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(54) DISK-SHAPED SABOT

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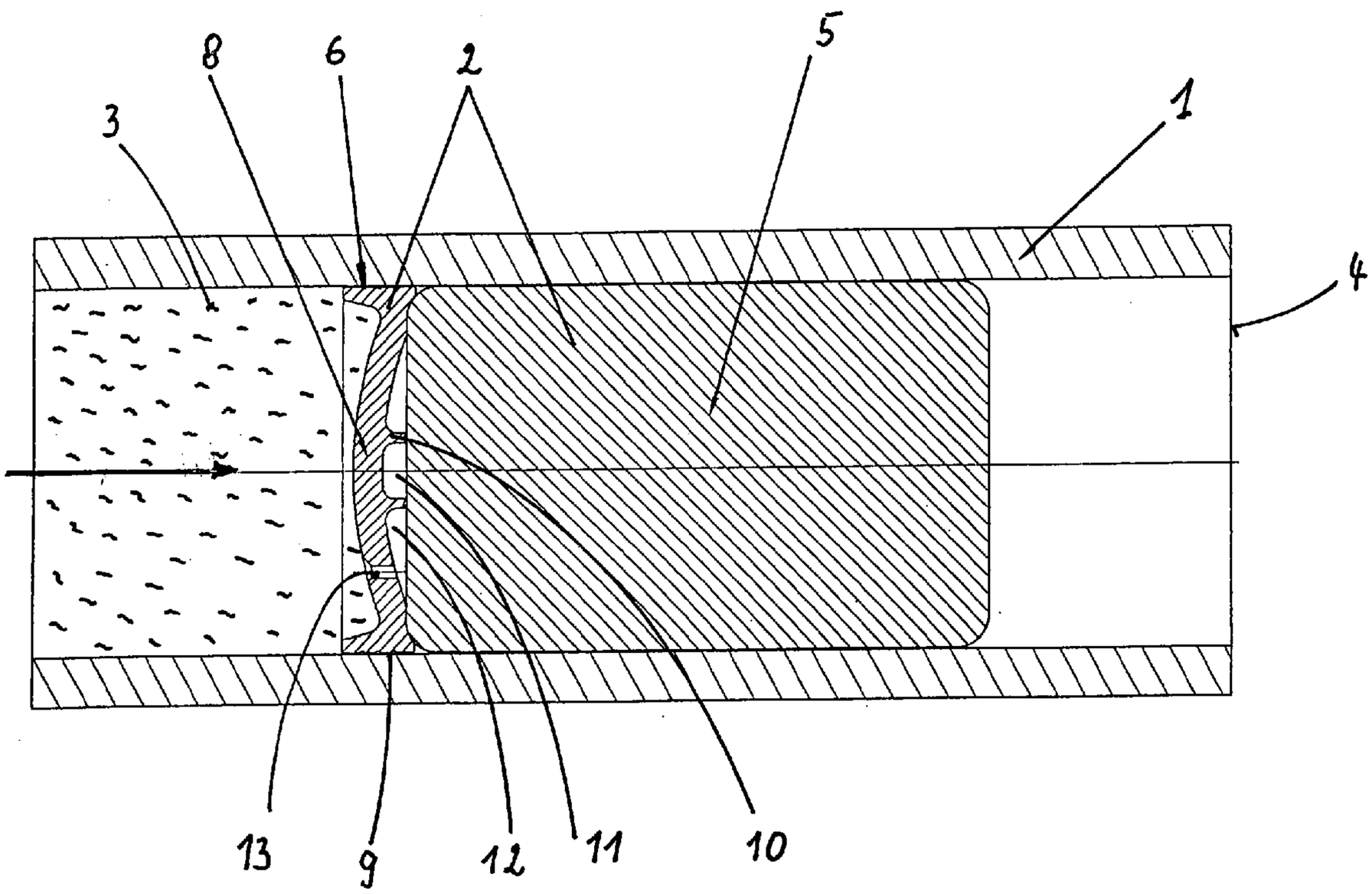
(57) **ABSTRACT**

A disk-shaped sabot is provided for accelerating a projectile body fired from a smoothbore barrel, the projectile body having the same caliber as the barrel. The sabot is configured so that it is supported only in sections on the rear zone of the projectile body to transmit gas pressure forces impacting the projectile body, at least one cavity remaining between the sabot and the rear of the projectile body. At least one pressure-relieving bore extends through the bottom of the sabot, through which bore propelling gases penetrate the cavity when the projectile unit is fired and produces a defined excess pressure in relation to the outer ambient pressure, which causes the sabot to separate from the projectile body as soon as the projectile unit, consisting of the projectile body and the sabot, passes the muzzle of the barrel and without impairing the further trajectory of the projectile body.



