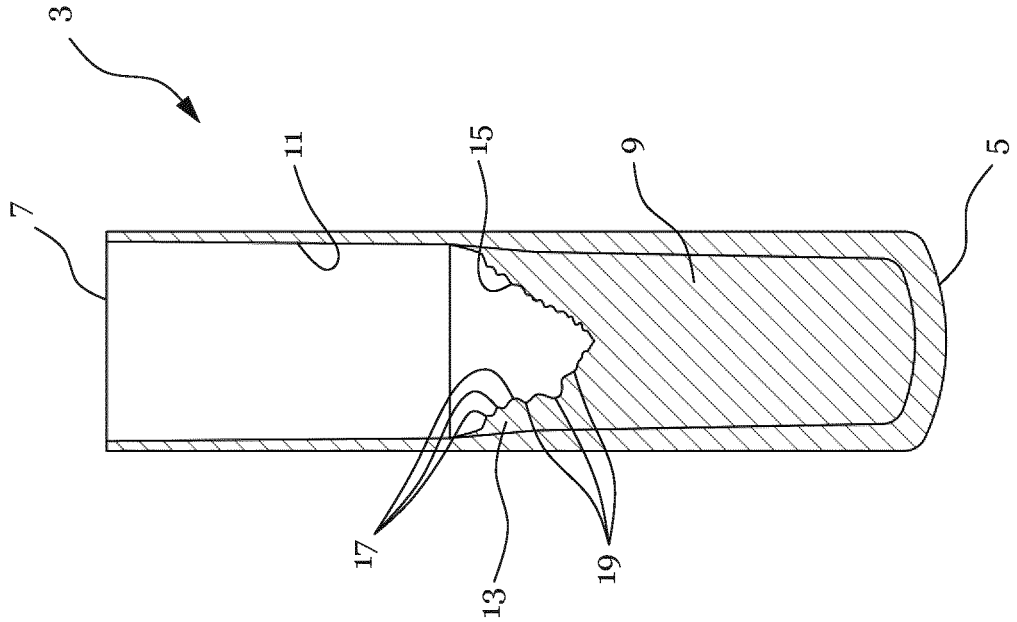

Fig. 2

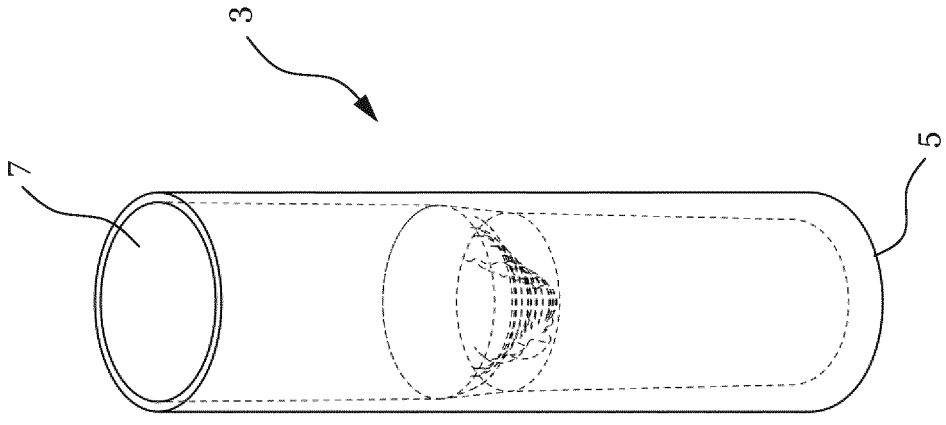

Fig. 1

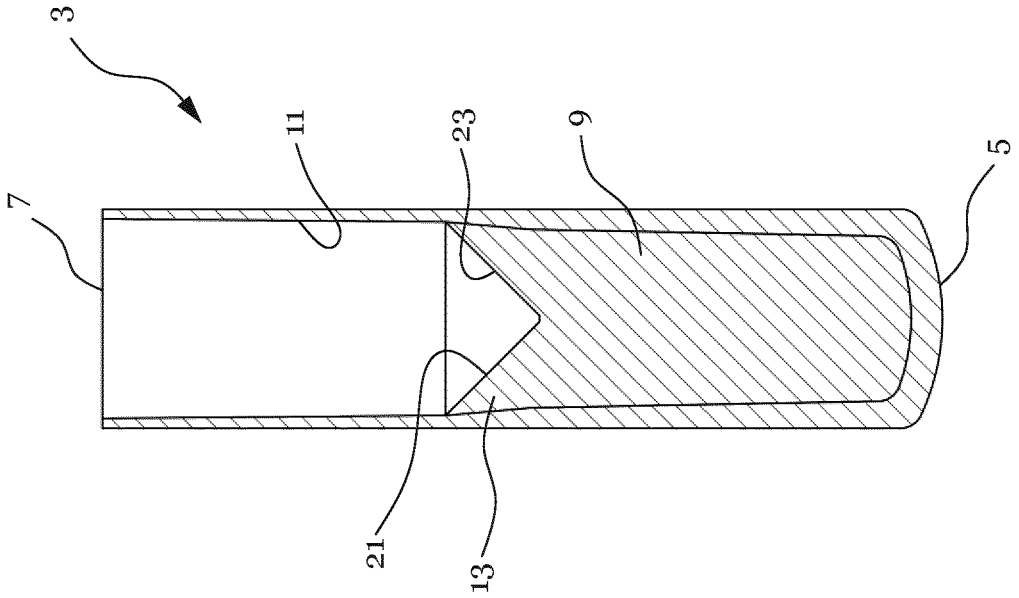

Fig. 4

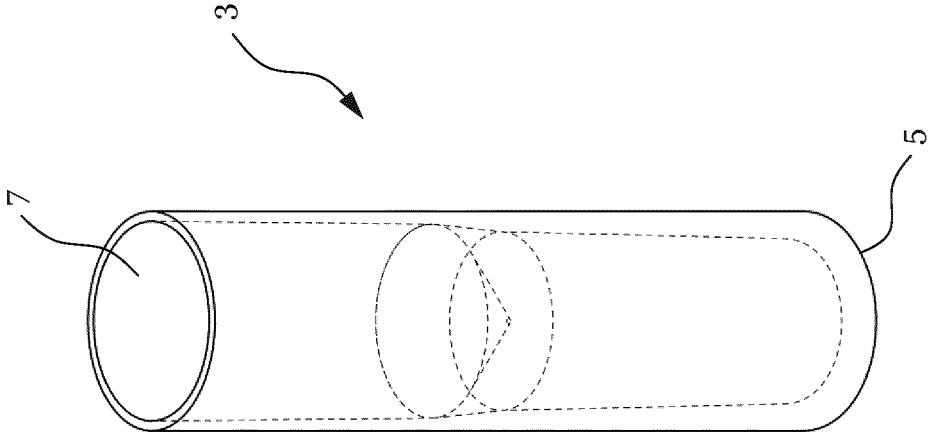

Fig. 3

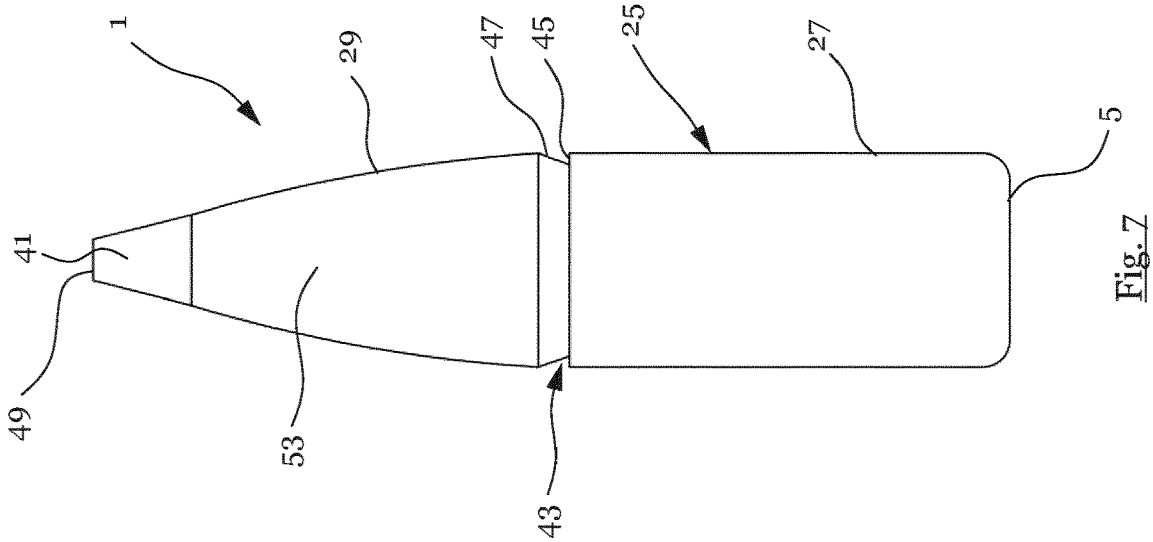

Fig. 7

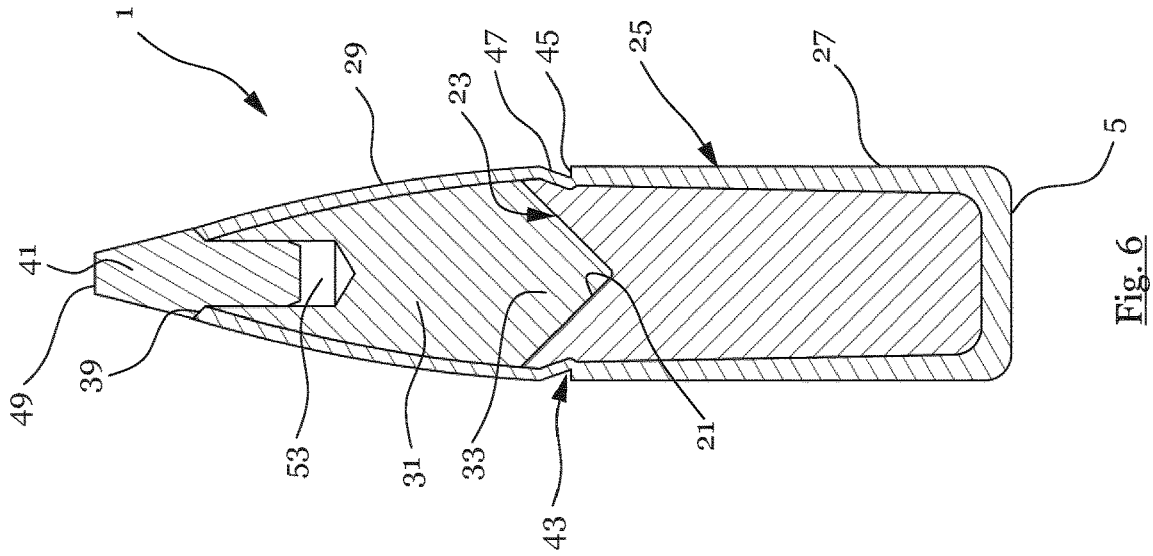

Fig. 6

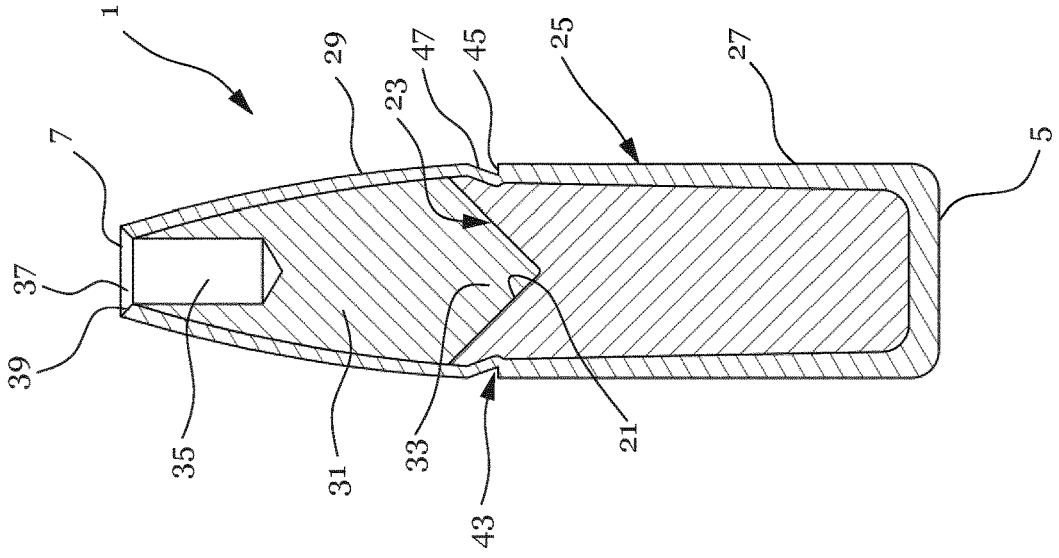

Fig. 5

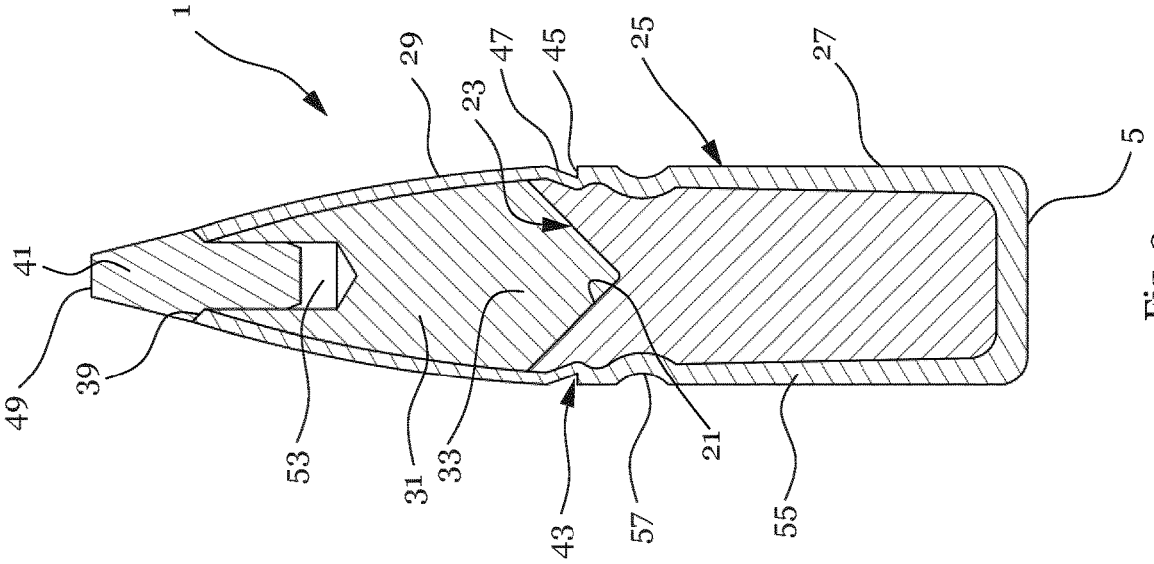
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Fig. 9

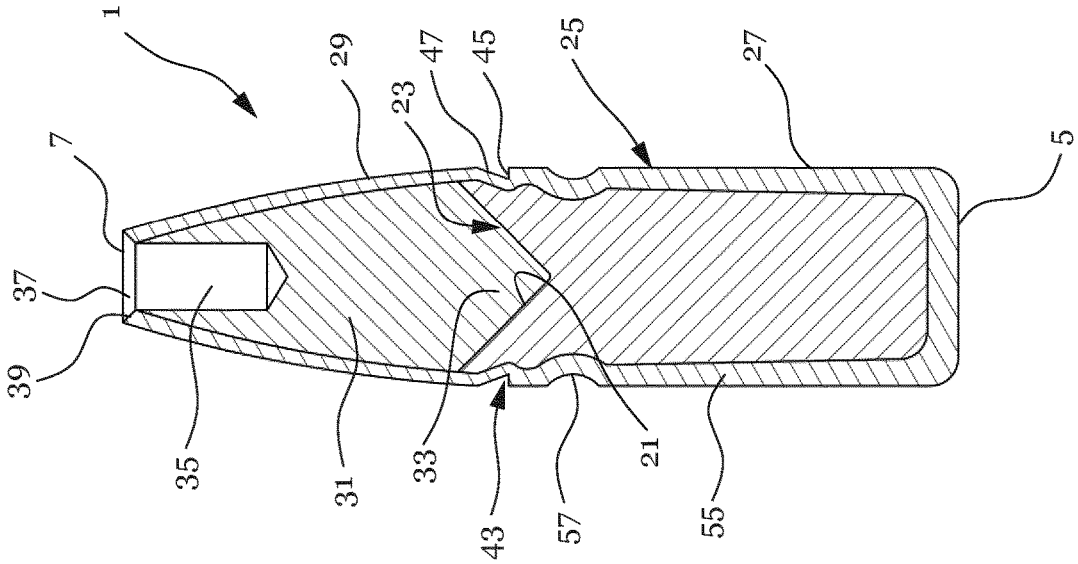
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Fig. 8

EXPANDING AND/OR PARTIALLY FRAGMENTING BULLET

[0001] The present invention refers to a deformation and/or partial fragmentation projectile. The invention further relates to a method of manufacturing a deformation and/or partial fragmentation projectile.

[0002] Projectiles are usually made of relatively soft lead encased in a harder material, such as copper or a copper alloy, such as tombac. The lead gives the projectile its high specific gravity, which is important for its ballistic performance. The projectile jacket protects the rifle barrel from lead and allows higher projectile velocities, since the harder outer layer allows the projectile to follow the rifling of the rifle barrel even at high velocities, which gives it its twist.

