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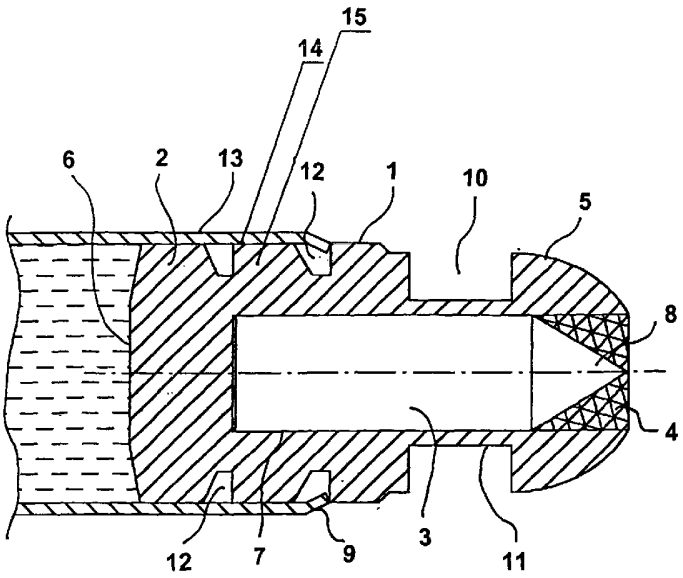

(57) Abstract: The cartridge consists of a shell (13) with powder filling (16) and a bullet (1), where the bullet (1) comprises a body (2) having a rear base (6) and peripheral walls, in the axis of which is fixed a piercing core (3). The body (2) of the bullet (1) is adapted for controlled detachment, in the area of weakening of its peripheral wall, of at least one of its forward portion (5) and a rear portion (17) of greater diameter, corresponding to the calibre of the gun, for stabilising and guiding the bullet (1) in the gun barrel. The piercing core (3) is lodged with radial allowance in the body (2), in the opening (19) on the fron side. Between the forward portion (59) and the rear portion (17) of the bullet (1), the body (2) has a deforming wall (10) with reduced thickness, so that the area where it meets the shouldered rear portion (17) forms the ripper zone of the front portion of the body (2), while the piercing core (3) comes to point at its front end (8) and the hollow between this front end of the core (3) and the adjacent part of the inner wall of the opening (19) of the body (2) is filled with a malleable plug (4) whose outer surface forms at least the greater part of the impacting surface (20) of the bullet (1). The subject of the invention also involves a method of preparing at least one radial incision in the body (2) of the bullet (1) of the cartridge, during which the rear portion (17) of the body (2) is formed with a greater outer diameter with at least one radial incision (12) of trapezoidal section with symmetrical sides. The body (2) is then extruded, through a stepwise narrowing opening in a calibrating member, to the required lower calibre, by which the material of the body (2) in the area of the radial incision (12) becomes non-homogeneous and deforms so that the front side of the radial incision (12) in the direction of the extrusion straightens until it is at right angles to the axis fo the body (2), with a simultaneous increase in the density of the material in this area, and its rear side opens up still more, with a simultaneous decrease in the density of the material in this area.

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PIERCING BULLET AND METHOD FOR MANUFACTURING THEREOF

Field of the invention

The invention concerns the arrangement of a cartridge with piercing bullet with increased effectiveness in penetrating bullet-proof vests and other ballistic shields, particularly hard barriers such as armoured transport means, special glass etc.

Description of the prior art

Expanding bullets are known for pistols, rifles, shotguns and the like, in which the body or jacket of the bullet mushrooms open to a greater diameter on striking a barrier, thus causing a greater effect upon that barrier. This effect is to a considerable degree influenced by the velocity of the bullet and the resistance of the barrier to the impact of the bullet. The front portions of the bullet, for attainment of controlled expansion, are arranged by appropriate methods so that opening of the body of the bullet on impact with the barrier occurs more forcibly and at lower velocities. The bodies of the bullets can be furnished beforehand with outer transverse or longitudinal peripheral incisions (PCT Application WO 00/79211, US Patent 6,148,731, CZ Patent 289,744) or with inner longitudinal incisions (US Patent 3,881,421) which facilitate controlled opening of the body of the bullet; for this purpose caps are also used with peripheral projections which are forced backwards, on impact, into the opening in the bullet (US Patent 4,685,397, PCT Application WO 00/79211) and the body of the bullet is ruptured internally by their projections. In the aforementioned PCT application WO 0079211 a bullet is specifically described showing controlled expansion, where an opening is drilled from the front into the body, in which there is firmly lodged a core made of a harder and more solid material, for example steel. The solution is intended for hunting rifles, and therefore for soft targets. The core is released from the bullet after opening of its body. The purpose is to facilitate controlled opening of the body of the bullet on striking the target so that the body does not fragment into more pieces, its enlarged front surface delivers the essential part of its energy to the target which, however, remains intact and undamaged as a target (game). In the given case this is achieved both by outer radial grooves and by inner longitudinal grooves. In none of these solutions was the purpose to penetrate a hard material in a barrier, nor was it a question of unfavourable impact angles.

Summary of the invention

The said purpose is achieved by the solution according to the invention submitted, by employing several of the already known features mentioned above, but in a new combination with additional features. The solution involves a cartridge consisting of a shell with powder filling and a bullet, where the bullet comprises a body having a rear base and peripheral walls, in the axis of which is fixed a piercing core. The basis of the invention lies in the fact that the body is adapted for controlled

detachment, in the area of weakening of its peripheral wall, of at least one of its forward portions after the bullet impacts with the barrier.

Upon impact of the bullet with a hard barrier, for example a steel plate or a glass or ceramic sheet, the piercing core of the bullet breaks into the barrier and at the same time there is an abrupt opening of the peripheral wall of the front portion of the body of the bullet, which rips off in the area of its weakening uncovering the piercing core and, due to the inertial mass of the rear portion of the body, its further penetration into the hard barrier is significantly increased. Thus only the hard, sharp core of the bullet breaks into the barrier.

The body of the bullet comprises a guiding forward portion and a rear portion of greater diameter for stabilising and guiding the bullet in the barrel. The diameter of the rear portion corresponds to the calibre of the gun. The piercing core is lodged with radial allowance in the body, in the opening on the front side. Between the forward portion and the rear portion of the bullet, the body has a deforming wall with reduced thickness, so that the area where it meets the shouldered rear portion forms the ripper zone of the front portion of the body. The piercing core comes to a point at its front end and the hollow between this front end of the core and the adjacent part of the inner wall of the opening of the body is filled with a malleable plug whose outer surface forms at least the greater part of the impacting surface of the bullet.

