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(71) Applicant: **Consulpack S.r.l.**
24047 Treviglio (BG) (IT)

(72) Inventors:
- **BAR, Ettore**
  24042 Capriate San Gervasio (BG) (IT)
- **CORNA, Glauco**
  20069 Vaprio D'Adda (MI) (IT)

(74) Representative: **Botti & Ferrari S.p.A.**
Via Cappellini, 11
20124 Milano (IT)

(54) **FIREARM CARTRIDGE AND RELATED CASE AND PRIMER**

(57) A firearm cartridge (1;40;50;60;70;80) is described, comprising a primer (3) adapted to contain a priming charge (18) and a casing (2) comprising a chamber (8) adapted to contain a propelling charge in communication with a housing (12) adapted to receive the above primer (3), the cartridge (1;40;60) being characterized in that said chamber (8) of the casing and said primer (3) or said priming charge are isolated from each other by interposing a breaking element (22;42;62) therebetween. A casing and a primer for a cartridge of the above type are also described in different embodiments.

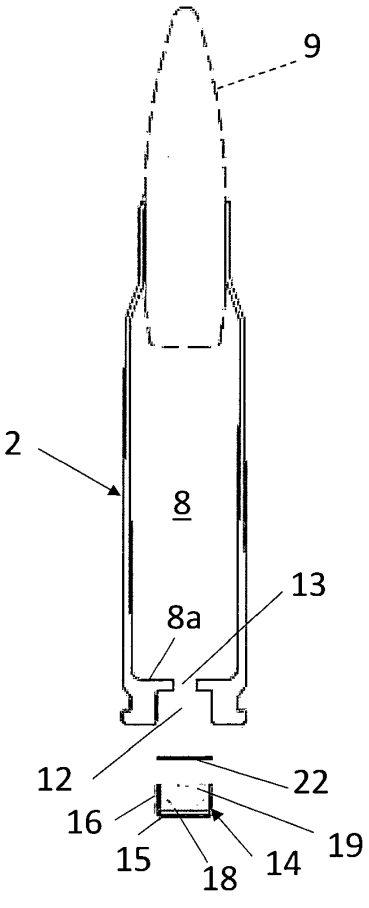

Fig. 2

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Description

Field of application

[0001] In its more general aspect, the present invention relates to the field of firearms.

[0002] In particular, the present invention relates to a firearm cartridge comprising a casing having a chamber adapted to contain a propelling charge (or propellant), and a primer having a cavity adapted to contain a priming charge, wherein said chamber of the casing and said cavity of the primer are isolated from each other by interposing a breaking element.

[0003] Moreover, the present invention relates to a casing comprising a breaking element adapted to close and isolate, preferably seal, the above chamber containing the propelling charge on the side facing the primer.

[0004] The present invention also relates to a primer comprising a breaking element adapted to close and isolate, preferably seal, the above cavity containing the priming charge on the side facing the chamber containing the propelling charge of the casing.

Prior art

[0005] As it is known, in the field of firearms ammunition cartridges comprise a primer containing a priming explosive compound (priming charge or primer) and a casing containing a propelling charge (or propellant), typically a smokeless explosive powder, which, when ignited by the priming charge pushes a bullet along the barrel of a firearm, such as a gun or a rifle, towards a target.

[0006] In more detail, the casing of known cartridges is typically made of forged brass and/or steel and/or technopolymers, it has a cylindrical or cylindro-conical shape and it comprises a tubular body having an open end, commonly called mouth or collar, on which a bullet is hold by friction, and a base portion, commonly called base, located at the opposite end of the tubular body and usually formed integrally with the latter.

[0007] The tubular body of the casing has internally a chamber intended to contain the propelling charge while the base portion has a recess suitably shaped to receive a primer, typically a percussion primer. Moreover, a passageway called flash hole is provided between the chamber of the tubular body and the recess of the base portion.

[0008] The primer comprises a metal cap having a cavity adapted to contain the priming charge and an anvil arranged in said cavity, the anvil having a head and a plurality of feet. The metal material of the cap has such an appropriate thickness as to be able to withstand the highest pressure occurring inside the ammunition upon firing the bullet.

[0009] Upon firing, the pressure of the trigger of the firearm releases the firing pin which in turn hits the surface of the metal cap in the direction of the anvil head. This causes the detonation of the explosive priming compound located between the cap and the anvil and consequently the spread of high-temperature gases, sparkling particles and flames through the free areas of the anvil and the flash hole causing the ignition of the propelling charge (propellant) located in the chamber of the tubular body of the casing.

[0010] The gases released by the rapid combustion of the propelling charge push the bullet into the barrel and thus ahead therethrough until the muzzle.

[0011] In view of the above, it is evident that the primer charge and the propelling charge are positioned in a single closed environment divided into two spaces bidirectionally communicating with each other through the flash hole.

[0012] Although the above-described firearm cartridges are widely used, they are not free from drawbacks which must be solved.

[0013] In fact, it should be noted that in known cartridges the bullet is inserted into the casing by pressure and kept in place by the interference between the internal diameter of the neck of the casing and the external diameter of the bullet and/or by a mechanical crimping known as factory crimp.

[0014] If on the one hand these devices provide some protection from moisture and/or other external elements entering the chamber containing the propelling charge, the chamber is not hermetically sealed on the bullet side since the elasticity of the neck of the casing and the finish thereof is commonly quite rough and also crimping cannot be excessive not to deform the bullet and vary the diameter and thus the ballistic features thereof.

[0015] It results that the whole system comprising the casing and the primer is not hermetically sealed and therefore there is a real risk that both the primer charge and the propelling charge can absorb moisture.

[0016] Nevertheless, it is known that the combustion speed of the powders forming the propelling charge varies with the moisture content therein and this can involve, disadvantageously, a variation of the external ballistic features of the bullet and thus a reduced shooting precision.

[0017] This drawback is particularly felt when the firearm is intended to be used in the sports field, in particular by athletes of long-range shooting sports disciplines.

[0018] Moreover, the moisture absorption by the primer charge can involve missed ignitions thereof upon firing with just as undesirable consequences.

[0019] Furthermore, it should be stated that the primer production process provides the deposition of a given amount of priming material inside the metal cap. Such a material is commonly in a liquid form or in a cream or paste form and it is typically deposited by screen printing or volumetric dosing.

[0020] Nevertheless, both because of the particular production technology adopted for the primer production, and because of the very low amount of dosed priming material, the above deposition systems are not able to reach such an accuracy level as to ensure a dosing consistency of the priming material in all primers being pro-

duced. As a result, this prevents a perfect repeatability of ignition of the primer that can satisfy the most demanding shooters such as particularly athletes of the long-range shooting sports disciplines.