[0003] In the case of partial jacket projectiles or partial fragmentation projectiles, the core is not enclosed by jacket material on the projectile front side and is exposed. On impact with a target, the projectile tip deforms due to the high pressure on impact and on penetration of the target. For example, the projectile may deform mushroom-like (mushrooming) or at least partially deform. The projectile can thus deliver its energy to the target medium much more effectively than a full metal jacket projectile, in which the jacket completely surrounds the core, but has a lower penetration performance. Such projectiles are used in particular as hunting projectiles, since they are more reliable than full metal jacket projectiles in causing a quicker death of the shot game due to the effective energy release in the game body. Partial fragmentation projectiles are usually constructed such that that they fragment in a controlled manner except for a defined residual body. The suction effect of the residual body ensures that the fragments of the front, fragmented core section leave the target for the most part. Deformation projectiles mushroom on impact with the target and remain mass-stable. As a rule, deformation projectiles are designed to lose very little weight on the target. The effect is primarily achieved by the increase in cross-section of the uniformly mushrooming projectile and the constant weight.

[0004] For example, DE 10 2015 001 559 A1 discloses a lead-free partial fragmentation projectile. The projectile has a substantially hollow cylindrical jacket into which a two-part core is pressed. Any lead-free compressible materials are suggested as core materials, for example tin, zinc or granules. On such a partial fragmentation projectile, it has been found to be a disadvantage that the lead-free projectiles do not have the same performance as lead-containing projectiles. In particular, the tin material used tends to crack when the projectile hits the target, leaving no deformed residual body. Furthermore, the pressing of the core into the projectile jacket also does not fulfil the desired function, in particular the required permanently stable, firm connection of jacket and core. When the projectile hits its target, there is a risk that the compressed core will detach from the jacket, leaving no deformed residual body.

[0005] It is the object of the present invention to improve the disadvantages arising from the known prior art, in particular to improve a deformation and/or partial fragmentation projectile as well as a manufacturing process for a deformation and/or partial fragmentation projectile such that its deformation and/or fragmentation leaves a defined, deformed residual body upon impact with a target.