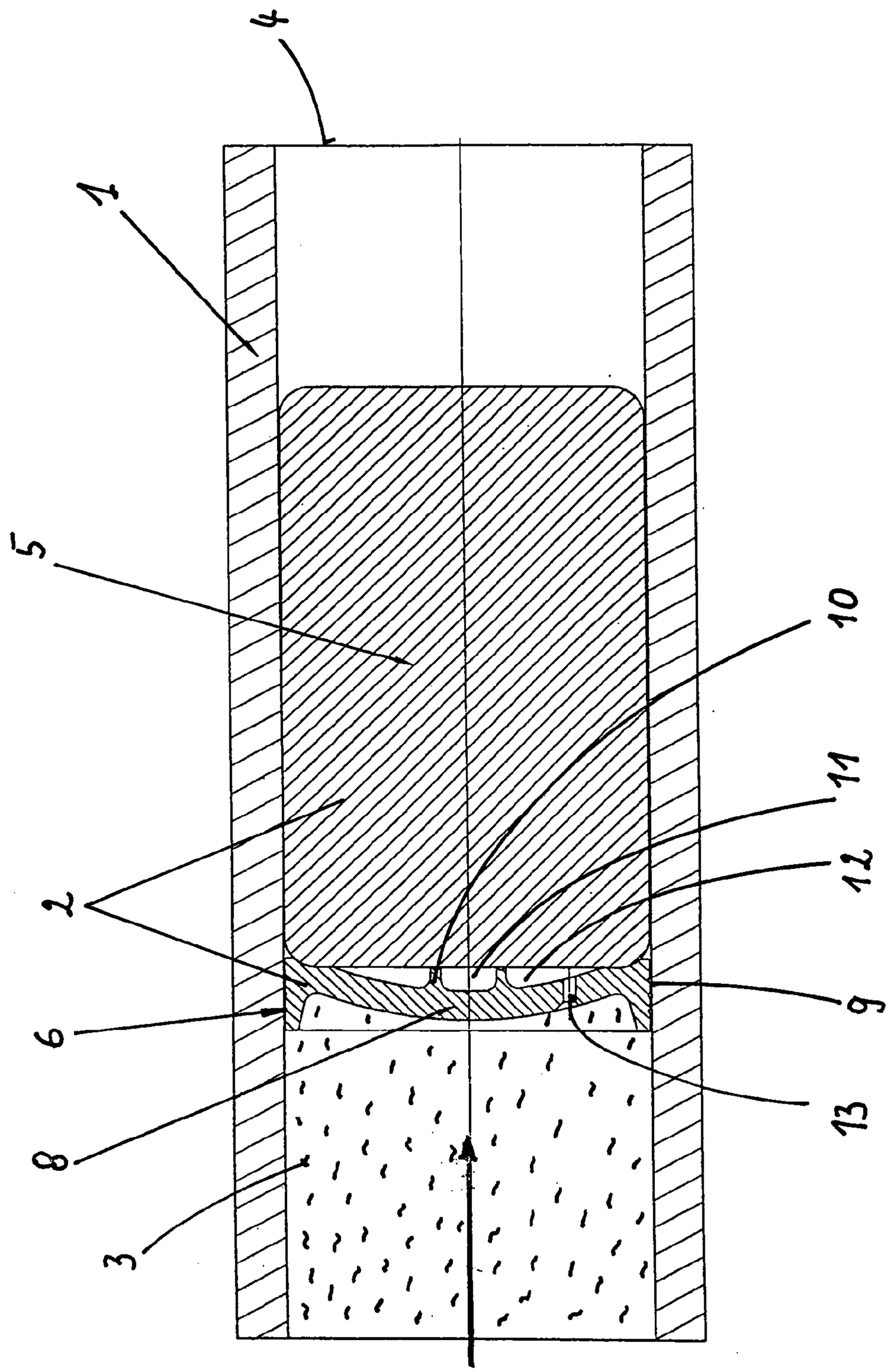


Fig. 1

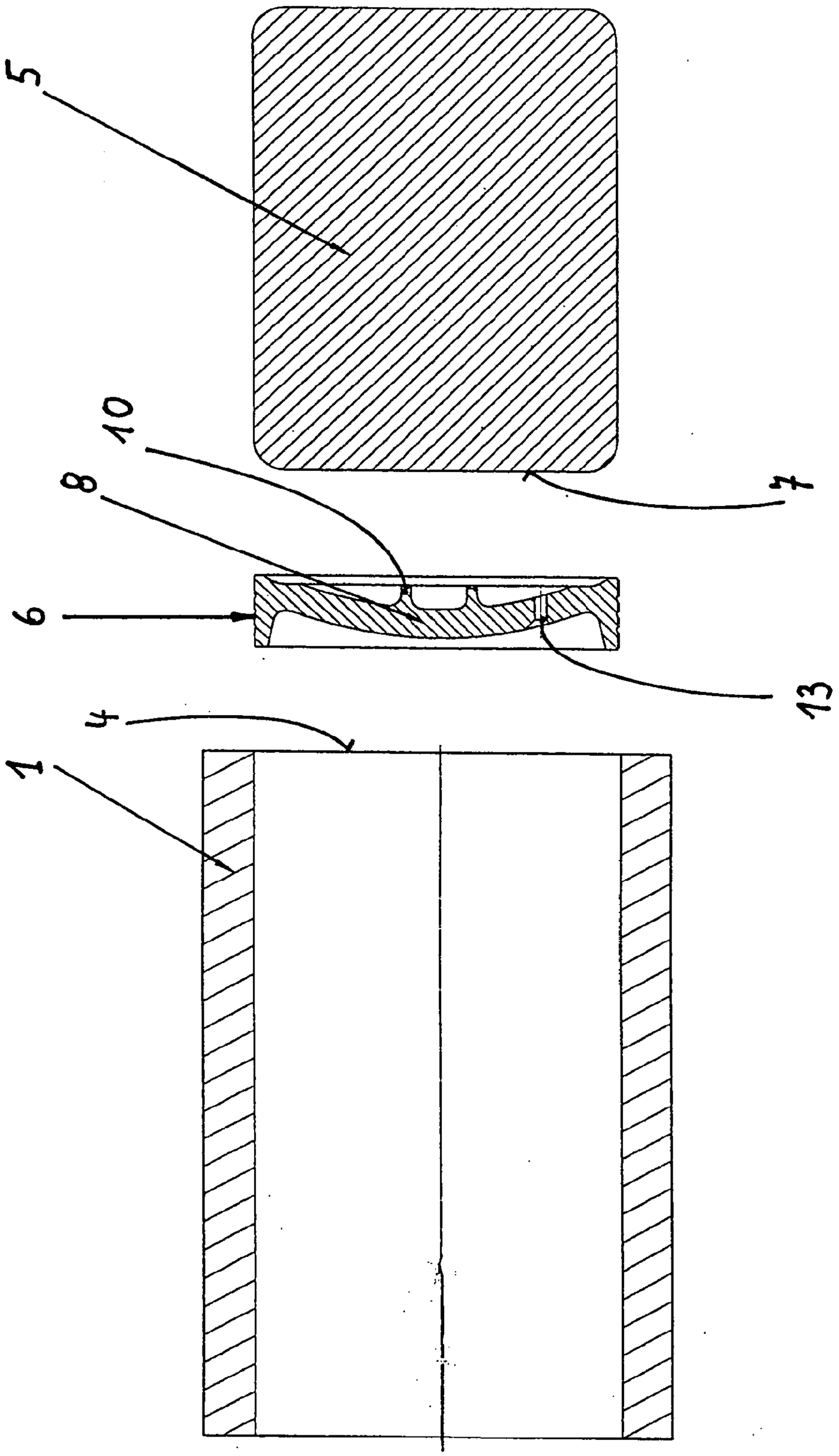


Fig. 2

DISK-SHAPED SABOT

[0001] This is a National Phase Application in the United States of International Patent Application No. PCT/EP2008/005246 filed Jun. 27, 2008, which claims priority on German Patent Application No. DE 10 2007 033 833.5, filed Jul. 18, 2007. The entire disclosures of the above patent applications are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The invention relates to a disk-shaped sabot for accelerating a projectile body that can be fired from a launch tube embodied as a smoothbore barrel, wherein the projectile body preferably has the same caliber as the barrel.

BACKGROUND OF THE INVENTION

[0003] The use of disk-shaped sabots for armor projectiles were known from the Rheinmetall GmbH, Düsseldorf document "Waffentechnisches Taschenbuch" [Weapons Manual], 7th edition 1985, page 472 ff. The aim of these known sabots is to achieve a high initial velocity when a projectile embodied sub-caliber is fired and to have, during the further trajectory, a low deceleration. The sabot encloses the respective projectile body at the rear in a positively engaged manner and has an outer diameter corresponding to the caliber of the weapon barrel.