[0021] The main object of the present invention is hence to provide a firearm cartridge and respective improved casing and primer which allow the drawbacks previously mentioned with reference to the prior art to be overcome or drastically reduced, in particular a cartridge and/or related casing and primer which allow the external ballistic performances of the bullet to be improved, particularly in terms of shooting precision, and/or the risk of missed ignitions of the priming charge to be reduced, so as to meet the requirements of the users, particularly in the field of sports use, and/or of the market.

[0022] Another object of the present invention is to provide a firearm cartridge and related casing and primer as above which can be produced in a simple way and at low cost without modifying current production standards.

Summary of the invention

[0023] These objects are mainly achieved by a firearm cartridge comprising a primer adapted to contain a priming charge and a casing comprising a chamber adapted to contain a propelling charge (or propellant) in communication with a housing adapted to receive the above primer, the cartridge being characterized in that said chamber of the casing and said primer or said priming charge are isolated from each other by interposing a breaking element therebetween.

[0024] In an embodiment of the invention, the breaking element is made so as to break or be perforated when undergoing a pressure which is equal or higher than a threshold value of the pressure generated by gases released by the ignition of the primer upon firing.

[0025] In an embodiment of the invention, the primer comprises a cap having a cavity adapted to contain the priming charge and optionally an anvil arranged in said cavity. Preferably, the primer is a percussion primer comprising an anvil arranged in said cavity.

[0026] In an embodiment of the invention, the casing comprises a tubular body having an open end for inserting and keeping a bullet in place and a chamber adapted to contain a propelling charge, and a base portion (or base) located at the opposite end of said tubular body, said base portion having a recess forming a housing for receiving the primer, a flash hole being moreover provided between the chamber of the tubular body and the above recess.

[0027] In an embodiment of the invention, the breaking element comprises a membrane applied on the cap of the primer or containing the primer so as to close, preferably seal, the above primer.

[0028] In an embodiment of the invention, the breaking element comprises a membrane applied in said housing or recess between the chamber adapted to contain the propelling charge and the primer so as to close the above flash hole.

[0029] In an embodiment, the chamber adapted to contain the propelling charge has a bottom in communication with the above recess through the flash hole and the breaking element comprises a membrane fixed in the above recess on the external surface of the above bottom or fixed on the internal surface of the above bottom so as to close, preferably seal, the flash hole.

[0030] In an embodiment of the invention, the breaking element comprises a pin fixed to the casing at the flash hole so as to close, preferably seal, said flash hole.

[0031] In an embodiment, the breaking element comprises a pin or projection formed integrally with the anvil which, with the insertion of the primer into the housing or recess of the casing, occludes the above flash hole.

[0032] In another embodiment, the breaking element comprises a pin or projection formed integrally with the anvil which, when in use, with the ignition of said primer, is able to occlude the above flash hole by breaking upon exceeding said threshold value of the pressure generated by gases released by the ignition of the primer.

[0033] Moreover, the above objects are achieved by a primer comprising a cap having a cavity adapted to contain a priming charge, and optionally an anvil, the primer being characterized in that it further comprises a breaking element applied or fixed to said cap so as to close, preferably seal, said cavity. Preferably, the primer is a percussion primer and the above cavity of the cap also comprises an anvil.

[0034] Moreover, the above objects are achieved by a primer comprising a cap having a cavity adapted to contain a priming charge, and an anvil, the primer being characterized in that it further comprises an element comprising a pin or projection formed integrally with the anvil adapted to occlude the flash hole of a casing into which said primer is inserted.

[0035] Moreover, the above objects are achieved by a primer comprising a cap having a cavity adapted to contain a priming charge, and an anvil, the primer being characterized in that it further comprises a breaking element comprising a pin or projection formed integrally with the anvil which, when in use, with the ignition of the primer, is able to occlude the flash hole of a casing into which said primer is inserted.

[0036] The above objects are also achieved by a casing comprising a chamber adapted to contain a propelling charge (or propellant), a housing adapted to receive a primer and a flash hole between the above chamber and the above recess, the casing being characterized in that it further comprises a breaking element applied so as to close, preferably seal, said flash hole so as to isolate the above chamber adapted to contain the propelling charge from said recess.

[0037] In an embodiment, the chamber of the casing adapted to contain the propelling charge has a bottom in communication with the housing for the primer through the flash hole, and the breaking element comprises a membrane fixed in said housing for the primer on the

external surface of the bottom of the above chamber or fixed on the internal surface of said bottom so as to close, preferably seal, the flash hole.

[0038] In an embodiment, the breaking element comprises a pin fixed to the casing at the flash hole so as to close, preferably seal, said flash hole.

[0039] Further features and advantages of the present invention will be apparent from the following description of some preferred embodiments, said description being given by way of non-limiting example with reference to the attached figures.

Brief description of the figures

[0040] In the figures:

- Figure 1 shows a sectional view of a cartridge comprising a casing and a primer in accordance with an embodiment of the present invention;
- Figure 2 shows an exploded sectional view of the cartridge of Fig. 1;
- Figure 3 shows a perspective view of a primer of the cartridge according to the present invention;
- Figure 4 shows a sectional view of a cartridge comprising a casing and a primer according to another embodiment of the present invention;
- Figure 5 shows an exploded sectional view of the cartridge of Fig. 4;
- Figure 6 shows a sectional view of a cartridge comprising a casing and a primer according to a further embodiment of the present invention;
- Figure 7 shows an exploded sectional view of the cartridge of Fig. 6;
- Figure 8 shows a sectional view of a cartridge comprising a casing and a primer according to a further embodiment of the present invention;
- Figure 9 shows an exploded sectional view of the cartridge of Fig. 8, and
- Figures 10-11 show respective sectional views of a cartridge comprising a casing and a primer according to further embodiments of the present invention.

Detailed description

[0041] In the present description and in the attached claims, the term "breaking element", means an element of any material, shape and size which, suitably applied between the casing and the primer or to one of them, allows to separate or isolate, preferably seal, the chamber containing the propelling charge and the primer from each other, substantially preventing the passage of high-temperature gases formed by the detonation of the priming charge in the primer after firing in the chamber containing the propelling charge up to reach a predetermined breaking pressure or perforation of the element.

[0042] In the present description and in the attached claims, the terms "seal", "sealing" and the like mean a separation in particular between the casing and the primer which is fluid-tight, particularly gas-tight.