[0006] This task is solved by the features of claims **1**, **5** and **10**, respectively.

[0007] Thereafter, a deformation and/or partial fragmentation projectile, such as a hunting projectile, is provided. Partial fragmentation projectiles are generally designed to fragment in a controlled manner to a defined residual body upon impact of the projectile with a target. Deformation projectiles generally have inherent mass-stable, controlled deformation.

[0008] The deformation and/or partial fragmentation projectile comprises a jacket. The jacket may be realized as a rotationally symmetrical, in particular substantially cylindrical hollow body, which is designed to be open towards an end face. Suitable materials for the jacket are metals, in particular hard metals, such as copper, copper alloys, for example tombac. The jacket may, for example, have on its outer periphery a preferably circumferential tear-off edge that may, for example, be arranged approximately at the transition between the projectile front-sided ogive and the projectile rear. Upon impact of the projectile with a target, the tear-off edge may assist in causing the jacket to begin to deform and/or fragment in the region of the ogive to the tear-off edge. Further, it may be provided that the projectile front-sided ogive of the jacket is torn away from the rear upon impact of the projectile with a target, along the tear-off edge. The tear-off edge may, for example, be oriented substantially perpendicular to the longitudinal axis of the projectile and may further serve to determine the deformation and/or fragmentation behavior of the deformation and/or partial fragmentation projectile, in particular to delimit a deformation and/or fragmentation of the projectile.

[0009] The deformation and/or partial fragmentation projectile further comprises a two-part core arranged within the jacket, comprising a projectile front-side core part and a projectile rear-side core part. In particular, in a partial fragmentation projectile according to the invention, the projectile front-side core part is arranged in the jacket, or dimensioned such that a projectile front-side core tip of the projectile front-side core part protrudes from the jacket and/or is not surrounded by a jacket. Both the projectile rear-sided core part and the projectile front-sided core part may be fully circumferentially adjacent to an inner circumference of the jacket along their entire outer surface. Furthermore, the core parts may be arranged in the jacket such that the projectile rear-sided core part rests on a projectile rear-sided bottom of the jacket and/or that the projectile rear-side core part rests, in particular, on the projectile rear-sided core part over its entire surface. For example, a parting plane between the core part on the projectile rear side and the core part on the projectile front side is formed by a respective end face of the core parts, in particular a projectile front-sided end face of the core part on the projectile rear side and a projectile front-sided end face of the core part on the projectile front side. The parting plane between the projectile rear-sided core part and the projectile front-sided core part may be, for example, cone-shaped and oriented in the direction of the projectile rear, that is, formed from the inner circumference of the jacket cone-shaped in the direction of the projectile rear to a cone tip located, for example, on an axis of rotation of the jacket. It has been found that in generic deformation and/or partial fragmentation projectiles, the tear-off edge is to be provided in the region of the parting plane between the core parts. This means that an axial position of the tear-off edge on the projectile jacket may be coordinated with respect to the axial position or axial extension of the parting plane between the core parts, and

thus with a dimensioning of the core parts. For example, the tear-off edge is located between a beginning of the cone-shaped parting plane located at the inner circumference of the jacket and an end of the parting plane formed as a tip of the cone at the rear of the projectile. It has been found that such positioning of the tear-off edge with respect to the parting plane between the core parts results in reliable deformation and/or partial fragmentation upon impact of the projectile with a target.

[0010] In accordance with a first aspect of the present invention, the core is secured in the jacket such that the projectile rear-sided core part is more strongly secured to the jacket than the projectile front-sided core part. It has been found that by fastening the projectile front-sided core part in the jacket less strongly, reliable tear-off of the projectile front-sided core part, in particular the projectile front-sided core part and/or the ogive part of the jacket surrounding the projectile front-side core part, is ensured upon impact of the projectile with a target. The stronger attachment of the projectile rear-sided core part strengthens the connection or attachment of the projectile rear-sided core part to the jacket, thereby ensuring that the projectile rear-sided core part does not disengage from the jacket upon impact of the projectile with the target, thereby maintaining a defined projectile residual body which can realize effective energy dissipation in the target. Surprisingly, it has been shown that the measure according to the invention of more strongly fastening the projectile rear-sided core part in the jacket with respect to the projectile-front-side core part makes it possible to dispense with additional, in particular constructive, measures for increasing the connection between the projectile rear-sided core part and the jacket. For example, no circumferential retaining groove provided in the prior art is to be introduced at the jacket, which projects inwardly in relation to the rest of the jacket in the direction of the core part in order to retain the latter in a form-fitting manner. This also provides a more cost-effective and easier-to-implement manufacturing process for deformation and/or partial fragmentation projectiles.

[0011] According to an exemplary further embodiment of the present invention, the projectile front core part is attached to the jacket such that upon impact of the projectile with a target, the projectile front core part may detach from the jacket. Further, the projectile rear-sided core part may be attached to the jacket such that upon impact of the projectile with a target, the projectile rear-sided core part remains attached to the jacket. It has been found that for reliable deformation and/or partial fragmentation of generic projectiles, it may be necessary for the projectile front-sided core part to move substantially completely, optionally together with the jacket part surrounding the projectile front-side core part, from the remainder, in particular from the projectile rear-side jacket part and from the projectile rear-sided core part, in particular separates, while it may be advantageous for the projectile rear-sided core part and possibly the projectile rear-sided jacket part to remain attached to one another, in particular in order to form a defined remainder body.

[0012] In an exemplary further embodiment of the deformation and/or partial fragmentation projectile according to the invention, the projectile rear-sided core part is at least 5% more strongly attached to the jacket than the projectile front-sided core part. Preferably, the projectile rear-sided core part is at least 10%, 15%, 20%, 25% or at least 30% more strongly attached to the jacket than the projectile front-sided core part. In a further embodiment, it may be provided that the projectile rear-sided core part is at least 40%, 50%, 60%, 70%, 80%, 80% or at least 100% more strongly attached to the jacket.

[0013] According to an exemplary further embodiment of the present invention, the projectile rear-sided core part is made of lead. Alternatively, the projectile rear-sided core part may be made of tin, zinc, or alloys thereof. Further, the projectile front-sided core part may be made of lead and/or tin or alloys thereof. Zinc is conceivable as a further material. It has been found that lead is to be regarded as particularly advantageous with respect to the performance of the deformation and/or partial fragmentation projectiles according to the invention.

[0014] In accordance with another aspect of the present invention, combinable with the preceding aspects and exemplary embodiments, there is provided a deformation and/or partial fragmentation projectile, such as a hunting projectile. Partial fragmentation projectiles are generally designed to fragment in a controlled manner to a defined residual body upon impact of the projectile with a target. Deformation projectiles generally have inherent mass-stable, controlled deformation.