Upon impact of the bullet with a hard barrier, the soft material of the plug permits the instant fixation of the bullet to the barrier in the place of contact, without the angle of impact of the bullet changing. The sharp point digs into the barrier, thus preventing its glancing off, ricocheting or rupturing. As soon as the point penetrates the barrier, the material of the plug is displaced along the conical surface of the point of the piercing core, the weakened deforming wall of the body of the bullet bulges outwards and then the whole forward portion of the body of the bullet breaks off and disintegrates. Its broken-off fragments scatter in all directions along the surface of the hard barrier, but the person firing is not struck or endangered by this disintegration, even when firing at close range. Only the sharp hard core of the bullet penetrates the hard material of the barrier, partly by its own inertia and partly by the inertia of the rear portion of the bullet which increases the penetration of the core. The piercing core is made of a material with a high degree of strength, hardness and mass, for example steel, tungsten or sintered metal carbides.

The deforming wall can be formed by the base of a rectangular groove, arranged radially in the body of the bullet, while the rear side wall of this groove, which is at the same time the forward surface of the shouldered rear portion, forms the first impacting surface. The length and depth of the rectangular groove are dictated by the type and strength of the material used in the body of the bullet to ensure its

manipulating solidity, so that this weakened part of the body is not deformed as the bullet is pushed into the shell and in normal manipulation of the cartridge. After detachment of the whole front portion of the body of the bullet upon impact with the hard barrier and its disintegration, the rear side wall of the rectangular groove forms the first impact surface of the body of the bullet with the barrier.

The front portion of the body of the bullet in the direction of the exit from the opening preferably narrows down in a rounded shape so that the impact surface of the bullet forms a malleable plug, while the conical front end of the core of the bullet runs into this impact surface with its point. The rounded front portion serves to guide the cartridge from the magazine into the cartridge chamber of the gun. The malleable plug, made of lead or plastic for example, reduces the dynamic deformational strength of the forward portion of the body of the bullet. After impact with the hard barrier it behaves like a fluid in a closed space permitting, as already mentioned, the instant fixation of the bullet to the barrier at the point of contact and subsequently causing the outward bulging of the weakened body of the bullet and the breaking off of the forward portion of the body of the bullet in the area of the rear side wall of the base of the rectangular groove, which at the same time forms the front surface of the shouldered rear portion.

The body of the bullet can be advantageously adapted for gradual detachment of at least one of its other parts in the direction from the front wall of the bullet, in the area of a radial incision in the peripheral wall of the rear portion. The body can have at least one radial incision on the outer periphery of its rear portion.

In an alternative embodiment the body can have at least one spiral-shaped incision on the outer periphery of its rear portion, or evenly arranged spaced-out axial incisions.

In a further embodiment two radial incisions of trapezoidal section can be arranged at a distance from each other in the rear portion of the body of the bullet in the direction of the axis of the narrowed section, the forward wall of each of the incisions being at right angles to the axis of the bullet, while their rear walls are part of the second and third impact surfaces respectively.
At the moment when the core of the bullet penetrates the hard barrier so deeply that the rear portion of the body of the bullet touches the barrier, the controlled swift disintegration occurs of the individual parts of the body, separated from each other by radial incisions, which easily separate from the remainder of the body of the bullet and in such a way that the remaining portion of the body is always lined up on its front portion (in the direction of the movement of the bullet) in the course of its disintegration. This facilitates the further gradual controlled disintegration of the body of the bullet, thus avoiding unnecessary loss of energy during penetration of the core into the hard material of the barrier. The outer diameter of the hole of the shot-through material of the barrier, which is basically

cylindrical in shape, always corresponds to the outer diameter of the fired core. On the front side of the shot-through barrier an impression is formed by the controlled disintegration of the body of the bullet. In a barrier made of soft material, for example soft steel, the impression is greater, in hard material (for example steel sheets used for armoured vehicles, walls and the like) it is almost imperceptible. Upon impact with a hard barrier the piercing bullet immediately behaves like an under-calibered bullet, since only the core and not the body of the bullet breaks into the barrier, with greater firing energy.

The base of the body of the bullet closes with its surface the inner space in the shell, which is preferably filled with a compressed powder filling. This makes it possible for the piercing bullet to have a high initial velocity, which is achieved by the low mass of the bullet in combination with the special preparation and filling of the shell with powdered fill. First of all a determined quantity of powder is put into the shell or into the jig and is compressed with a determined pressure (a pill is formed having the internal dimensions of the shell). Alternatively, a previously compressed powder pill, whose dimensions correspond to the shape of the shell, can be inserted into the shell. By this technique the cartridge is supplied with a large amount of energy which is released, after ignition by a fuse, during the whole period of passage of the bullet through the gun barrel, without dangerously exceeding the maximum permitted pressure in the cartridge. Quite a different curve thus arises in the course of combustion of the powdered fill and a basically longer duration of the pressure needed during the whole period of acceleration of the bullet in the gun barrel. The pressure at the mouth is thereby increased compared to normal ammunition, for example in the 9 mm LUGER cartridge (the most frequently used gun for police and special army units) there is a twofold increase. In short pistol cartridges this velocity and energy, which is almost three times greater than in normal ammunition, cannot be created without compression of powder. Moreover this method of preparation and filling of the cartridge ensures, with a light bullet for example 2.9 grams in weight, normal functioning of guns (pistols and automatic weapons) that is repeating, automatic loading etc.

A further basic feature of the invention is the method of preparing at least one radial incision in the body of the bullet of the cartridge according to any of the embodiments mentioned, during which the rear portion of the body is formed with a greater outer diameter with at least one radial incision of trapezoidal section with symmetrical sides, and subsequently the body is extruded, through a stepwise narrowing opening in a calibrating member, to the required lower calibre, by which the material of the body in the area of the radial incision becomes non-homogeneous and deforms so that the front side of the radial incision in the direction of the extrusion straightens until it is at right angles to the axis of the body, with a simultaneous increase in the density of the material in this area, and its rear side opens up still more, with a simultaneous decrease in the density of the material in this area. This arrangement allows for controlled and gradual deformation of the rear portion of the body of the bullet after impact

with the barrier. The effect of this non-homogeneous material of the body of the bullet is the reduction of the dynamic strength of the body of the bullet, at least on one impact surface, which after detachment has the shape of a truncated cone, narrowing in the direction of the front portion of the bullet. Thus the body of the bullet does not penetrate the material of the barrier.

A further advantage of the cartridge with the bullet according to this invention is that the type of cartridge can be immediately identified and distinguished from ordinary ammunition by the outer shape of the bullet, and by feel alone under unfavourable visual conditions, for example at night.