[0004] The disadvantage of the known sabots, i.a., is that at the separation of the sabot from the projectile body, a mechanical influencing of the projectile body frequently takes place, so that the departure of the projectile body is impaired. This applies to twist-stabilized projectiles, in which the sabot is segmented due to the twist and the sabot cage segments are then ejected laterally, as well as to sabot projectiles shot from a smoothbore cannon, in which, as a rule, the sabot is segmented through ram air forces and ejected backwards. In both cases, this may cause the projectile body to wobble, which must be compensated for during the further flight of the respective projectile body, for instance, through a compensating twist.

[0005] The object of the invention is to provide a sabot for accelerating a projectile body that can be fired from a smoothbore barrel, wherein the projectile body preferably has the same caliber as the barrel, and wherein the sabot separates from the projectile body immediately after passage of the muzzle of the respective barrel without considerably impairing the trajectory of the projectile body.

SUMMARY OF THE INVENTION

[0006] This object is achieved according to the invention by the features of first embodiment, which pertains to a disk-shaped sabot for accelerating a projectile body (**5**) that can be fired from a launch tube (**1**), embodied as a smoothbore barrel, wherein the projectile body preferably has the same caliber as the barrel, with the features: (a) the sabot (**6**) has an outer diameter that corresponds to the caliber of the barrel (**1**); (b) the sabot (**6**) is embodied in such a manner that for transmission of the gas pressure forces impacting the projectile body (**5**) occurring during the firing, it is supported only in sections at the projectile body (**5**), in such a way that at least one cavity (**11**, **12**) remains between the sabot (**6**) and the rear (**7**) of the projectile body (**5**); and (c) at least one pressure-relieving bore (**13**) extends through the bottom (**8**) of the sabot (**6**) opposite the rear (**7**) of the projectile body (**5**), through which bore propelling gases (**3**) penetrate the cavity (**11**, **12**) between the sabot (**6**) and the rear (**7**) of the projectile body (**5**) in a controlled manner when the projectile unit (**2**) is fired and produces a defined excess pressure in relation to the outer ambient air pressure, which excess pressure causes the sabot (**6**) to separate from the projectile body (**5**) as soon as the projectile unit (**2**) comprising projectile body (**5**) and sabot (**6**) has passed the muzzle (**4**) of the barrel (**1**). The subordinate embodiments disclose further, particularly advantageous, features in accordance with the present invention.