[0043] In an embodiment, the breaking element is a membrane of any shape and size which are suitable for withstanding the pressure of gases released by the priming charge upon firing until a predetermined threshold pressure. By way of non-limiting example, the membrane can be shaped like a disc, cup, pin or can have any other shape which is suitable for achieving the above-indicated objects.

[0044] The breaking element, shaped for example like a membrane, can be made of any appropriate material, such as a metal material, a non-metal material, a polymer material or a combination thereof.

[0045] Moreover, the breaking element can be a single layer or a multilayer of one or any combination of the above materials. For example, the breaking element can be shaped like a membrane having a layer of metal material and a coating of a polymer material.

[0046] Metal materials which are suitable for the breaking element comprise, but are not limited to, copper and alloys thereof. However it should be understood that the breaking element can be made of any metal which is compatible with the internal ballistic process, i.e. with the process occurring inside the cartridge and/or the barrel of the firearm upon firing.

[0047] Suitable non-metal materials comprise, but are not limited to, polymer materials such as for example polyethylene terephthalate (PET), polypropylene (PP), polyethylene (PE), polytetrafluoroethylene (PTFE), polymethylmethacrylate (PMMA), polyvinylidene fluoride (PVDF), fluorinated ethylene propylene (FEP), any kind of cellulose and compostable materials.

[0048] The polymer material can be composed of a single polymer, of a mixture of polymers or in the form of a multilayer of different polymers coupled to each other. The polymer material can be possibly charged with one or more adjuvants of the combustion of the propelling charge during the internal ballistic process, i.e. the process occurring inside the cartridge and/or the barrel of the firearm upon firing.

[0049] Suitable combustion adjuvants comprise lubricants, pickling agents, antioxidants and more generally compounds, such as for example acids, bases and solvents in the solid and/or liquid state, which are to be burnt during the internal ballistic process.

[0050] In the present invention, the breaking element, shaped for example like a membrane, can be flat or curved (for example concave) and can be provided with predefined breaking points obtained by forming for ex-

ample incision lines with a predefined geometry by means of processing techniques which are conventional per se, for example by laser processing.

[0051] In an embodiment, the breaking element, preferably shaped like a membrane, is made with a thickness preferably comprised between 0.05 mm and 1 mm, particularly between 0.1 mm and 0.3 mm.

[0052] It was surprisingly found that the use of a breaking element interposed between the casing and the primer so as to isolate the chamber containing the propelling charge and the primer from each other, wherein the breaking element is able to break upon reaching a predetermined gas pressure, allows the drawbacks previously mentioned with reference to the prior art to be solved or drastically reduced and at the same time considerable advantages to be obtained.

[0053] In fact, in the event of moisture being present in the propelling charge contained in the chamber of the casing, the isolation between the chamber containing the propelling charge and the primer allows the primer to be effectively protected from moisture, thereby avoiding or considerably reducing the possibility of malfunction of the primer in terms of missed or reduced ignition of the priming charge upon firing.

[0054] Moreover, the isolation between the chamber containing the propelling charge and the primer by means of the above breaking element prevents the high-temperature gases and flames generated upon ignition of the primer by the firing pin from immediately spreading inside the chamber containing the propelling charge, as it occurs in the cartridges of the prior art, which can involve an initial latency in which the pressure inside the chamber containing the propelling charge gradually increases up to reach an appropriate pressure peak, with subsequent ignition of the propelling charge which is initially slower and not homogeneous along the chamber of the casing.

[0055] Differently, in the present invention, due to the isolation between the chamber containing the propelling charge and the primer by means of the above breaking element, the high-temperature gases and flames are introduced into the chamber containing the propelling charge upon reaching an appropriate pressure, which is sufficient to perforate the breaking element, making thus the ignition of the propelling charge smoother along the whole chamber of the casing containing the propelling charge.

[0056] Therefore it results that both the internal ballistic and the external ballistic performances of the bullet are significantly improved, in particular in terms of shooting precision, thereby meeting the expectations and/or the requirements of the users, particularly in the field of sports use.

[0057] Moreover, in this way, possible differences of primer ignition performances due to inhomogeneities in the amount of priming charge inserted into the primers at the time of the production thereof can also be compensated for.

[0058] A cartridge in accordance with a first embodiment of the invention, which is globally indicated with the reference number 1, is shown in figures 1-2.

[0059] The cartridge 1 comprises a casing 2 and a primer 3.

[0060] The casing 2 comprises a substantially cylindrical central tubular body 4 having a longitudinal axis X connected at one end to a collar 5 with a lower diameter, through an abutment 6, and connected at the opposite end to a base portion that is to a base 7.

[0061] The tubular body 4 internally defines a chamber 8 adapted to contain, when in use, a propelling charge in the powder, granule or other form (not shown) which, when ignited by the primer 3, pushes a bullet 9 (shown in dotted lines) along the barrel of a firearm and therefrom outside towards a target.

[0062] The collar 5 has at the free end an opening through which the bullet 9 is inserted after inserting the powders of the propelling charge into the chamber 8 of the casing 2. In particular, the bullet 9 is kept in place by interference between the surface of the internal wall of the collar 5 and the external surface of the bullet 9. Alternatively, the bullet 9 can be kept in place in the collar 5 of the casing 2 by mechanical crimping (not shown) or other functionally equivalent connection means.

[0063] The wall of the external cylindrical surface of the tubular body 4 of the casing 2 can have an increasing thickness from the end of connection with the collar 5 toward the base 7 so as to provide a greater mechanical strength in close proximity to the base 7 to withstand the deformation or the breaking due to the high pressure generated inside the chamber 8 by the combustion of the propelling charge upon firing.

[0064] The base 7 has, at the free end, a protrusion or little collar 10 delimited by a circumferentially-extending groove 11 which acts as a grip for the firearm extractor. Moreover, the base 7 has a recess 12 which is substantially cylindrical and central with respect to the above longitudinal axis X of the casing 2, the recess 12 being open towards the free end of the base 7. The recess 12 forms the accommodation housing for the primer 3.

[0065] Moreover, the casing 2 comprises a passageway 13, the so-called flash hole, in the bottom wall 8a of the chamber 8 which puts in fluid communication the chamber 8 adapted to contain the propelling charge with the recess 12 adapted to receive the primer 3.

[0066] The casing 2 can be made of an appropriate metal material, particularly brass.

[0067] With particular reference to Figure 3, the primer 3 comprises a cap 14, which is shaped like a substantially cylindrical cup, comprising a bottom 15 and lateral walls 16 terminating in an open upper end. A cavity 17 is present inside the cap 14, which is adapted to contain a priming charge 18 and an anvil 19.