Brief description of the drawings

The invention will be more clearly explained in the examples by means of the attached drawings and the subsequent detailed description. Fig. 1 is a schematic representation in longitudinal section of an example of the configuration of the body of the bullet with radial outer incisions and inserted hard core. In Fig. 2 there is a photo of one of the possible embodiments of the piercing bullet, where not only the outer shape and configuration of the bullet, whose body is made of brass, are visible but also the shaped lead plug on the front surface of the bullet. Fig. 3 shows a similar embodiment of the bullet as in Fig. 2, the body of the bullet in this case being made of a light metal alloy, with the possibility of colour differentiation which assists in the determination and identification of the origin. Fig. 4 shows the bullet after hitting the target. Fig. 4A involves a soft material, for example a living organism, a soft mass such as clay etc; B involves a target made of a harder material, for example wood or plywood; C is a soft metal, for example class 11321 steel and D is a hard metal, ceramic or glass. The gradual controlled deformation of the body of the bullet can be seen, depending upon the hardness of the targeted barrier. The body of the bullet goes through the target matter only in the cases of A and B; in the case of C and D it glances off the barrier and only the piercing core penetrates, the remainder of the body of the bullet being broken up into fragments, which are shown in Fig. 5. Fig. 6 shows a side view of glued multi-layer glass, for example of the kind used for protection of bank operations, in the given case 30 mm thick. In Fig. 7 the glass shown in Fig. 6 has been shot through by the piercing bullet according to this invention. Fig. 8 shows a bullet hole in hard material, in this case a steel sheet of the HARDOX type, 5 mm thick, the view being from the side where the bullet enters. The impression of the bullet is minimal here. Fig. 9 shows the opposite side to Fig. 8, where the bullet exits.

Fig. 10 shows a bullet hole in soft material, in the given case a class 11375 steel sheet of 10 mm strength; the view is from the side where the bullet enters, the impression of the body of the bullet being evident here. Fig. 11 shows the opposite side to Fig. 10, where the bullet exits.

Examples of preferred embodiments

The piercing bullet 1 consists of a cylindrical body 2 generally made of brass, a light metal alloy, plastic and the like, which is lodged with clearance and in a pre-defined position in the shell 13 with corresponding dimensions for various types of cartridges and uses. The body 2 is inseparably joined to the shell 13 by a conventional method, usually crimped or painted over. In the production of the body of the bullet 2 its initial outer guiding diameter is greater than after completion. In its rear portion (with respect to the direction of the movement of the bullet 1 after it is shot from the gun), which is preferably inside the shell 13, the body 2 is furnished on its outer surface with radial incisions 12 or with spiral-shaped incisions (generally one to three incisions). The incisions 12 are separated from each other by the guiding surfaces of the cylindrical part of the body 2 of the bullet 1, which serve to guide the bullet 1 in the bore of the barrel and cause its rotation in the barrel. The incisions 12 can be produced by various methods, for example machining, rolling, pressing, injection moulding in the case of plastics, and so on. They are generally trapezoidal in shape, narrowing down in the direction of the axis of the body 2 of the bullet 1. The depth of the incisions 12 is dictated by the material used for the body 2 of the bullet 1 and the requirements for subsequent destruction of the body 2 after hitting the target. So that the bullet should acquire the final size of the diameter of the body 2, it is calibrated by extrusion through a stepped calibrating member in the direction of the movement (trajectory) of the bullet 1 after firing from the gun. During this operation a change occurs in the shape of the incisions 12. The material of the body 2 of the bullet 1 is deformed in the area of the guiding rings formed by the incisions. In the forward parts of the rings, with respect to the direction of their calibration, the material of the body 2 is squeezed backwards and a non-homogeneous structure arises. The originally slanting surface of the rear parts of the guiding rings straighten until they form a right angle with respect to the axis of the body 2 and the density of the material increases in the area of the base of the incisions 12. Conversely, in the forward parts of the guiding rings there is a reduction in the density of the material and an increase in the angle of their sloping surfaces. This modification permits a controlled and gradual deformation of the rear portion of the body 2 of the bullet 1 after its impact with the barrier.

After insertion of the front portion of the bullet 1 into the bore of the gun barrel, the outer diameter of the body 2 of the bullet 1 is reduced at a certain distance before the mouth of the shell 13. In the direction of the forward portion of the bullet 1 the body 2 is further lightened by the deforming groove 10 formed in it. The length and depth of the deforming groove 10 are dictated by the type and strength of the material used in the body 2 of the bullet 1 to ensure the manipulating strength of the bullet 1. In other words, to ensure that this weakened part of the body 2 is not deformed as the bullet 1 is pushed (in preparation and filling) into the shell 13 and in normal manipulation of the bullet 1 and the cartridge.

Connected to the deforming groove 10, in the forward direction, is the rounded front part or head 5 of the bullet 1, which corresponds to the type of bullet and serves to guide or introduce the cartridge from the magazine into the cartridge chamber of the gun, by the force of the gun breech. Even during this operation, deformation (misalignment, eccentricity) of the jacket of the body 2 of the bullet 1 cannot occur in the area of the deforming groove 10. From the forward side the body 2 of the bullet 1 is furnished along its axis with a central opening 7 of circular section, into which is inserted a core 3 made of a material with a high degree of strength, hardness and mass, for example steel, hardened steel, tungsten or sintered metal carbides. The core 3 in its forward part comes to a point 8, which can be in the shape of a cone with a sharp-angled apex. The jacket of the cone can be flat, rounded or basically of any rotary shape suitable for the specific uses of the material and the application of the cartridge.

The free space of the opening 7 between the point 8 and the inner wall of the head 5 is filled with a plug 4 of soft material, for example lead or plastic. Its purpose is to reduce the dynamic deformational strength of the forward part of the bullet 1. After impact with the barrier it behaves like a fluid in a closed space, acting in all directions. After the bullet 1 hits the target obliquely, there is deflection of the head 5 of the bullet 1 and gradual deformation of the body 2 in the area of the deforming groove 10. The soft material of the plug 4 permits the instant fixation of the bullet 1 to the barrier at the point of contact, without the angle of impact of the bullet 1 changing. In this process, the sharp point 8 of the core 3 of the bullet 1 digs into the barrier, thus preventing its glancing off, ricocheting or rupturing. As soon as the point 8 penetrates the barrier, the material of the plug 4 is displaced along the conical surface of the point 8, the weakened body 2 of the bullet 1 in the area of the deforming groove 10 bulges outwards and then the whole forward portion of the body 2 of the bullet 1 breaks off and disintegrates. Part of the core 3 is thereby uncovered.