[0007] More particularly, in accordance with a second embodiment of the invention, the first embodiment is modified so that the cavity (**11**, **12**) between the sabot (**6**) and the projectile body (**5**) is arranged in such a way that after the projectile unit (**2**) has passed the muzzle (**4**), a uniform separation of sabot (**6**) and projectile body (**5**) is ensured. In accordance with a third embodiment of the invention, the second embodiment is further modified so that the cavity (**11**, **12**) arranged between the sabot (**6**) and the rear (**7**) of the projectile body (**5**) encloses the central longitudinal axis of the projectile unit (**2**) centrally and/or in a ring-shaped manner. In accordance with a fourth embodiment of the invention, the first embodiment, the second embodiment and the third embodiment are further modified so that the sabot (**6**) is embodied plate-shaped with an outwardly domed bottom (**8**) in relation to the rear of the projectile body, wherein the bottom (**8**) is supported at the outer edge (**9**) on the projectile body (**5**). In accordance with a fifth embodiment of the invention, the fourth embodiment is further modified so that the sabot (**6**) is supported also in the central area of the projectile body (**5**) via at least one support web (**10**) at the rear (**7**) of the projectile body (**5**). In accordance with a sixth embodiment of the present invention, the fifth embodiment is further modified so that the support web (**10**) is embodied ring-shaped. In accordance with a seventh embodiment of the present invention, the first embodiment, the second embodiment, the third embodiment, the fourth embodiment, the fifth embodiment, and the sixth embodiment are further modified so that the sabot (**6**) is embodied to be one-piece. In accordance with an eighth embodiment of the invention, the first embodiment, the second embodiment, the third embodiment, the fourth embodiment, the fifth embodiment, the sixth embodiment, and the seventh embodiment are further modified so that the sabot (**6**) is made of a light metal, preferably an aluminum alloy.

[0008] The invention is essentially based on the idea that a sabot at the rear of the projectile, and preferably one-piece, is activated as a result of a pressure difference derived and metered in a controlled manner during passage of the barrel, wherein the sabot is enclosed between the inner contour of the sabot at the rear of the projectile and the rear of the projectile in such a way that, as a result of the standard physical effects after passage of the muzzle, this pressure level, like an expanded air spring, spontaneously induces the separation of projectile and sabot in as contactless a manner as possible.

[0009] To this end, the sabot is embodied (i.e., includes a body) in such a way that, for transmission of the gas pressure forces impacting the projectile body occurring during the firing, it is supported only in sections at the rear zone of the projectile body in such a way that at least one cavity remains between the sabot and the rear of the projectile body, and that at least one pressure-relieving bore extends through the wall

of the sabot, through which bore propelling gases penetrate the cavity between the sabot and the rear of the projectile body when the projectile unit is fired and produces a defined excess pressure in relation to the outer ambient air pressure, which excess pressure causes the sabot to separate from the projectile body as soon as the projectile unit, comprising projectile body and sabot, has passed the muzzle of the barrel.

[0010] This separation of the sabot from the projectile body takes place almost without any mechanical interaction between the sabot and the projectile body and, thus, minimizes a departure impairment.

[0011] The cavity between the sabot body and projectile body should preferably be arranged in such a way that, after the projectile unit has passed the muzzle, a uniform separation of sabot and projectile body is ensured. To this end, the cavity arranged between the sabot and the rear of the projectile body can enclose the central longitudinal axis of the projectile unit centrally and/or in a ring-shaped manner.

[0012] In an advantageous form of embodiment of the invention, the sabot is embodied as plate-shaped with an outwardly domed bottom in relation to the rear of the projectile body, wherein the bottom is supported at the outer edge on the projectile body and is supported in the central area of the projectile body via a ring-shaped support web at the rear of the projectile body. The support web is selected thereby so that the force is introduced in the areas of the projectile body that also withstand the firing loads during passage through the barrel.

[0013] The sabot is preferably made of a light metal, preferably an aluminum alloy.

[0014] With this solution principle, in accordance with the present invention, comparatively fragile sub-groups of cargo projectiles can be fired securely from a smoothbore cannon of corresponding caliber. The fragility does not have an unfavorable effect thereby.

[0015] Further details and advantages of the invention are revealed by the following exemplary embodiments explained based on the Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The drawings show:

[0017] FIG. **1** The longitudinal section through a part of a barrel with a projectile unit comprising a projectile body and a sabot, which unit moves towards the muzzle of the barrel; and

[0018] FIG. **2** The projectile unit shown in FIG. **1** after leaving the barrel.