[0068] The anvil 19 comprises a head 20 and three substantially equally spaced feet 21, extending from the head 19 towards the open end of the cap 14.

[0069] The priming charge 18 is arranged in the cavity

17 of the cap 14 in the gap between the head 20 of the anvil 19 and the internal wall of the bottom 15 of the cap 14.

[0070] The cap 14 of the primer 3 has a cylindrical shape which is substantially complementary to the one of the recess 12 of the base 7 so as to be arranged inside the recess 12 during the assembling of the cartridge 1 and kept substantially by pressure against the internal lateral walls of the above recess 12.

[0071] In accordance with the present invention, the cartridge 1 comprises a breaking element arranged between the chamber 8 of the casing 2 and the primer 3 so that said chamber 8 and said primer 3 are substantially isolated from each other. In the present embodiment, the breaking element consists of a disc-shaped membrane 22 having a greater diameter than the one of the flash hole 13, in particular a diameter which is substantially equal to the transverse extension (diameter) of the recess 12 with respect to the longitudinal axis X of the casing 2.

[0072] In more detail, in the present embodiment, the membrane 22 is arranged in the recess 12 of the base 7 between the chamber 8 adapted to contain the propelling charge and the primer 3 so as to close, preferably seal, the flash hole 13.

[0073] This can be performed, for example, during the assembling of the cartridge 1, by arranging to insert first the breaking membrane 22 into the recess 12 so as to put it in abutment against the external surface of the bottom wall 8a of the chamber 8 and to insert then by pressure the cap 14 of the primer 3 in the recess 12 abutting against the breaking membrane 22.

[0074] Alternatively, the membrane 22 can be previously fixed to the bottom wall 8a of the chamber 8 on the external surface thereof facing the recess 12 or on the internal surface (bottom) thereof facing the inside of the chamber 8.

[0075] The fixing can be performed by any means being conventional per se which is suitable for this purpose, for example by crimping, welding, application of adhesives, pressure, plastic deformation, jointing, screwing.

[0076] In the above alternative, the application and/or fixing of the membrane 22 allows to close, preferably seal, the flash hole 13, thereby isolating the chamber 8 adapted to contain the propelling charge and the primer 3 arranged in the recess 12 from each other.

[0077] According to yet another alternative, the membrane 22 can be instead fixed to the cap 14 in close proximity to or at the open end thereof so as to act as a lid thereof and close, preferably seal, the cavity 15 of the cap 14. The fixing can be performed by any means being conventional per se which is suitable for this purpose, for example by fixing the ends of the membrane 22 to the edges of the lateral walls 16 of the cap 14 by crimping, welding, application of adhesives, pressure, interference, jointing.

[0078] In this way, this allows to close, preferably seal, the cap 14 of the primer 3, thereby isolating the chamber 8 adapted to contain the propelling charge and the primer 3 arranged in the recess 12 from each other.

[0079] Firearm cartridges and related casing and primer according to other embodiments of the present invention are described in figures 4-11.

[0080] The elements of the cartridges of the embodiments of Figures 4-11 which are structurally and/or functionally equivalent to corresponding elements of the above-described cartridge 1 of Figures 1-3 will be given the same reference numbers of the latter. Moreover, these elements will not be further described for the sake of conciseness.

[0081] A cartridge according to another embodiment of the invention is shown in figures 4-5, the cartridge being globally indicated with the reference number 40.

[0082] The cartridge 40 comprises a casing 2 and a primer 3 as previously described in connection with the cartridge 1, and a breaking element arranged between the chamber 8 of the casing 2 and the primer 3 so that said chamber 8 and said primer 3 are substantially isolated from each other. In the present embodiment, the breaking element consists of a membrane 42 which is shaped like a substantially cylindrical overturned skirt or cup having such a size as to cover above and at least partially laterally (externally) the cap 14 of the primer 3.

[0083] In more detail, in the present embodiment, the membrane 42 comprises a top wall 43 and descending lateral walls 44, it has a transverse extension (external diameter) which is substantially equal to the diameter of the recess 12 of the casing 2 and it has an internal diameter between the lateral walls 44 which is slightly greater than the external diameter of the cap 14 of the primer. In this way, when assembling the cartridge 40, the membrane 42 can be arranged by way of lid on the cap 14 of the primer, with the top wall 43 which covers the open end of the cap 14 and the lateral walls 44 which at least partially laterally cover the lateral walls 16 of the cap 14 preferably abutting against the latter, so as to close and isolate the primer 3 containing the priming charge 18.

[0084] The resulting assembly comprising the primer 3 and the respective lid consisting of the membrane 42 can thus be applied in the recess 12 of the casing with the lateral walls 44 of the membrane 42 which, under the insertion push, abut by pressure against the lateral walls of the recess 12, thereby allowing to keep the assembly in place and to isolate, preferably seal, the chamber 8 adapted to contain the propelling charge and the primer 3 from each other.

[0085] Alternatively, the same result can be achieved by applying first the membrane 42 inside the recess 12 of the casing 2 and then by applying by pressure the cap 14 of the primer 3 in the gap between the lateral walls 44 of the membrane 42.

[0086] A cartridge according to another embodiment of the invention is shown in figures 6-7, the cartridge being globally indicated with the reference number 50.

[0087] The cartridge 50 differs from the above-described cartridge 40 of Figures 4-5 in that the membrane

42 which is shaped like a substantially cylindrical overturned skirt or cup has a transverse extension (external diameter) which is substantially equal or slightly lower than the internal diameter of the cap 14 of the primer 3, so as to be inserted, preferably by friction, into the cap 14 to close, preferably seal, it.

[0088] In this way, the resulting assembly comprising the cap 14 of the primer and the respective closing lid consisting of the membrane 42 arranged internally can be applied in the recess 12 of the casing with the lateral walls 16 of the cap 14 which, under the insertion push, abut by pressure against the lateral walls of the recess 12 and the upper part 43 of the membrane 42 which occludes the flash hole 13, thereby allowing to keep the assembly in place and to isolate, preferably seal, the chamber 8 adapted to contain the propelling charge and the primer 3 from each other.

[0089] It should be noted that in the above-described embodiments, the cap 14 of the primer can contain the anvil 19 (as shown in figures 1-7) or it can also be devoid of the anvil.

[0090] A cartridge according to a further embodiment of the invention is shown in figures 8-9, which is globally indicated with the reference number 60.

[0091] The cartridge 60 comprises a casing 2 and a primer 3 as previously described in connection with the cartridge 1, and a breaking element arranged between the chamber 8 of the casing 2 and the primer 3 so that said chamber 8 and said primer 3 are substantially isolated from each other. In the present embodiment, the breaking element consists of a substantially cylindrical pin 62 having a diameter which is substantially equal to the one of the flash hole 13.