[0015] The deformation and/or partial fragmentation projectile comprises a jacket. The jacket may be realized as a rotationally symmetrical, in particular substantially cylindrical hollow body, which is designed to be open towards an end face. Suitable materials for the jacket are metals, in particular hard metals, such as copper, copper alloys, for example tombac. The jacket may, for example, have on its outer periphery a preferably circumferential tear-off edge which may, for example, be arranged approximately at the transition between the projectile front-sided ogive and the projectile rear. Upon impact of the projectile with a target, the tear-off edge may assist in causing the jacket to begin to deform and/or fragment in the region of the ogive to the tear-off edge. Further, it may be provided that the projectile front-sided ogive of the jacket is torn away from the rear upon impact of the projectile with a target, along the tear-off edge. The tear-off edge may, for example, be oriented substantially perpendicular to the longitudinal axis of the projectile and may further serve to determine the deformation and/or fragmentation behavior of the deformation and/or partial fragmentation projectile, in particular to delimit a deformation and/or fragmentation of the projectile.

[0016] The deformation and/or partial fragmentation projectile further comprises a two-part core arranged within and attached to the jacket, comprising a projectile front-side core part and a projectile rear-sided core part. In particular, in a partial fragmentation projectile according to the invention, the projectile front-side core part is arranged in the jacket, or dimensioned such that a projectile front-side core tip of the projectile front-side core part protrudes from the jacket and/or is not surrounded by a jacket. Both the projectile rear-sided core part and the projectile front-sided core part may be fully circumferentially adjacent to an inner circumference of the jacket along their entire outer surface. Furthermore, the core parts may be arranged in the jacket such that the projectile rear-sided core part rests on a projectile rear-sided bottom of the jacket and/or that the projectile rear-sided core part rests, in particular, on the projectile rear-sided core part over its entire surface. For example, a parting plane between the core part on the projectile rear side

and the core part on the projectile front side is formed by a respective end face of the core parts, in particular a projectile front side end face of the core part on the projectile rear side and a projectile front-sided end face of the core part on the projectile front side. The parting plane between the projectile rear-sided core part and the projectile front-sided core part may be, for example, cone-shaped and oriented in the direction of the projectile rear, that is, formed from the inner circumference of the jacket cone-shaped in the direction of the projectile rear to a cone tip located, for example, on an axis of rotation of the jacket. It has been found that in generic deformation and/or partial fragmentation projectiles, the tear-off edge is to be provided in the region of the parting plane between the core parts. This means that an axial position of the tear-off edge on the projectile jacket may be coordinated with respect to the axial position or axial extension of the parting plane between the core parts, and thus with a dimensioning of the core parts. For example, the tear-off edge is located between a beginning of the cone-shaped parting plane located at the inner circumference of the jacket and an end of the parting plane formed as a tip of the cone at the rear of the projectile. It has been found that such positioning of the tear-off edge with respect to the parting plane between the core parts results in reliable deformation and/or partial fragmentation upon impact of the projectile with a target.

[0017] According to the further aspect of the present invention, a connection technique for attaching the projectile front-sided core part to the jacket differs at least in sections from a connection technique for attaching the projectile rear side core part to the jacket. This means that the connection technique for attaching the core part to the jacket does not necessarily have to differ along the complete connection areas of the respective projectile core with respect to the projectile jacket. For example, the connection technique differs at least 30%, preferably at least 50%, 60%, 70%, 80%, 90%, or preferably 100%, with respect to a total core outer surface area available for connection to the jacket. In accordance with the present invention, it has been found that by employing different connection techniques, reliable operation of the deformation and/or partial fragmentation projectile is ensured. In particular, a controlled, defined deformation and/or partial fragmentation of the projectile is ensured, and in particular it is ensured that the different connection techniques react differently upon impact of the projectile on the target, in particular withstand. Connection techniques are generally described as the constructive methods of connecting individual components. The connection techniques can be divided, for example, into releasable connections and non-releasable connections, a connection being generally releasable if the connection can be released again without damaging the connected individual components, and being described as non-releasable if, when the individual components are removed from one another, i.e. when the connection between the individual components is released, this is accompanied by destruction of at least one of the individual components.

[0018] According to an exemplary further development of the present invention, the connection technique for fastening the projectile rear-sided core part to the jacket and the connection technique for fastening the projectile front-sided core part to the jacket are based, at least in sections, on different physical principles of action. The connection techniques can also be subdivided according to physical principles of action, namely into form-fit, force-fit and material-fit, or combinations thereof. A positive connection is generally defined as a connection in which at least two connection partners engage with each other. A non-positive connection is based on a normal force existing between the surfaces of the connecting partners to be connected. Material-locking connections are characterized by the fact that the connecting partners are held together by atomic or molecular forces. According to an exemplary further development of the deformation and/or partial fragmentation projectile according to the invention, the projectile rear-sided core part is attached to the jacket in a materially bonded manner, preferably soldered and/or welded and/or bonded to the jacket. In particular, the projectile rear-side core part forms a non-detachable connection with the jacket. Further, the projectile front-sided core part may be positively and/or non-positively attached to the jacket. In particular, securing the projectile rear core part to the jacket in a form-fit and/or force-fit manner ensures that the projectile rear core part remains adhered to the jacket after impact of the projectile with the target and/or securing the projectile front core part to the jacket in a form-fit and/or force-fit manner ensures that upon impact of the projectile with the target, the projectile front core part may become detached from the jacket and/or the projectile front core part may become detached from the jacket upon impact of the projectile with the target. The projectile front-sided ogive part of the jacket can detach from the projectile front-side core part, in particular after tearing along the tear-off edge.

[0019] In another exemplary embodiment of the present invention, the projectile rear-sided core part is attached to the jacket by means of fusion brazing or diffusion brazing. Diffusion brazing or fusion brazing are thermal processes for joining metal joint partners by material bonding. Diffusion brazing involves diffusion, i.e. mixing, at the interfaces to be attached to each other between the projectile jacket and the projectile core, and fusion brazing involves generating the brazed joint by melting a brazing alloy. For the purposes of the present invention, the fusion soldering or diffusion soldering processes have proven to be particularly advantageous in terms of precision and functional reliability.

[0020] In a further exemplary embodiment of the present invention, an outer circumferential surface of the projectile rear-sided core part facing the jacket is joined to a jacket inner surface in a material-locking manner, preferably soldered and/or welded and/or bonded. According to an exemplary further development, more than 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% or preferably 100% of a total outer circumferential surface of the projectile rear-sided core part is materially joined to the inner surface of the jacket. It should be understood that by increasing the areas of the projectile rear side core part and the jacket to be joined to each other in an integral manner, a reinforcement of the joint existing between the projectile rear side core part and the jacket is achieved. According to the present invention, this can be varied or adjusted depending on the respective field of application of the deformation and/or partial fragmentation projectile according to the invention or depending on the materials used.