DETAILED DESCRIPTION OF THE INVENTION

[0019] In FIG. **1**, **1** designates a barrel of a smoothbore weapon (e.g., a mortar) in which a projectile unit **2** is situated that, after ignition of a propelling charge (not shown), moves towards the muzzle **4** of the barrel **1** due to the high-pressure propelling charge gases **3** produced by igniting the propelling charge. The projectile unit **2** is composed of a full-caliber projectile body **5** and a plate-shaped sabot **6**, which, according to the invention, is made of an aluminum alloy, and the sabot is arranged at the rear of the projectile body **5** and, likewise, has an outer diameter that corresponds to the caliber of the barrel **1**.

[0020] The projectile body **5** shown is not a hostile projectile, but, for example, is the assembly of a rocket whose firing strength is to be tested. The projectile body **5** is hereby shown simplified only as a solid body. However, it can, of course, also be a hollow body, for example, to accept control electronics, fuel or propelling charge powder, etc.

[0021] The one-piece plate-shaped sabot **6** has a body comprising an outwardly domed bottom **8** in relation to the rear **7** of the projectile body **5**, wherein the bottom **8** is supported at the outer edge **9** and in the central area of the projectile body **5** via a ring-shaped support web **10** at the rear **7** of the projectile body **5** so that, between the rear **7** of the projectile body **5** and the sabot **6**, a central cavity **11** and a ring-shaped cavity **12** that surrounds the ring-shaped support web **10** is formed. A pressure-relieving bore **13** extends through the bottom **8** of the sabot **6**, through which bore the propelling charge gases **3** released when the projectile unit **2** is fired penetrate first, the ring-shaped cavity **12**, and then also the central cavity **11** in a controlled manner via an opening, not shown in FIG. **1**, so that a defined excess pressure in relation to the outer ambient air pressure is produced in the cavities **11**, **12**.

[0022] Therefore, as soon as the projectile unit **2** has passed the muzzle **4** of the barrel **1** (FIG. **2**) and the pressure of the propelling charge gases **3** acting on the sabot **6** at the rear declines, the pre-pressurized propelling charge gases in the cavities **11**, **12** expand and, due to the different mass ratio between the (light) sabot **6** and the (heavy) projectile body **5**, force the sabot **6** backwards away from the projectile body **5**, without this resulting in a considerable mechanical influence of the projectile body **5** through the sabot **6**. Thus, the sabot **6** is light compared to the heavy projectile body **5**.

[0023] Of course, the invention is not limited to the exemplary embodiment described above. Thus, it is not essential for the barrel to be a weapon barrel; it can also be a launch tube produced specifically for test purposes. Instead of a propelling charge, the propelling gases can also be made available through a different gas generator (e.g., a nitrogen gas source).

REFERENCE LIST

[0024] **1** Launch tube, weapon barrel
[0025] **2** Projectile unit
[0026] **3** Propelling gases, propelling charge gases
[0027] **4** Muzzle
[0028] **5** Projectile body
[0029] **6** Sabot
[0030] **7** Rear
[0031] **8** Bottom
[0032] **9** Outer edge
[0033] **10** Support web
[0034] **11** (Central) cavity
[0035] **12** (Ring-shaped) cavity
[0036] **13** Pressure-relieving bore

1. A disk-shaped sabot for accelerating a projectile body that can be fired from a launch tube embodied as a smoothbore barrel having a caliber and a muzzle, wherein the projectile body has the same caliber as the barrel, wherein the sabot comprises:

(a) an outer diameter that corresponds to the caliber of the barrel;

(b) a body configured to transmit gas pressure forces impacting the projectile body during firing when the projectile body and the sabot form a projectile unit, wherein the body of the sabot is supported only in sections at the projectile body so that at least one cavity remains between the sabot and a rear of the projectile

body when the sabot and the projectile body are disposed to form the projectile unit; and

(c) at least one pressure-relieving bore that extends through a bottom of the body of the sabot opposite the rear of the projectile body, wherein propelling gases move through the bore so that propelling gases penetrate the at least one cavity between the sabot and the rear of the projectile body in a controlled manner when the projectile unit is fired so that the propelling gases produce a defined excess pressure in relation to outer ambient air pressure, wherein the excess pressure causes the sabot to separate from the projectile body as soon as the projectile unit has passed the muzzle of the barrel.