[0092] In the present embodiment, the pin 62 is fixed to the casing 2 at the flash hole 13 so as to close it and thereby isolate the chamber 8 adapted to contain the propelling charge and the primer 3 inserted into the recess 12 from each other.

[0093] The fixing can be performed by any means being conventional per se which is suitable for this purpose, such as the above-indicated ones.

[0094] In a further alternative embodiment of the present invention shown in Figure 10, the breaking element of the cartridge now globally indicated with the number 70 can also be not an additional element but consist, for example, of a projection (or pin) 62 formed integrally with the anvil 19 of the primer 3 which, upon insertion of the primer 3 into the appropriate housing of the casing 2, occludes the flash hole so as to separate the primer 3 containing the priming charge from the chamber 8 of the casing containing the propelling charge and isolate them from each other fulfilling at the same time its function of promoting the detonation of the priming charge upon firing.

[0095] The projection 62 of the primer 19 can be possibly fixed to the casing 2 so that it closes, preferably seals, the flash hole 13.

[0096] The fixing (sealing) can be performed in any way and with any material, for example the anvil 19 can be locked with the projection 62 thereof on the flash hole 13 by gluing, pressing and other systems which are appropriate for achieving the above object.

[0097] In a further alternative embodiment of the present invention illustrated in Figure 11, in the cartridge now globally indicated with the number 80, the primer 3 containing the priming charge 18 can be sealed with a sealant consisting of an anvil 19 equipped with a projection 62 which occludes the flash hole 13 after the ignition of the primer. More in particular, upon ignition of the primer, the projection 62 of the anvil is pushed on the flash hole by the pressure of the generated gases and with increasing pressure it collapses, letting the ignition pass to the chamber 8 of the cartridge.

[0098] Alternatively, the anvil 19 equipped with the projection 62 can be fixed to the casing 2, upon insertion of the primer 3 in the appropriate housing of the casing 2, so that the projection 62 closes, preferably seals, the flash hole 13 so as to separate the primer 3 containing the priming charge from the chamber 8 of the casing containing the propelling charge and isolating them from each other.

[0099] The fixing (sealing) can be performed in any way and with any material, for example the anvil 19 can be locked with the projection 62 thereof on the flash hole 13 by gluing, pressing and other systems which are suitable for achieving the above object.

[0100] Concerning the operation of the cartridge of the invention, it should be stated that, upon firing, the pressure of the trigger of the firearm releases the firing pin, which in turn deforms the surface of the primer cap in the direction of the anvil head. This causes the detonation of the priming charge located between the cap and the anvil and consequently the release of detonation products (high-temperature gases, sparkling particles and flames) which involve an increasing rise in pressure. Unlike known cartridges in which the detonation products are left free to immediately pass through the flash hole so as to access the chamber containing the propelling charge provoking the ignition thereof, in the present invention the detonation products enter the chamber containing the propelling charge passing through the flash hole after perforating the breaking element, which occurs upon reaching or exceeding a preset breaking pressure in that element.

[0101] In this way, the detonation products directly spread along the whole chamber of the casing with an appropriate pressure thereby obtaining a more homogeneous ignition of the propelling charge and consequently a smoother internal and external ballistic behaviour of the bullet, which results in a greater shooting precision.

[0102] Besides the above-described features and advantages, it should be noted that the present invention does not involve substantial modifications of the shape and functional features of the casing and primer which, therefore, can be made advantageously according to the currently used production standards.

[0103] Moreover, the present invention can be advantageously used also in the field of the preparation of reconstructed cartridges obtained by recharging casings recovered after use with a new dose of propelling charge. In this casing, in fact, it is sufficient to provide during the assembling, besides a new primer, also a breaking element according to the above-described modes, in particular a separated breaking element to be interposed between the chamber of the casing containing the propelling charge and the primer to be inserted in the recess or a preset breaking element to the primer to be inserted in the recess.

[0104] The present invention is also useful in the case of use of so-called leadless, non-toxic, metal-free exploding priming materials, or in the casing of exploding priming materials, where a confined space is required in order to allow the effect and/or maximize the effectiveness of said exploding material.

[0105] Moreover, the present invention also allows the use of primers without anvil through the use of different primer explosives and a primer sealing.

[0106] In fact, as it can be easily inferred by observing a used primer, the firing pin determines such a deformation that reduces the internal volume of the primer cap. By proceeding with the appropriate sealing of the primer a given and confined space is created, where a percussion creates a significant volume reduction with subsequent instant increase in pressure and temperature.

[0107] Thus, by using a suitable exploding material in a sufficient amount or even up to completely filling the primer cap, the presence of the anvil can be deleted. Among the various materials that can be used, piezoelectric ceramic crystals are mentioned by way of non-limiting example.

[0108] Moreover, the present invention allows the use inside the primer, of explosive materials in the liquid form and/or in the gaseous form.

[0109] The breaking element covered by the present invention has particular advantages also in the casing of subsonic or so-called depowered ammunition, since in said ammunition the volume occupied by the propelling charge is considerably lower than the internal volume of the casing, and a controlled primer allows to reach in a more optimum way the powder wherever it is inside the casing.

[0110] It is known to the internal ballistics that the pressure generated by the single primer is sufficient to engage the bullet into the rifling of the barrel, it will be then the propelling charge to continue the path inside the barrel, as a result a more controlled primer allows a greater repeatability of the same engagement.

[0111] A person skilled in the art will be allowed to bring several modifications and variations to the cartridge, casing and primer according to the invention, all however falling within the scope of protection of the attached claims.

Claims

1. Firearm cartridge (1;40;50;60;70;80) comprising a primer (3) adapted to contain a priming charge (18) and a casing (2) comprising a chamber (8) adapted to contain a propelling charge in communication with a housing (12) adapted to receive the above primer (3), the cartridge (1;40;60) being **characterized in that** said chamber (8) of the casing and said primer (3) or said priming charge are isolated from each other by interposing a breaking element (22;42;62) therebetween.

2. Cartridge (1;40;50;60;70;80) according to claim 1, wherein said breaking element (22;42;62) is made of a material which is able to break or be perforated when undergoing a pressure which is equal or higher than a threshold value of the pressure generated by gases released by the ignition of the primer (3) upon firing.

3. Cartridge (1;40;50;60;70;80) according to claim 1 or 2, wherein said primer (3) comprises a cap (14) having a cavity (15) adapted to contain said priming charge (18) and optionally an anvil (19) arranged in said cavity (15).