If the barrier is made of a hard material, for example steel, glass, ceramic, in the shape of a plate or board etc., then its broken-off fragments glance off and scatter in all directions along the surface. It is evident particularly when firing at close range, for example 1 to 2 metres. In no event is the person firing struck or endangered by this disintegration. Only the hard core 3 of the bullet 1 is forced into (penetrates) the hard material of the barrier, partly by its own inertia and partly by the inertia of the rear portion of the bullet 1 which, through the base 6 of the body 2 of the bullet 1, increases the penetration of the core 3 by its inertial mass. At the moment when the core 3 penetrates the hard barrier so deeply that the rear portion of the body 2 of the bullet 1 touches the barrier, controlled disintegration occurs of the individual parts of the body 2, for example gradually along the individual guiding rings which during manufacture (calibration) are made so that they easily separate from the remainder of the body 2 of the bullet 1 and in such a way that the remaining portion of the body 2 is always lined up on its front portion (in the direction of the movement of the bullet 1) in the course of

its disintegration. This facilitates the further gradual controlled disintegration of the body 2 of the bullet 1, thus avoiding unnecessary loss of energy during penetration of the core 3 into the hard material of the barrier. The outer diameter of the hole of the shot-through material of the barrier, which is basically cylindrical in shape, always corresponds to the outer diameter of the fired core 3. On the front side of the shot-through barrier an impression is formed by the controlled disintegration of the body 2 of the bullet 1. In a barrier made of soft material, for example soft steel, the impression is greater, in a hard material barrier (for example steel sheets of the HARDOX type used for armoured vehicles, walls and the like) it is almost imperceptible. Upon impact with a hard barrier the piercing bullet 1 immediately behaves like an under-calibered bullet, since only the core 3 and not the body 2 of the bullet 1 penetrates the barrier, with greater firing energy. However, as soon as this piercing bullet 1 hits a target matter like wood for example, it behaves like a normal conventional bullet 1 and frequently does not disintegrate at all. The bullet hole in such a case corresponds to the diameter of the body 2 of the bullet 1.

Where it hits a target matter like a human body, there is penetration of the whole bullet into this matter. With a delay which corresponds to an ordinary penetration of several centimetres (2 to 3 cm) the forward portion of the bullet 1 disintegrates. All the fragments are caught up by the target matter and after about 15 cm almost all the energy of the shot is delivered to the target matter. There arises a so-called oscillatory hollow with a capacity of approximately one litre (1 dm^3). The bullet 1 in this case behaves like ammunition with shock effect and significant damage to the target matter.

A further basic feature of the piercing bullet 1 is its high initial velocity, for example in the 9 mm calibre LUGER with four-inch barrel v_0 = 756 m/s, the energy E_0 = 829 J and the average pressure in the gun barrel is 297 MPa. This velocity is achieved by the low mass of the bullet 1 in combination with the special preparation and filling of the powdered fill in the shell 13. It involves an appropriate ammunition powder which is compressed. First of all a determined quantity of powder is put into the shell or into the jig and is compressed with a determined pressure (a pill is formed having the internal dimensions of the shell). Alternatively, a previously compressed powder pill, whose dimensions correspond to the shape of the shell, can be inserted into the shell. By this technique the cartridge is supplied with a large amount of energy which is released, after ignition by a fuse, during the whole period of passage of the bullet through the gun barrel, without dangerously exceeding the maximum permitted pressure in the cartridge. Quite a different curve thus arises in the course of combustion of the powdered fill and a basically longer duration of the pressure needed during the whole period of acceleration of the bullet in the gun barrel. The pressure at the mouth is thereby increased compared to normal ammunition, for example in the 9 mm LUGER cartridge (the most frequently used gun for police and special army units) there is a twofold increase.

In short pistol cartridges this velocity and energy, almost three times greater than in normal ammunition, cannot be created without compression of powder. Moreover this method of preparation and filling of the cartridge ensures, with a light bullet for example 2.9 grams in weight, normal functioning of guns (pistols and automatic weapons) that is repeating, automatic loading etc.

Industrial uses of the invention

The piercing bullet according to this invention is intended particularly for destroying common ballistic shields for individuals or vehicles. That includes bullet-proof vests with kevlar fibre, particularly for invisible wear and for stopping armoured transport means. At the same time there is no possibility of these bullets rebounding and threatening the vicinity.

PATENT CLAIMS

1. A cartridge consisting of a shell (13) with powder filling (16) and a bullet (1), where the bullet (1) comprises a body (2) having a rear base (6) and peripheral walls, in the axis of which is fixed a piercing core (3), characterised in that the body (2) is adapted for controlled detachment, in the area of weakening of its peripheral wall, of at least one of its forward portions after the bullet (1) impacts with the barrier.

2. A cartridge according to claim 1, characterised in that the body (2) comprises a guiding forward portion (5) and a rear portion (17) of greater diameter, corresponding to the calibre of the gun, for stabilising and guiding the bullet (1) in the gun barrel, where the piercing core (3) is lodged with radial allowance in the body (2), in the opening (19) on the front side and where, between the forward portion (5) and the rear portion (17) of the bullet (1), the body (2) has a deforming wall (10) with reduced thickness, so that the area where it meets the shouldered rear portion (17) forms the ripper zone of the front portion of the body (2), while the piercing core (3) comes to a point at its front end (8) and the hollow between this front end of the core (3) and the adjacent part of the inner wall of the opening (19) of the body (2) is filled with a malleable plug (4) whose outer surface forms at least the greater part of the impacting surface (20) of the bullet (1).

3. A cartridge according to claim 1 or 2, characterised in that a deforming wall (10) is formed by the base of a rectangular groove, arranged radially in the body (2) of the bullet (1), while the rear side wall of this groove, which is at the same time the forward surface of the shouldered rear portion (17), forms the first impacting surface (18).

4. A cartridge according to any of claims 1 to 3, characterised in that the front portion (5) of the body (2) of the bullet (1) in the direction of the exit from the opening (19) narrows down in a rounded shape so that the impact surface (20) of the bullet (1) forms a malleable plug (4), while the conical front end (8) of the core (3) of the bullet (1) runs into this impact surface (20) with its point.

5. A cartridge according to any of claims 1 to 4, characterised in that the body (2) of the bullet (1) is adapted for gradual detachment of at least one of its other parts in the direction from the front wall of the bullet (1), in the area of an incision in the peripheral wall of the rear portion (17).

6. A cartridge according to claim 5, characterised in that the body (2) has at least one radial incision (12) on the outer periphery of its rear portion (17).

7. A cartridge according to claim 5, characterised in that the body (2) has at least one spiral-shaped incision on the outer periphery of its rear portion (17).

8. A cartridge according to claim 5, characterised in that the body (2) has evenly arranged axial incisions spaced out on the outer periphery of its rear portion (17).