2. A sabot according to claim **1**, wherein the at least one cavity remaining between the sabot and the projectile body is arranged to ensure that, after the projectile unit has passed the muzzle, the sabot and the projectile body uniformly separate.

3. A sabot according to claim **2**, wherein the at least one cavity arranged between the sabot and the rear of the projectile body encloses a central longitudinal axis of the projectile unit centrally, or in a ring-shaped manner, or both centrally and in a ring-shaped manner.

4. A sabot according to claim **1**, wherein the body of the sabot is plate-shaped with an outwardly domed bottom in relation to the rear of the projectile body, wherein the outwardly domed bottom is supported at an outer edge on the projectile body.

5. A sabot according to claim **4**, wherein the sabot is supported also in a central area of the projectile body via at least one support web at the rear of the projectile body.

6. A sabot according to claim **5**, wherein the support web is ring-shaped.

7. A sabot according to claim **1**, wherein in that the sabot is embodied to be one-piece.

8. A sabot according to claim **1**, wherein the sabot is made of a light metal.

9. A sabot according to claim **2**, wherein the body of the sabot is plate-shaped with an outwardly domed bottom in relation to the rear of the projectile body, wherein the outwardly domed bottom is supported at an outer edge on the projectile body.

10. A sabot according to claim **3**, wherein the body of the sabot is plate-shaped with an outwardly domed bottom in relation to the rear of the projectile body, wherein the outwardly domed bottom is supported at an outer edge on the projectile body.

11. A sabot according to claim **8**, wherein the light metal is an aluminum alloy.

12. A sabot according to claim **8**, wherein the at least one cavity comprises a central cavity separated by a ring-shaped support web from a ring-shaped cavity.

13. A projectile unit comprising:

(a) a disk-shaped sabot disposed to accelerate a projectile body that can be fired from a launch tube embodied as a smoothbore barrel having a caliber and a muzzle; and

(b) a projectile body that has the same caliber as the barrel, wherein the sabot comprises

i. a body that has an outer diameter that corresponds to the caliber of the barrel, wherein the body of the sabot is plate-shaped and includes an outwardly domed bottom;

ii. a ring-shaped support web disposed on a concave side of the domed bottom so as to form a central cavity and a ring-shaped cavity that is separated from the central cavity by the ring-shaped support web; and

iii. at least one pressure-relieving bore that extends through the domed bottom of the body of the sabot opposite a rear of the projectile body and that communicates with the ring-shaped cavity, wherein, during firing, propelling gases move through the bore so that propelling gases penetrate the ring-shaped cavity disposed between the sabot and the rear of the projectile body in a controlled manner so that the propelling gases produce a defined excess pressure in relation to outer ambient air pressure, wherein the excess pressure causes the sabot to separate from the projectile body as soon as the projectile unit has passed the muzzle of the barrel of the launch tube.

14. A disk-shaped sabot for accelerating a projectile body that can be fired from a launch tube embodied as a smoothbore barrel having a caliber and a muzzle, wherein the projectile body has the same caliber as the barrel, wherein the sabot comprises:

(a) a body that has an outer diameter that corresponds to the caliber of the barrel, wherein the body of the sabot is plate-shaped and includes an outwardly domed bottom;

(b) a ring-shaped support web disposed on a concave side of the domed bottom so as to form a central cavity and a ring-shaped cavity that is separated from the central cavity by the ring-shaped support web; and

(c) at least one pressure-relieving bore that extends through the domed bottom of the body of the sabot and that communicates with the ring-shaped cavity, wherein, during firing, propelling gases move through the bore so that propelling gases penetrate the ring-shaped cavity disposed between the sabot and a rear of the projectile body in a controlled manner so that the propelling gases produce a defined excess pressure in relation to outer ambient air pressure, wherein the excess pressure causes the sabot to separate from the projectile body as soon as the sabot and the projectile body, forming a projectile unit, have passed the muzzle of the barrel of the launch tube.

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