[0021] In an exemplary embodiment of the present invention, the projectile front-sided core part is frictionally attached to the jacket. This is particularly easy to manufacture. For example, the projectile front-side core part is pressed into the jacket and/or clamped in the jacket. In this

regard, it may be provided that the projectile front-sided core part is secured to the jacket forming an interference fit therewith. Furthermore, a radial interference between the projectile front-side core part and the jacket may preferably be provided in the range of 0.001 mm to 0.01 mm.

[0022] In accordance with another aspect of the present invention, combinable with the preceding aspects and exemplary embodiments, a deformation and/or partial fragmentation projectile is provided, such as a hunting projectile. Partial fragmentation projectiles are generally designed to fragment in a controlled manner to a defined residual body upon impact of the projectile with a target. Deformation projectiles generally have inherent mass-stable, controlled deformation.

[0023] The deformation and/or partial fragmentation projectile comprises a jacket. The jacket may be realized as a rotationally symmetrical, in particular substantially cylindrical hollow body, which is designed to be open towards an end face. Suitable materials for the jacket are metals, in particular hard metals, such as copper, copper alloys, for example tombac. The jacket may, for example, have on its outer periphery a preferably circumferential tear-off edge which may, for example, be arranged approximately at the transition between the projectile front-sided ogive and the rear of the projectile. Upon impact of the projectile with a target, the tear-off edge may assist in causing the jacket to begin to deform and/or fragment in the region of the ogive to the tear-off edge. Further, it may be provided that the projectile front-sided ogive of the jacket is torn away from the rear upon impact of the projectile with a target, along the tear-off edge. The tear-off edge may, for example, be oriented substantially perpendicular to the longitudinal axis of the projectile and may further serve to determine the deformation and/or fragmentation behavior of the deformation and/or partial fragmentation projectile, in particular to delimit a deformation and/or fragmentation of the projectile.

[0024] The deformation and/or partial fragmentation projectile further comprises a two-part core arranged within the jacket, comprising a projectile front-side core part and a projectile rear-sided core part. In particular, in a partial fragmentation projectile according to the invention, the projectile front-side core part is arranged within the jacket, or dimensioned such that a projectile front-side core tip of the projectile front-side core part protrudes from the jacket and/or is not surrounded by a jacket. Both the projectile rear-sided core part and the projectile front-sided core part may be fully circumferentially adjacent to an inner circumference of the jacket along their entire outer surface. Furthermore, the core parts may be arranged in the jacket such that the projectile-rear-sided core part rests on a projectile rear-sided bottom of the jacket and/or that the projectile-rear-side core part rests, in particular, on the projectile rear-sided core part over its entire surface. For example, a parting plane between the core part on the projectile rear side and the core part on the projectile front side is formed by a respective end face of the core parts, in particular a projectile front side end face of the core part on the projectile rear side and a projectile front side end face of the core part on the projectile front side. The parting plane between the projectile rear-sided core part and the projectile front-sided core part may be, for example, cone-shaped and oriented in the direction of the projectile rear, that is, formed from the inner circumference of the jacket cone-shaped in the direction of the projectile rear to a cone tip located, for example, on an axis of rotation of the jacket. It has been found that in generic deformation and/or partial fragmentation projectiles, the tear-off edge is to be provided in the region of the parting plane between the core parts. This means that an axial position of the tear-off edge on the projectile jacket may be coordinated with respect to the axial position or axial extension of the parting plane between the core parts, and thus with a dimensioning of the core parts. For example, the tear-off edge is located between a beginning of the cone-shaped parting plane located at the inner circumference of the jacket and an end of the parting plane formed as a tip of the cone at the rear of the projectile. It has been found that such positioning of the tear-off edge with respect to the parting plane between the core parts results in reliable deformation and/or partial fragmentation upon impact of the projectile with a target. For example, the two-part core may be made of lead and/or tin and/or zinc and/or alloys thereof.

[0025] According to the further aspect of the present invention, a projectile rear-sided core part is soldered to the adjacent jacket and a projectile front-sided core part is substantially unsoldered with respect to the surrounding jacket, in particular with respect to the ogive part, preferably press-fitted. According to the invention, the function of the deformation and/or partial fragmentation projectile is thereby ensured, in particular a reliable deformation and/or fragmentation is achieved upon impact of the projectile on the target. In particular, after impact of the projectile on the target and/or after deformation and/or fragmentation of the projectile, the projectile-rear-sided core part remains adhered to the projectile-rear-sided jacket part surrounding it.

[0026] According to a further aspect of the present invention, which is combinable with the preceding aspects and exemplary embodiments, there is provided a method for producing a deformation and/or partial fragmentation projectile according to the invention. The method according to the present invention is adapted to realize the deformation and/or partial fragmentation projectile according to the present invention according to any of the preceding aspects and/or exemplary embodiments.

[0027] Preferred embodiments are given in the subclaims.

[0028] In the following, further properties, features and advantages of the invention will become clear by means of a description of preferred embodiments of the invention with reference to the accompanying exemplary drawings, which show:

[0029] FIG. **1** a perspective view of a blank of a jacket of a deformation and/or partial fragmentation projectile according to the invention;

[0030] FIG. **2** a sectional view of the jacket according to FIG. **1**;

[0031] FIG. **3** a further perspective view of a jacket of a deformation and/or partial fragmentation projectile according to the invention, according to a downstream processing and/or manufacturing step;

[0032] FIG. **4** a sectional view of the jacket according to FIG. **3**;

[0033] FIG. **5** a sectional view of a deformation and/or partial fragmentation projectile according to the invention;

[0034] FIG. **6** a sectional view of a further deformation and/or partial fragmentation projectile according to the invention;

[0035] FIG. **7** a perspective view of the deformation and/or partial fragmentation projectile according to FIG. **6**;

[0036] FIG. **8** a sectional view of a further embodiment of a deformation and/or partial fragmentation projectile according to the invention; and

[0037] FIG. **9** a sectional view of a further exemplary embodiment of a deformation and/or partial fragmentation projectile according to the invention.

[0038] In the following description of exemplary embodiments of deformation and/or partial fragmentation projectiles according to the invention, a deformation and/or partial fragmentation projectile is generally provided with the reference numeral **1**. In the course of describing the exemplary embodiments of deformation and/or partial fragmentation projectiles **1** according to the invention, the method of manufacturing a deformation and/or partial fragmentation projectile **1** according to the invention is also described schematically.