9. A cartridge according to claims 6 or 7, characterised in that two radial incisions (12) of trapezoidal section are arranged at a distance from each other in the rear portion (17) of the body (2) of the bullet (1) in the direction of the axis of the narrowed section, the forward wall of each of the incisions (12) being at right angles to the axis of the bullet (1), while their rear walls are part of the second and third impact surfaces (18) respectively.

10. A cartridge according to any of claims 1 to 9, characterised in that the base (6) of the body (2) of the bullet (1) closes with its surface the inner space in the shell (13), which is filled with a compressed powder filling (16) or powder pill.

11. A cartridge according to any of claims 1 to 10, characterised in that the piercing core (3) is made of a material with a high degree of strength, hardness and mass, from the group comprising steel, hardened steel, tungsten and sintered metal carbides.

12. A cartridge according to any of claims 1 to 11, characterised in that the malleable plug (4) of the body (2) of the bullet (1) is made of a material from the group comprising lead, plastic and wax.

13. A method of preparing at least one radial incision in the body (2) of the bullet (1) of the cartridge according to any of the preceding claims 1 to 12, during which the rear portion (17) of the body (2) is formed with a greater outer diameter with at least one radial incision (12) of trapezoidal section with symmetrical sides, characterised in that the body (2) is extruded, through a stepwise narrowing opening in a calibrating member, to the required lower calibre, by which the material of the body (2) in the area of the radial incision (12) becomes non-homogeneous and deforms so that the front side of the radial incision (12) in the direction of the extrusion straightens until it is at right angles to the axis of the body (2), with a simultaneous increase in the density of the material in this area, and its rear side opens up still more, with a simultaneous decrease in the density of the material in this area.

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AMENDED CLAIMS

[Received by the International Bureau on 26 August 2003 (26.08.03):
original claims 1 and 2 amended, remaining claims renumbered [3 pages] *

Statement under Article 19(1)

None of the documents referred to in the International Search Report (DE 100 45 009, US 3 213 792, WO 00 79211, WO 94 08201) involves a deforming wall in the bullet of the cartridge, with a ripper zone at the transition from a forward guiding portion of the body of the bullet, of smaller diameter, to a shouldered portion of the body of the bullet which is of greater diameter. As opposed to weakening the wall by a simple incision, the deforming wall according to the invention submitted, combined with the effects of the malleable plug with its compressive load after impact of the bullet, produces quite surprising results. The front portion of the body of the bullet separates easily and very quickly and, as a result, the bullet's puncturing capacity compared to that of known solutions is substantially increased. This increased puncturing capacity compared to known solutions is also enhanced by means of the vertically shouldered surface of the rear portion of the body of the bullet, which is connected to the deforming wall. After the separation of the front portion of the body of the bullet and the uncovering of its piercing core, this shouldered surface, by the action of hitting the barrier, initiates the gradual further disintegration of the body of the bullet, whose inertial mass speeds up the forward motion of the core and increases its penetration into the hard barrier. Together with the other features, particularly the system of further incisions in the rear portion of the body of the bullet with the non-homogeneous distribution of its mass, this represents a contribution to the field.

PATENT CLAIMS

1. A cartridge consisting of a shell (13) with powder filling (16) and a bullet (1), where the bullet (1) comprises a body (2) which is adapted by means of a malleable plug (4) for controlled detachment, in the area of weakening of its peripheral wall, of its forward portion after the bullet (1) impacts with the barrier, and which has a rear base (6) and peripheral walls defining on the front side the axial opening (7) in which is lodged a piercing core (3), where the body (2) comprises a guiding forward portion (5) and a rear portion (17) of greater diameter, corresponding to the calibre of the gun, characterised in that between the forward portion (5) and the rear portion (17) of the bullet (1) the body (2) has a deforming wall (10) with reduced thickness, so that the area where it meets the shouldered rear portion (17) forms the ripper zone of the front portion of the body (2), while the piercing core (3) comes to a point at its front end (8) and the malleable plug (4) filling the hollow between the front end of the core (3), lodged with radial allowance in the body (2), and the adjacent part of the inner wall of the opening (7) of the body (2), forms with its front surface at least the greater part of the impacting surface (20) of the bullet (1).

2. A cartridge according to claim 1, characterised in that a deforming wall (10) is formed by the base of a rectangular groove, arranged radially in the body (2) of the bullet (1), while the rear side wall of this groove, which is at the same time the forward surface of the shouldered rear portion (17), forms the first impacting surface (18).

3. A cartridge according to claim 1or 2, characterised in that the front portion (5) of the body (2) of the bullet (1) in the direction of the exit from the opening (7) narrows down in a rounded shape so that the impact surface (20) of the bullet (1) forms a malleable plug (4), while the conical front end (8) of the core (3) of the bullet (1) runs into this impact surface (20) with its point.

4. A cartridge according to any of claims 1 to 3, characterised in that the body (2) of the bullet (1) is adapted for gradual detachment of at least one of its other parts in the direction from the front wall of the bullet (1), in the area of an incision in the peripheral wall of the rear portion (17).

5. A cartridge according to claim 4, characterised in that the body (2) has at least one radial incision (12) on the outer periphery of its rear portion (17).

6. A cartridge according to claim 4, characterised in that the body (2) has at least one spiral-shaped incision on the outer periphery of its rear portion (17).

7. A cartridge according to claim 4, characterised in that the body (2) has evenly arranged axial incisions spaced out on the outer periphery of its rear portion (17).

8. A cartridge according to claim 5 or 6, characterised in that two radial incisions (12) of trapezoidal section are arranged at a distance from each other in the rear portion (17) of the body (2) of the bullet (1) in the direction of the axis of the narrowed section, the forward wall of each of the incisions (12) being at right angles to the axis of the bullet (1), while their rear walls are part of the second and third impact surfaces (19) respectively.

9. A cartridge according to any of claims 1 to 8, characterised in that the base (6) of the body (2) of the bullet (1) closes with its surface the inner space in the shell (13), which is filled with a compressed powder filling (16) or powder pill.

10. A cartridge according to any of claims 1 to 9, characterised in that the piercing core (3) is made of a material with a high degree of strength, hardness and mass, from the group comprising steel, hardened steel, tungsten and sintered metal carbides.

11. A cartridge according to any of claims 1 to 10, characterised in that the malleable plug (4) of the body (2) of the bullet (1) is made of a material from the group comprising lead, plastic and wax.