4. Cartridge (1;40;50;60;70;80) according to any one of the previous claims, wherein said casing (3) comprises a tubular body (4) having an open end for inserting and keeping a bullet (9) in place and said chamber (8) adapted to contain a propelling charge, and a base portion (7) located at the opposite end of said tubular body (4), said base portion (7) having a recess (12) forming said housing for receiving the primer (3), a flash hole (13) being moreover provided between said chamber (8) of the tubular body (4) and said recess (12).

5. Cartridge (1;40;50) according to any one of the previous claims, wherein said breaking element comprises a membrane (22;42) applied on said cap (14) of the primer (3) or containing said primer (3) so as to close, preferably seal, said primer (3).

6. Cartridge (1;40) according to claim 4, wherein said breaking element comprises a membrane (22;42) applied in said housing or recess (12) between said chamber (8) adapted to contain a propelling charge and said primer (3) so as to close said flash hole (13).

7. Cartridge (1;40) according to claim 4, wherein said chamber (8) adapted to contain a propelling charge has a bottom (8a) in communication with said recess (12) through said flash hole (13) and said breaking element comprises a membrane (22;42) fixed in said recess (12) on the external surface of said bottom (8a) or fixed on the internal surface of said bottom

(8a) so as to close, preferably seal, said flash hole (13).

8. Cartridge (60) according to claim 4, wherein said breaking element comprises a pin (62) fixed to said casing (2) at said flash hole (13) so as to close, preferably seal, said flash hole (13).

9. Cartridge (70) according to claim 4, wherein said breaking element comprises a pin or projection (62) formed integrally with said anvil (19) which, with the insertion of said primer (3) in said housing or recess (12), occludes said flash hole (13).

10. Cartridge (80) according to claim 4, wherein said breaking element comprises a pin or projection (62) formed integrally with said anvil (19) which, when in use, with the ignition of said primer, is able to occlude said flash hole (13) by breaking upon exceeding said threshold value of the pressure generated by gases released by the ignition of the primer (3).

11. Cartridge (1;40;50;60;70;80) according to any one of the previous claims, wherein said breaking element (22;42;62) has a thickness comprised between 0.05 mm and 1 mm, preferably between 0.1 mm and 0.3 mm.

12. Cartridge (1;40;50;60;70;80) according to any one of the previous claims, wherein said breaking element (22;42;62) is a single layer or a multilayer made of a metal material, a non-metal material, a polymer material or a combination thereof.

13. Firearm casing (2) comprising a chamber (8) adapted to contain a propelling charge (or propellant), a housing (12) adapted to receive a primer (3) and a flash hole (13) between said chamber (8) adapted to contain the propelling charge and said housing (12), the casing (3) being **characterized in that** it further comprises a breaking element (22;42;62) applied so as to close, preferably seal, said flash hole (13) so as to isolate said chamber (8) adapted to contain the propelling charge from said housing (12) adapted to receive said primer (3).

14. Casing (2) according to claim 13, wherein said chamber (8) adapted to contain the propelling charge has a bottom (8a) in communication with said housing (12) through said flash hole (13) and said breaking element comprises a membrane (22;42) fixed in said housing (12) on the external surface of said bottom (8a) or fixed on the internal surface of said bottom (8a) so as to close, preferably seal, said flash hole (13).

15. Casing (2) according to claim 13, wherein said breaking element comprises a pin (62) fixed to said casing (2) at said flash hole (13) so as to close, preferably seal, said flash hole (13).

16. Firearm primer (3) comprising a cap (14) having a cavity (15) adapted to contain said priming charge (18) and optionally an anvil (19) arranged in said cavity (15), the primer (13) being **characterized in that** it further comprises a breaking element (22;42) applied on said cap (14) of the primer (3) or containing said primer (3) so as to close, preferably seal, said primer (3).

17. Firearm primer (3) comprising a cap (14) having a cavity (15) adapted to contain said priming charge (18) and an anvil (19) arranged in said cavity (15), the primer (13) being **characterized in that** it further comprises a breaking element (22;42) comprising a pin or projection (62) formed integrally with said anvil (19) adapted to occlude the flash hole (13) of a casing (2) into which said primer (3) is inserted.

18. Firearm primer (3) comprising a cap (14) having a cavity (15) adapted to contain said priming charge (18) and an anvil (19) arranged in said cavity (15), the primer (13) being **characterized in that** it further comprises a breaking element (22;42) comprising a pin or projection (62) formed integrally with said anvil (19) which, when in use, with the ignition of said primer (3), is able of occlude the flash hole (13) of a casing (2) into which said primer (3) is inserted.

19. Firearm casing (2) or primer (3) according to any one of claims 13 to 18, wherein said breaking element (22;42;62) is made of a material which is able to break or be perforated when undergoing a pressure which is equal or higher than a threshold value of the pressure generated by gases released by the ignition of the primer upon firing.