[0039] With reference to FIGS. **1** to **4**, various manufacturing states of a jacket blank provided with reference numeral **3** for a deformation and/or partial fragmentation projectile **1** according to the invention are shown. With reference to FIGS. **5** to **9**, exemplary embodiments of deformation and/or partial fragmentation projectiles **1** according to the invention are illustrated.

[0040] FIGS. **1** and **2** show a rotationally symmetrical, preferably substantially cylindrical, jacket blank **3**. The jacket blank **3** has a bottom **5** at an end face and is open towards the other end face **7**. Between the end faces **5**, **7**, the jacket blank **3** has a substantially constant wall thickness which, however, decreases slightly from the bottom **5** towards the end face **7**, preferably continuously. In FIG. **1**, the wall thickness as well as a projectile core **9** arranged within the jacket blank **3** is indicated by dashed lines, the wall thickness course and the core part **9** incorporated in the jacket blank **3**, which is made for example of lead or also of tin or zinc or alloys thereof, being illustrated. The core part **9**, which rests on the bottom **5** and forms the projectile rear-sided core part in the deformation and/or partial fragmentation projectile **1** according to the invention described further below, is introduced into the jacket blank **3** by means of a thermal joining process and is fixed to an inner circumference **11** of the jacket blank **3** at least in sections. For example, the core part **9** may be attached to the jacket blank **3** as follows: a flux, i.e. an additive used in soldering for better wetting of the jacket blank **3** by the solder, is injected into the jacket and then the metal material, for example lead, to form the core part **9** is introduced into the metal blank **3**. Then, the core part **9** is caused to melt, for example by means of an induction coil, whereby the core part material **9** adheres to the jacket blank **3** in a material-locking manner. This is assisted by the flux in that the flux etches the jacket blank **3** on the inner circumferential surface **11** prior to melting of the core part material **9**. As a result, a distinct, strong intermetallic bond can be formed between the core part material **9** and the jacket blank **3**. In FIGS. **1** and **2**, it can also be seen that a cone preform **15** is formed at an end part **13** of the core part **9** facing away in the bottom **5** as a result of the method of attaching the core part **9** to the jacket blank **3** according to the invention. In particular, the cone preform **15** is formed by heating the molten core part material **9** such that that the latter starts to boil and thus expands, in particular boils up. When the core part material **9** is cooled to form the integral connections between the core part **9** and the jacket blank **3**, the liquid core part material **9** slides back down and into the jacket interior only to a limited extent, since integral connections have already been formed between the jacket inner circumference **11** and the outer circumference of the projectile core end section **13**. In particular, the volume of the liquefied and solidifying core part material **9** shrinks so that the core part material **9** increasingly pulls towards the jacket circumference **11** to form the cone preform **15**. In this regard, it can be seen that the surface of the cone preform **15** is irregular, in particular corrugated and/or textured, that is, has irregular protrusions **17** and recesses **19**.

[0041] Referring again to FIGS. **3** and **4**, the metal blank **3** is shown according to FIGS. **1** to **2**. With reference to FIGS. **3** and **4**, it can be seen that the metal blank **3** is in a downstream machining/manufacturing state with respect to FIGS. **1** to **2**. Referring in particular to FIG. **4**, it can be seen that the end part **13**, in particular the cone preform **15** with the protrusions **17** and recesses **19**, has been machined. For example, by means of a forming step, such as a cold forming step, the irregular cone preform **15** has been further machined into a regular cone recess **23** having a substantially flat surface **21**. The substantially V-shaped or cone-shaped recess **23** has a smaller axial dimension compared to the cone preform **15** shown in FIG. **2**, and an opening angle of the surface **21** forming the cone is larger than that shown in FIG. **2**.

[0042] FIGS. **5** to **9** illustrate exemplary embodiments of the deformation and/or partial fragmentation projectiles **1** according to the invention. In the present description of the exemplary embodiments, reference will essentially be made to the differences existing between the embodiments in order to avoid repetition. In this regard, identical or similar components are provided with identical or similar reference numerals. Referring to FIG. **5**, the projectile jacket **25** is formed from the jacket blank **3** and has a projectile rear jacket **27** adjoining the bottom **5** and a projectile front section **29** adjoining the projectile rear jacket **27** and formed as an ogive. Firstly, the manufacturing process will again be discussed: a further core part **31** is introduced into the jacket blank **3** with the projectile rear-side core part **9** preformed, and is brought into contact with the core part **9** over substantially its entire surface, which now forms the projectile core-sided core part. Thereby, the projectile front-side core part **31** is adapted to a shape of the projectile rear-sided core part **9**. In particular, the projectile front-side core part **31** has a substantially V-shaped or cone-shaped tip **33** which is shape-matched with respect to the cone recess **23** so as to form, in particular, full-surface contact with the surface **21** of the cone recess **23**. Subsequently, the projectile front jacket **29** is deformed under temperature treatment, i.e. compressed inwardly, in particular in the region of the front face **7**, so that the projectile front jacket **29** increasingly tapers in the direction of the front face **7** to form the ogive. During the deformation of the projectile front jacket **29**, a preferably cylindrical and sharpened mandrel (not shown) is inserted into the projectile front-sided core part **31** from the front side **7**, so that according to the final shape of the projectile jacket **25** shown in FIG. **5**, the projectile front-sided core part **31** has a substantially blind hole-like recess **35**. In this respect, the blind hole-like recess **35** has an internal diameter corresponding to that of the opening **37** remaining on the front face **7**. Furthermore, it may be provided that the opening **37** is delimited by a circumferential, bevelled and annular jacket end face **39**, which serves

in particular for supporting a further core part illustrated with reference to FIGS. **6** to **7**, in particular a projectile core tip **41**.

[0043] A preferably circumferential tear-off edge **43** is arranged, on the one hand, in the region of the cone recess **23** or of the cone tip **33** and, on the other hand, in the region of the transition between the projectile rear jacket **27** and the projectile front jacket **29**. In particular, the tear-off edge **43** is located in an axial region in which the cone recess **23** extends. It has been found that in doing so, the functionality of the partial fragmentation and/or deformation projectiles **1**, in particular the controlled deformation and/or fragmentation, of the projectiles **1** according to the invention is ensured. For example, a tapered deformation of the ogive-shaped projectile front part **29** starts from the break-off edge **43**, with the projectile front-side core part **31** being substantially unsoldered into the jacket **25**. For example, the projectile front-side core part **31** may be press-fitted into the jacket **25** and/or attached to the jacket **25** by positive and/or frictional connection techniques. According to FIG. **5**, the tear-off edge **43** has an inwardly recessed shoulder **45** and an adjoining chamfer **47**, which in turn merges into the ogive-shaped projectile front section **29**.