12. A method of preparing at least one radial incision in the body (2) of the bullet (1) of the cartridge according to any of the preceding claims 1 to 11, during which the rear portion (17) of the body (2) is formed with a greater outer diameter with at least one radial incision (12) of trapezoidal section with symmetrical sides, characterised in that the body (2) is extruded, through a stepwise narrowing opening in a calibrating member, to the required lower calibre, by which the material of the body (2) in the area of the radial incision (12) becomes non-homogeneous and deforms so that the front side of the radial incision (12) in the direction of the extrusion straightens until it is at right angles to the axis of the body (2), with a simultaneous increase in the density of the material in this area, and its rear side opens up still more, with a simultaneous decrease in the density of the material in this area.

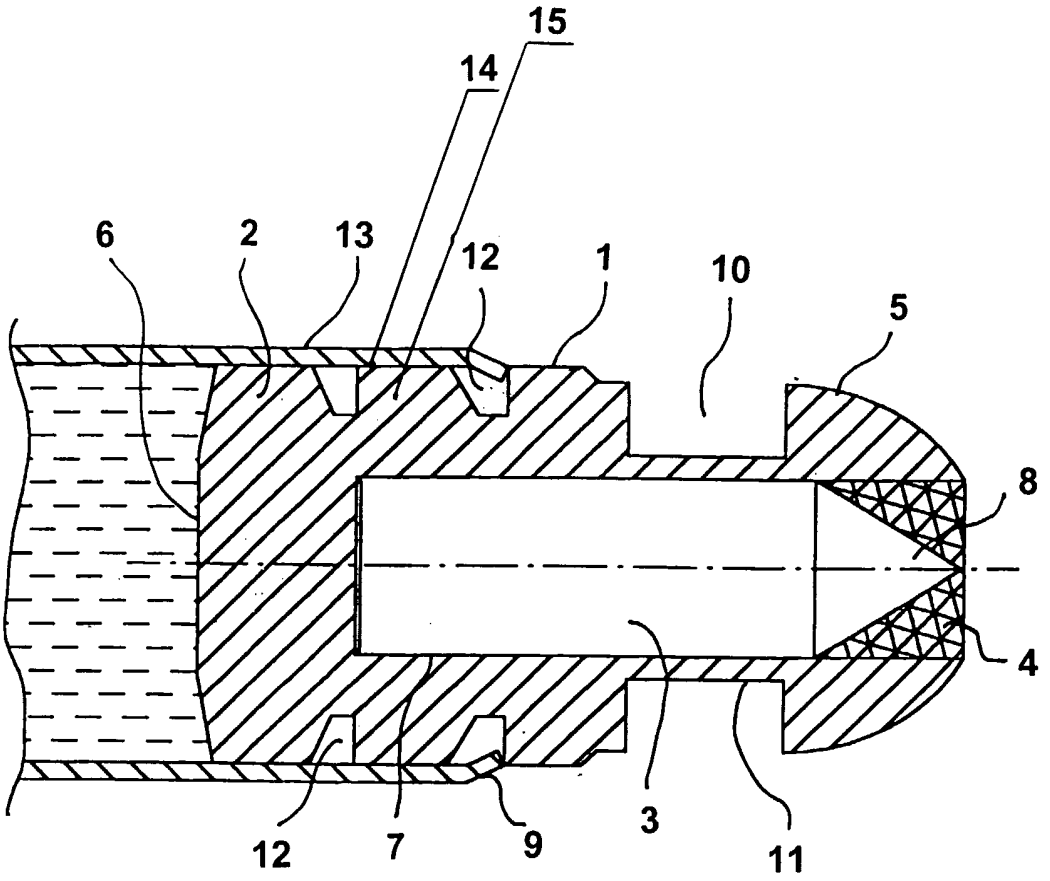

FIG. 1

FIG. 2