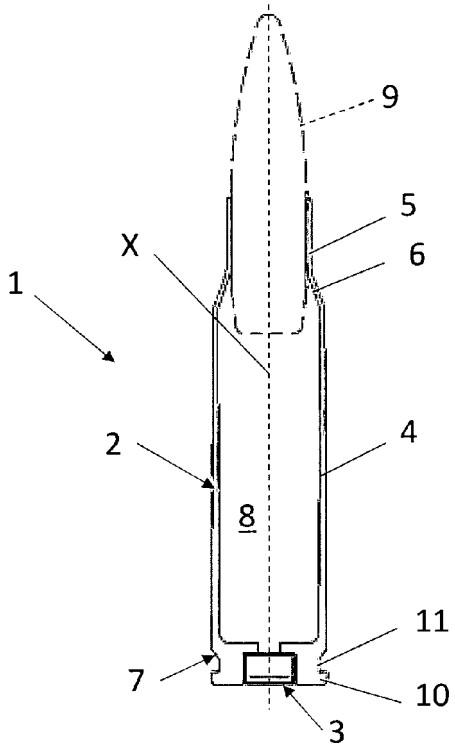

Fig. 1

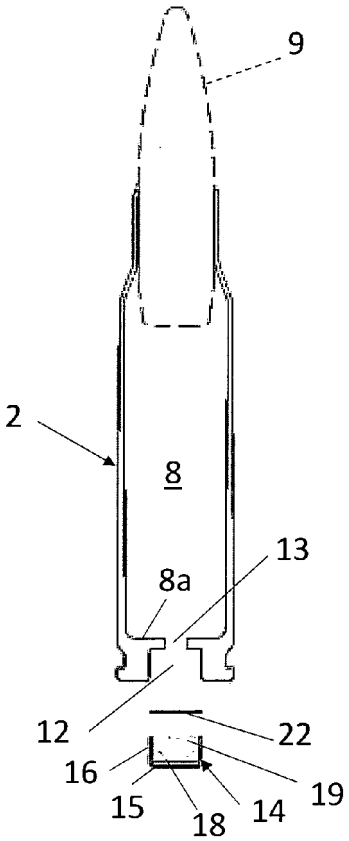

Fig. 2

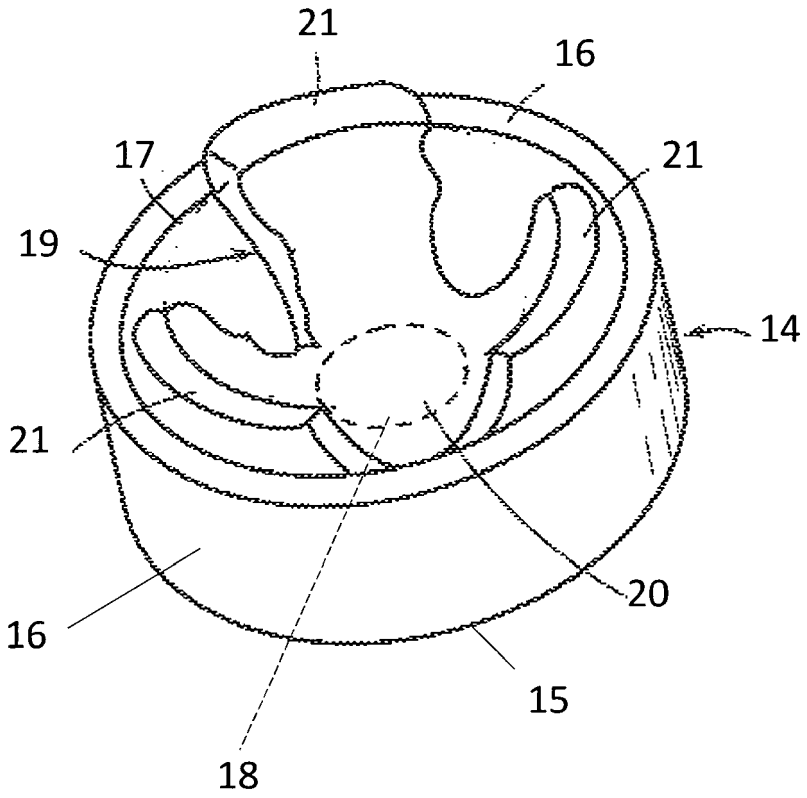

Fig. 3

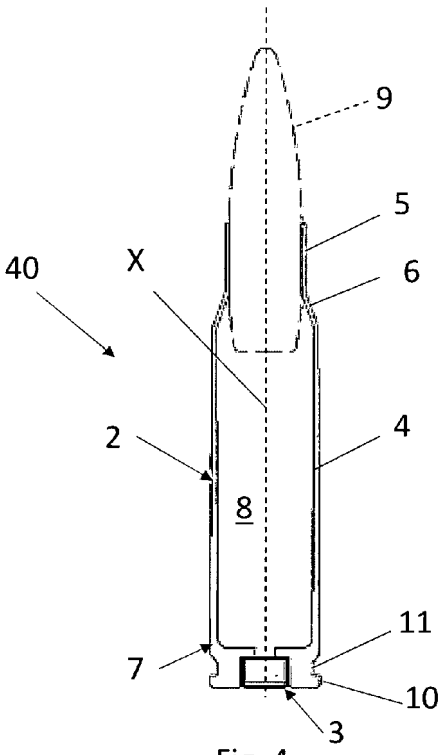

Fig. 4

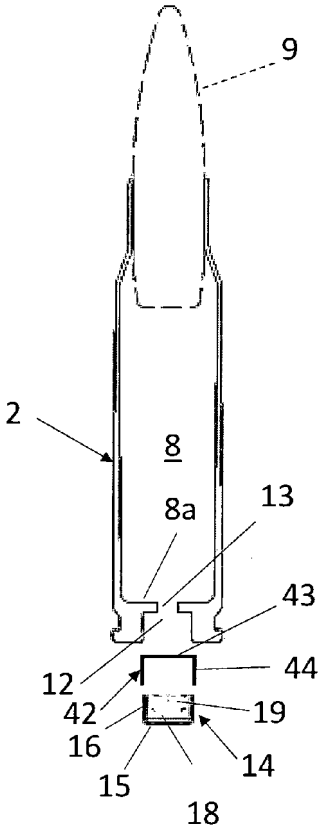

Fig. 5

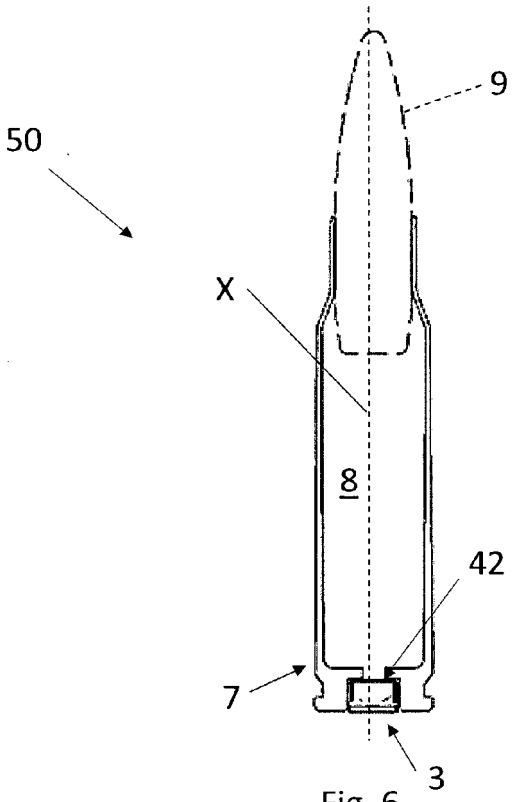

Fig. 6

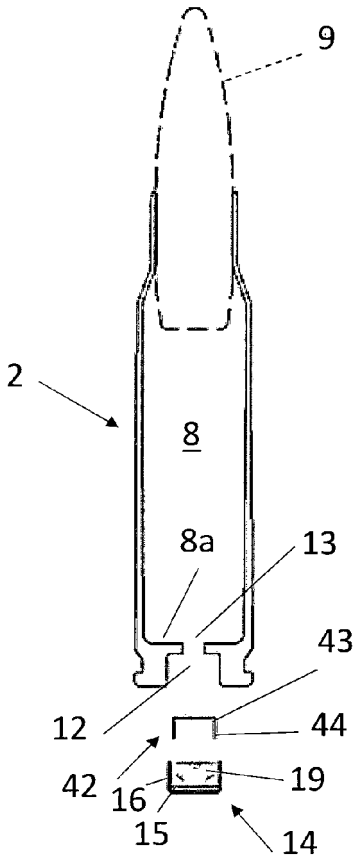

Fig. 7

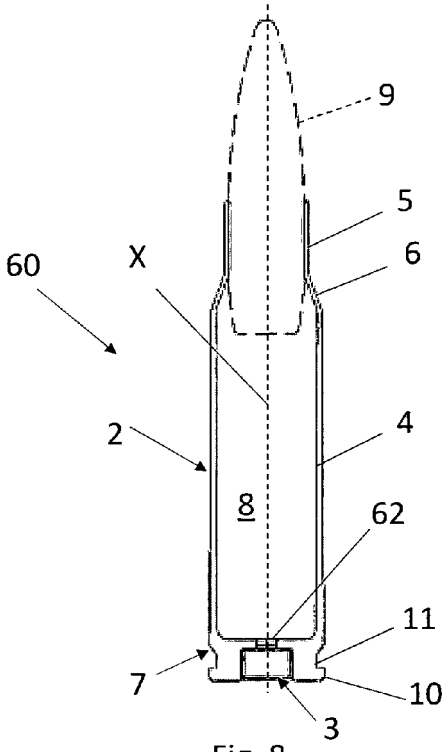