[0044] In FIG. **7**, the projectile core tip **41** can be seen at least partially, in particular the part protruding from the jacket **25**. The projectile core tip **41** is flattened at its front surface **49**. With reference to FIG. **6**, it can be seen that the projectile core tip **41**, made for example of the same material as the projectile rear-sided core part **9** and/or the projectile front-sided core part **31**, has a circumferential support surface **51** oriented at an angle with respect to a longitudinal axis of the projectile **1**, which is shape-matched with respect to the jacket end face **39**, in particular in order to rest fully and/or evenly. In the recess **35**, the projectile core tip **41** may be introduced or the projectile core tip **41** may be dimensioned with respect to a dimension of the recess **35** such that as to result in a cavity **53** which is not occupied by the projectile core tip **41**.

[0045] With reference to FIGS. **8** and **9**, two further exemplary embodiments of a deformation and/or partial fragmentation projectile **1** according to the invention are illustrated, FIG. **8** substantially corresponding to the embodiment according to FIG. **5** and FIG. **9** substantially corresponding to the embodiment according to FIG. **6**. Therefore, only the differences with respect to the embodiments will be discussed below. In FIGS. **8** and **9**, a groove **57**, which is preferably circumferential and curved in cross-section, in particular part-circular or semicircular, is provided on an outer circumference **55**, which groove may also be referred to as a retaining groove, and serves to retain the projectile-rear core part **9** with respect to the projectile jacket **25**. As has already been explained, according to the invention, the additional retaining groove **57** and thus also the corresponding additional manufacturing step for introducing the retaining groove **57** into the projectile jacket **25** can be dispensed with without having to accept any losses in terms of the controlled and/or defined deformation and/or fragmentation of the deformation and/or partial fragmentation projectiles **1** according to the invention. However, the retaining groove **57** may also prove advantageous with respect to handling, for example during manufacture and/or transport of the deformation and/or partial fragmentation projectiles **1** according to the invention. Furthermore, the retaining groove **57** may also provide an additional fixation of the projectile rear core part **9** into the projectile jacket **25** and thus serve as a kind of securing device. The embodiment according to FIG. **9** can essentially be regarded as a combination of the embodiment according to FIGS. **6** and **8**, namely with respect to the additionally introduced retaining groove **57** and the inserted projectile core tip **41**.

[0046] The features disclosed in the foregoing description, figures and claims may be significant, both individually and in any combination, for the realization of the invention in the various embodiments.

LIST OF REFERENCE SIGNS

[0047] **1** deformation and/or partial fragmentation projectile
[0048] **3** jacket blank
[0049] **5** bottom
[0050] **7** front side
[0051] **9** core part
[0052] **11** inner circumferential surface
[0053] **13** end section
[0054] **15** cone preform
[0055] **17** protrusion
[0056] **19** recess
[0057] **21** cone surface
[0058] **23** cone recess
[0059] **25** jacket
[0060] **27** projectile rear jacket
[0061] **29** projectile front jacket
[0062] **31** projectile front-sided core part
[0063] **33** cone tip
[0064] **35** recess
[0065] **37** opening
[0066] **39** jacket end face
[0067] **41** projectile core tip
[0068] **43** tear-off edge
[0069] **45** shoulder
[0070] **47** chamfer
[0071] **49** front face
[0072] **51** support surface
[0073] **53** cavity
[0074] **55** Outer circumference
[0075] **57** groove

1. A deformation and/or partial fragmentation projectile comprising a jacket and a two-part core arranged inside the jacket and having a projectile front-sided core part and a projectile rear-sided core part, wherein the core is fastened to the jacket such that that the projectile rear-sided core part is fastened more strongly to the jacket than the projectile front-sided core part.

2. The deformation and/or partial fragmentation projectile according to claim **1**, wherein the projectile front-sided core part is attached to the jacket such that that upon impact of the projectile with a target, the projectile front-sided core part can detach from the jacket, and/or the rear core part is secured to the jacket such that upon impact of the projectile with a target, the rear core part remains secured to the jacket.

3. Deformation and/or partial fragmentation projectile according to claim **1**, wherein the projectile rear core part is at least 5% stronger, preferably at least 10%, 15%, 20%, 25% or at least 30% stronger, attached to the jacket than the projectile front core part.

4. Deformation and/or partial fragmentation projectile according to claim **1**, wherein the projectile rear-sided core

part is/are made of lead and/or the projectile front-sided core part is/are made of lead and/or tin.

5. Deformation and/or partial fragmentation projectile, in particular according to claim **1**, comprising a jacket and a two-part core arranged inside the jacket and fastened thereto, with a projectile front-sided core part and a projectile rear-sided core part, wherein a connection technique for attaching the projectile front-sided core part to the jacket differs at least in sections from a connection technique for attaching the projectile rear-sided core part to the jacket.

6. Deformation and/or partial dismantling projectile according to claim **5**, wherein the connection technology for fastening the projectile front-sided core part and the connection technology for fastening the projectile rear-sided core part to the jacket are based, at least in sections, on different physical principles of action, wherein in particular the core part at the rear of the projectile is fastened to the jacket by a material fit, preferably soldered and/or welded and/or glued to the jacket, and/or the projectile front-sided core part is fastened to the jacket by a form fit and/or force fit.

7. Deformation and/or partial fragmentation projectile according to claim **5**, wherein the projectile rear-sided core part is attached to the jacket by means of fusion brazing or diffusion brazing.

8. Deformation and/or partial fragmentation projectile according to claim **5**, wherein an outer circumferential surface of the projectile rear-sided core part facing the jacket is joined, in particular to more than 5%, preferably to 100% of a total outer circumferential surface of the projectile rear-sided core part, to a jacket inner surface by material bonding, preferably by brazing.

9. A deformation and/or partial fragmentation projectile according to claim **5**, wherein the projectile front-side core part is frictionally secured to the jacket, in particular is pressed into the jacket and/or is clamped in the jacket, and/or is secured to the jacket with the formation of an interference fit, wherein in particular a radial interference between projectile front-side core part and jacket is in the range from 0.001 mm to 0.01 mm.

10. A deformation and/or partial fragmentation projectile, in particular a hunting projectile, in particular according to claim **1**, comprising a jacket and a two-part core arranged inside the jacket, preferably made of lead and/or tin, wherein a projectile rear-sided core part is soldered to the adjacent jacket and a projectile front-sided core part is substantially unsoldered, preferably pressed in, with respect to the surrounding jacket.

11. A method of manufacturing a deformation and/or partial fragmentation projectile formed according to claim **1**.

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