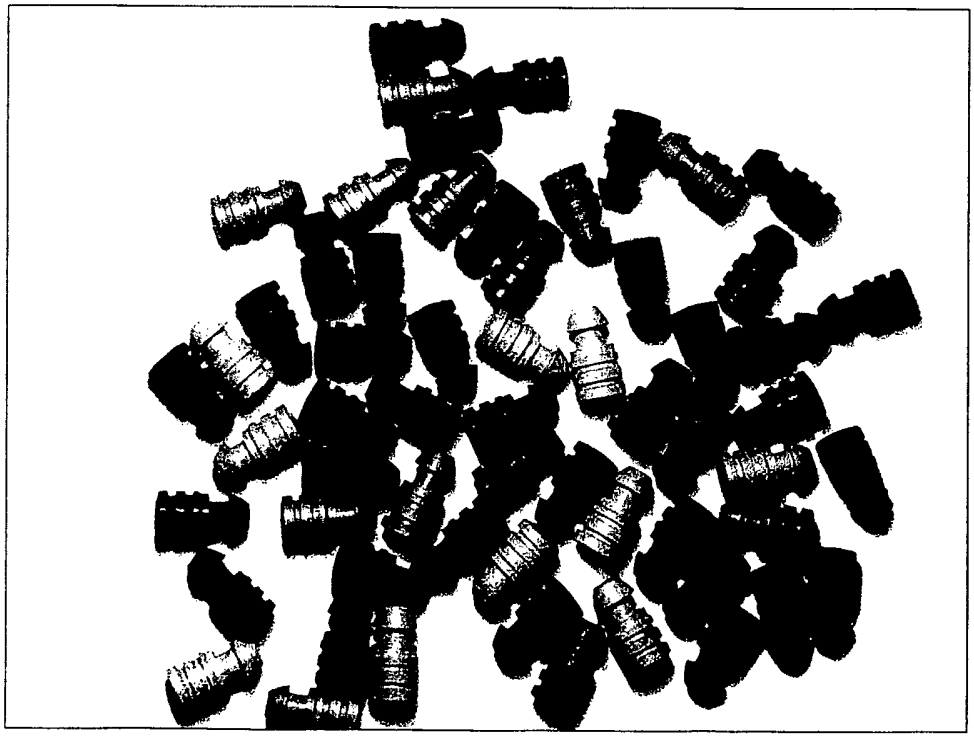

FIG. 3

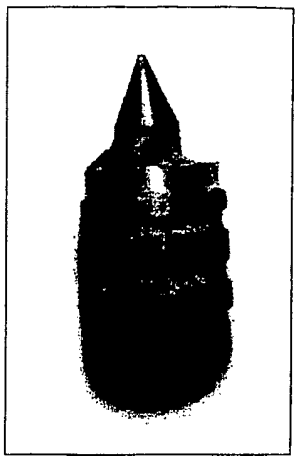

FIG. 4a

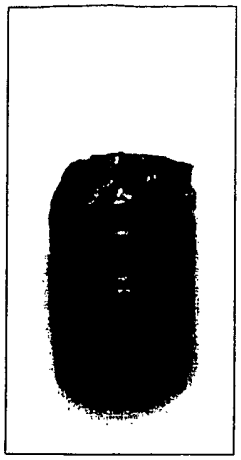

FIG. 4b

FIG. 4c

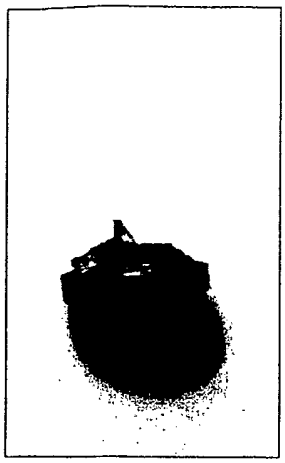

FIG. 4d

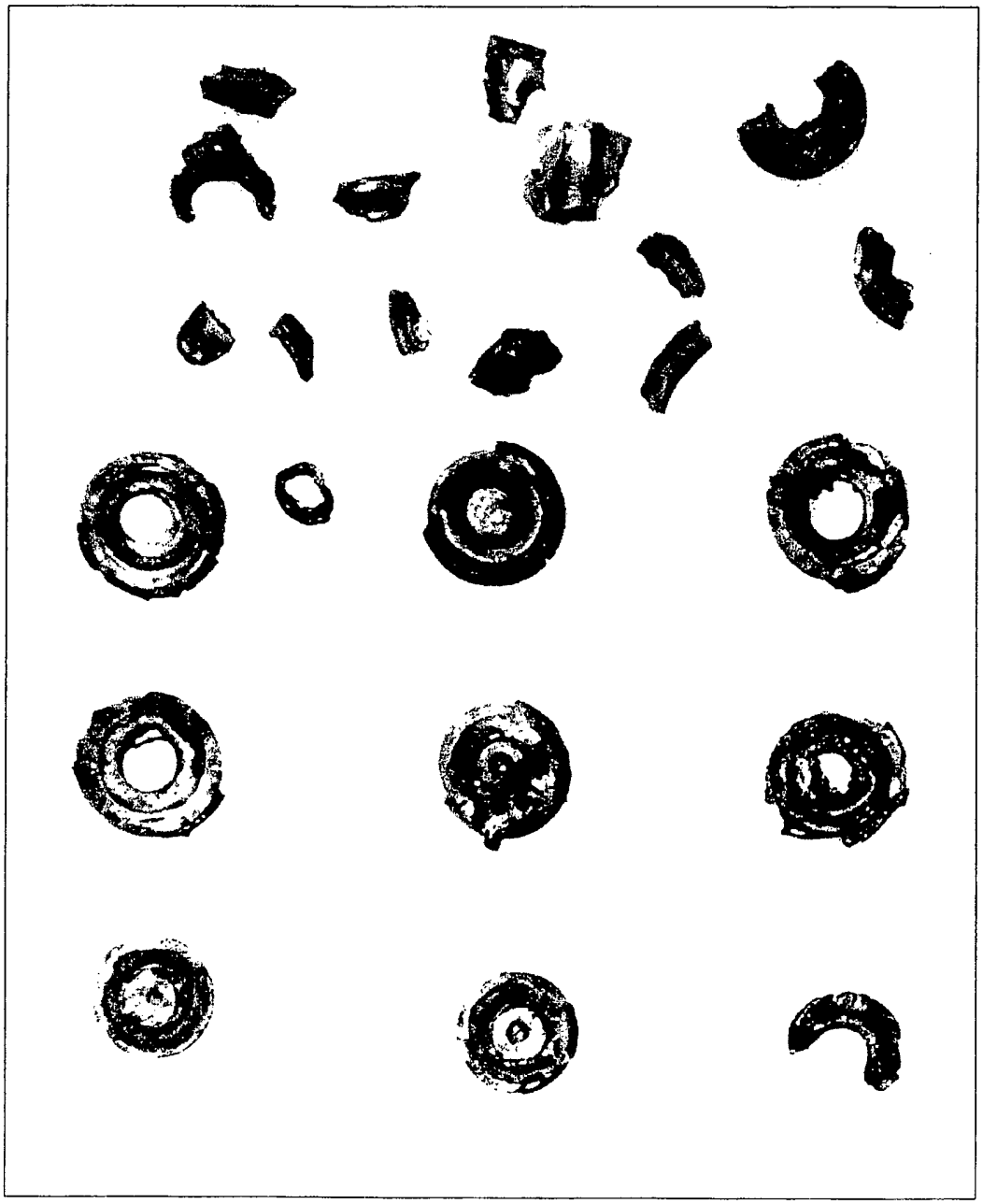

FIG. 5

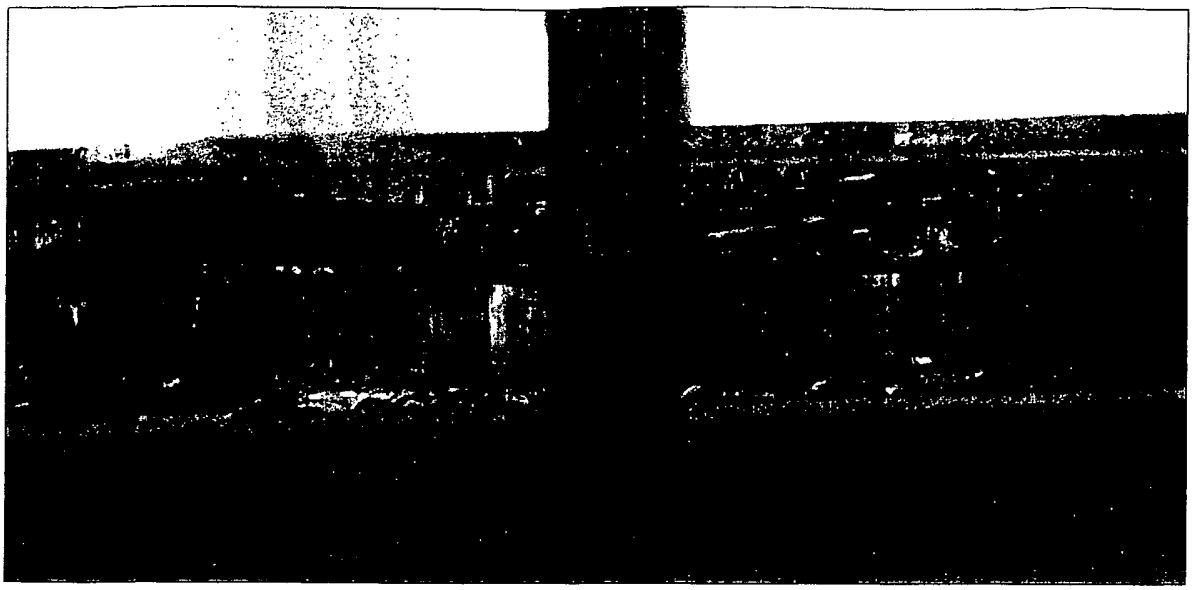

FIG. 6

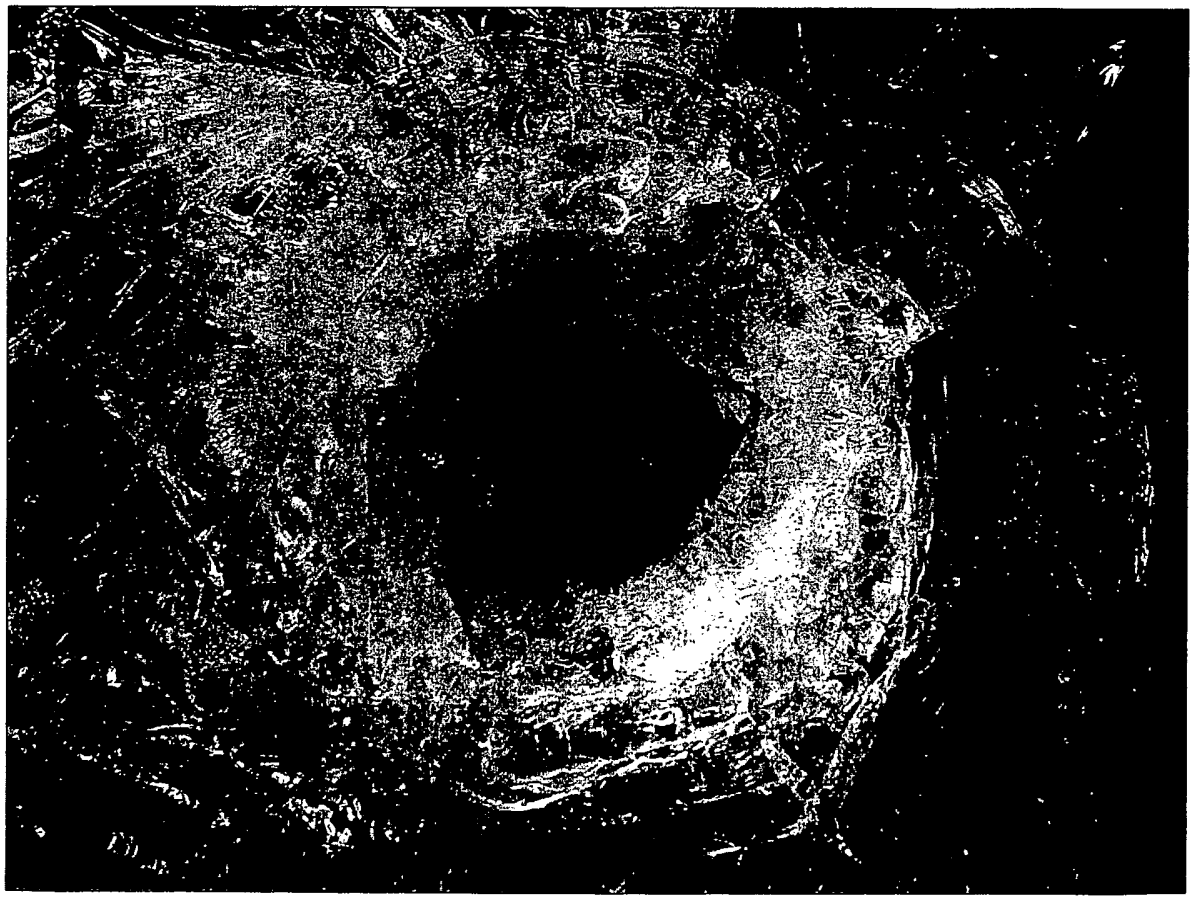

FIG. 7

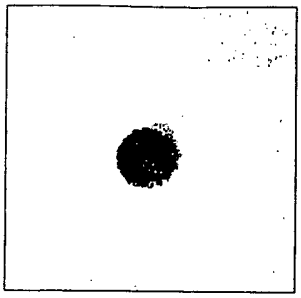

FIG. 8

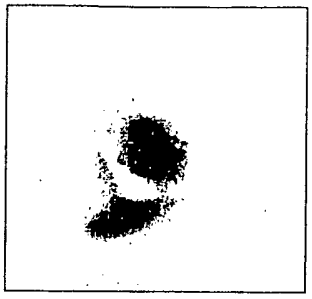

FIG. 9

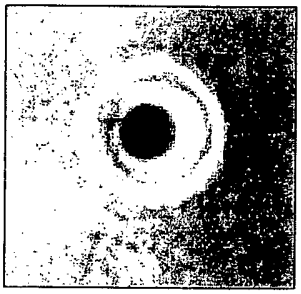

FIG. 10

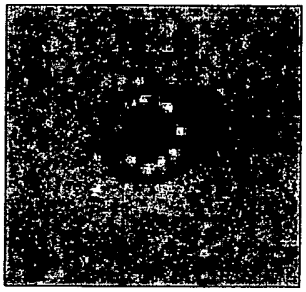

FIG. 11

INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/CZ 03/00016

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F42B12/06 F42B12/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F42B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 100 45 009 A (DYNAMIT NOBEL) 10 May 2001 (2001-05-10)	1,2
Y	column 3, line 22 - line 38; figure 1	3-6
A		7,8,10, 12

X	US 3 213 792 A (GRENANDER ET AL.) 26 October 1965 (1965-10-26)	1
Y	column 1, line 16 - line 19	3,4
A	column 2, line 10 - line 14; claim 1; figure 1	6,10,11

X	WO 00 79211 A (SAUVESTRE) 28 December 2000 (2000-12-28)	1
Y	page 5, line 35 -page 6, line 21; figure 1	5,6
A		8,10

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2003	27/06/2003

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Internat Application No
PCT/CZ 03/00016

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	WO 94 08201 A (WINTER) 14 April 1994 (1994-04-14)	1
A	page 4, line 9 -page 6, line 5; claims 1,2; figure 1	2-4,6, 10,13
A	US 6 135 028 A (KUHNS ET AL.) 24 October 2000 (2000-10-24) column 2, line 56 - line 66; figures 1,2	1-3,5-11
A	DE 22 23 477 A (KOPSCH ET AL.) 22 November 1973 (1973-11-22) page 7, line 2 - line 7; figures 4,5	2-4,6
A	US 4 947 755 A (BURCZYNSKI) 14 August 1990 (1990-08-14) column 5, line 45 -column 6, line 37; figures 5,6	13

INTERNATIONAL SEARCH REPORT

on on patent family members

Internal Application No
PCT/CZ 03/00016

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