Fig. 8

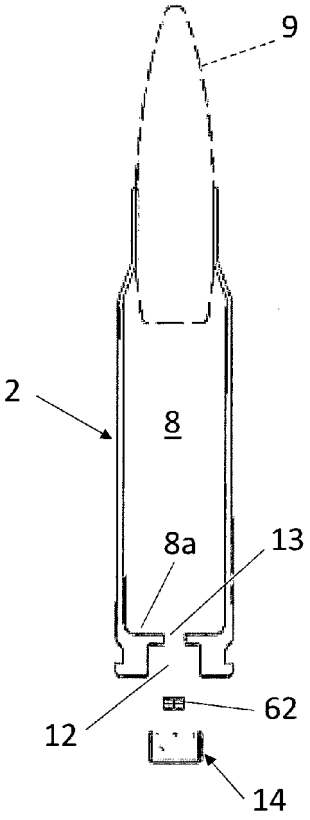

Fig. 9

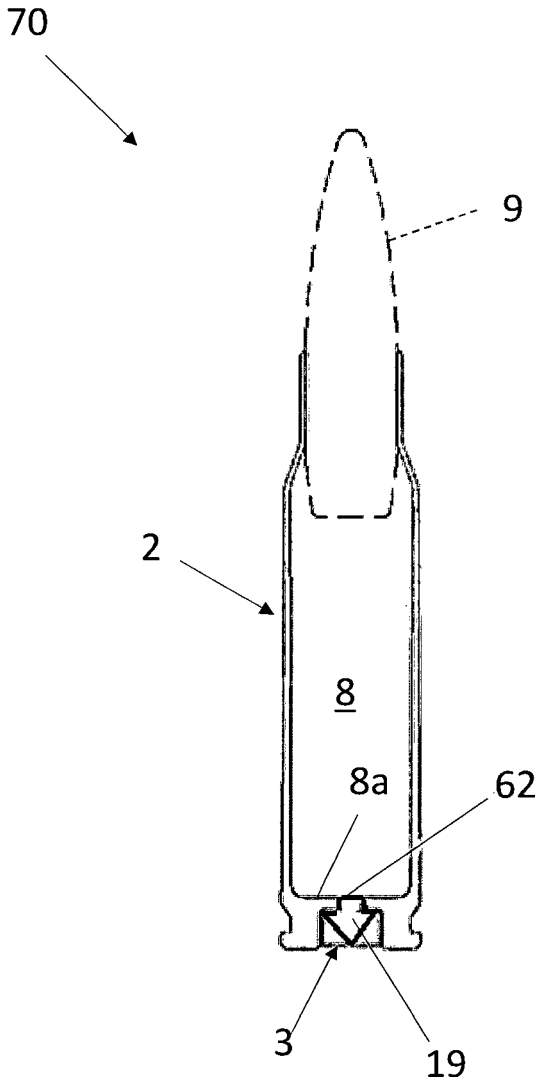

Fig. 10

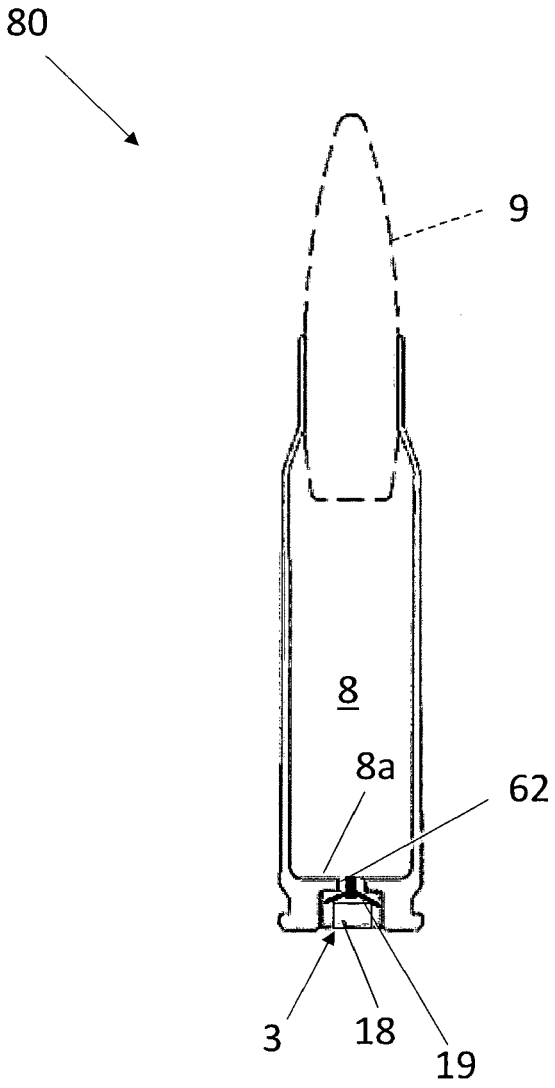

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 22 42 5023

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 November 2022	Beaufumé, Cédric

CATEGORY OF CITED DOCUMENTS

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