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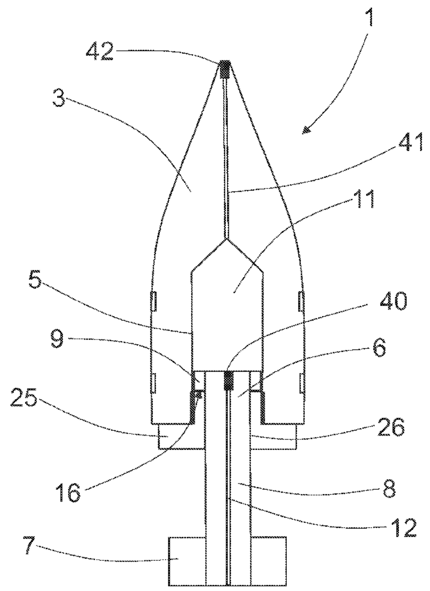

Fig. 2

(57) **Abstract:** The object of the invention is a pressurized projectile (1), which comprises a jacket (2), a core (3) and a stabilizing part (6), which stabilizing part (6) consists of a shaft (8) and a fin part (7) attached to the shaft (8) at the first end (20) of the stabilizing part (6), whereby the core (3) of the projectile (1) has a cylindrical cavity (5) which is closed at least partially by a closing element (25), which closing element (25) has an opening (26) for the shaft (8) of the stabilizing part (6), whereby a piston (9) is attached to the second end (30) of the shaft (8) of the stabilizing part (6), which piston is placed in the cavity (5) to form a space (11) on the front side of the piston (9) and through the shaft (8) of the stabilizing part (6) a channel (12) runs into the space (11) and which channel (12) has a valve structure (40) that allows the propellant gas pressure to enter the cavity (5) of the projectile (1) and prevents the propellant gas from exiting the projectile (1) through the channel (12).

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PRESSURIZED PROJECTILE

The object of the invention is a pressurized projectile according to the independent claim. The projectile is suitable for use especially, but not only, in heavy weapons, providing improved hit accuracy compared to conventional projectiles.

Cartridges suitable for weapons typically consist of an ammunition i.e. a projectile, which is a generic term that includes all throwable pieces or projectiles to be fired. The main types of projectiles are bullets, grenades and special ammunition. Projectiles may include sharp arrows, blunt arrows, sling stones, cannonballs, shrapnel and stones fired with catapults. A cartridge, on the other hand, refers to an ammunition combination in which the projectile with possible detonators, casing, powder charge and detonator are connected into a single unit. The cartridge contains as a single unit all the elements necessary to set the projectile in motion. Almost all small-calibre firearms are cartridge firearms.

In a cartouche discharge, the projectile and propelling charge are loaded into the weapon separately. This type of discharge is used especially in large-calibre (over 100 mm) cannons, where the use of a cartridge discharge is not meaningful for technical reasons: the physical size and weight of the cartridge would become too large. In this case, the charge chamber is first loaded with a projectile and then with a cartouche containing the propelling charge, which can be in a brass case containing the detonator, or in a textile or cardboard package, in which case the separate detonator is placed last before closing the lock. Especially in very large-calibre ship cannons, textile-wrapped powder bags are popular, so that the amount of the propelling charge can be easily adjusted in relation to the firing distance.

A bullet usually refers to a non-explosive projectile of a small-calibre, usually less than 20 mm, weapon, i.e. the part of a cartridge that is fired at a target. Bullets of hunting weapons usually consist of a brass alloy jacket and a lead core. The jacket can also be made of soft steel and the core of some metal other than lead. Bullets can also be made entirely of lead or other metal. At present, all-copper bullets are also used in big game hunting due to the material's appropriate softness (does not damage the barrel of the weapon) and resilience (deforms when hit but does not fragment).

In everyday language, a rifle (groove, scratch) nowadays most commonly refers to a gently rotating groove on the inner surface of a firearm's barrel, i.e. a furrow, the purpose of which is to make a bullet or other projectile rotate during its flight around its longitudinal axis in order to improve accuracy. At present, rifled barrels are used in almost all rifles, pistols and cannons. Unrifled, i.e. smooth, barrels are used at present in shotguns, grenade launchers, rocket launchers, tank cannons and some other cannons. There are usually four to eight rifles in the barrel of small arms, but other solutions are also applied. The number of rifles in rifle-calibre weapons is usually four to six, and they are made along the entire length of the barrel. The exception is a separate, rifled reducing socket made for the shotgun. The distance during which one rifle makes a full thread in the barrel is called the angle of rifling. The depth of the rifles in small arms is usually between 0.1–0.3 mm and the angle is about one round at a distance of 20–30 cm. A long bullet usually needs a short angle of rifling to stabilize. Too rapid angle of rifling may cause a phenomenon called overstabilization, in which case the bullet does not change its axial angle according to the angle of the trajectory. Thus, it ends up in an oblique position in its trajectory in relation to its direction of propagation, which is disastrous both in terms of accuracy and power. Also, the pressure level and the weapon's susceptibility to wear may increase, the barrel may copper faster than normal and the accuracy may therefore suffer.

Although rifle-calibre weapons improved significantly in accuracy after the introduction of rifling, there has also been an opposite development. For example, tanks are equipped with smoothbore cannons that fire tail-stabilized projectiles. The accuracy and penetration are good and the first shot against, for example, an enemy tank can be fired from about 3,000 metres away or even further. With a smooth bore, higher muzzle velocities can be achieved than with a rifled bore, which in this context means a longer area of effect and better armour penetration, especially with subcalibre projectiles and flechettes as well as armour-piercing shells.

Bullets can also have grooves called rifles. This is the case, for example, with some shotgun slugs. In this case, we talk about air grooves, and their purpose is the same as rifles in a barrel: to make the bullet rotate, in this case by means of air resistance.

Flechette, or arrow projectile or cartridge, is based on arrow-shaped "bullets". They resemble nails with arrow-like fins at the end to stabilize the flight. They don't fragment on target. Arrow projectiles are used in military operations against human targets. They are designed for various weapons: cannons, rifles, pistols and shotguns. Arrow projectiles are particularly effective against various types of protective equipment such as bullet-proof and shrapnel vests and helmets. For this reason, the use of arrow projectiles is often restricted to official use only.

Subcalibre arrow projectiles are mainly used against other tanks. An arrow projectile used in a smoothbore tank cannon (100–125 mm) reaches a muzzle velocity of as high as over 1,500 m/s. The arrow itself is a sharp-pointed and over half a metre long "dart" with a diameter of 2–3 cm (the dimensions depend on the calibre of the weapon), which has, in its rear end, small fins that stabilize the flight. The manufacturing material of the arrow is hard and very heavy metal: tungsten carbide or "DU" (depleted uranium). Arrow projectile penetration is based on very high impact velocity, high kinetic energy and small impact area. The arrow point is already inside the tank, while the tail is still outside. The high weight of the arrow in relation to the cross-sectional area maintains the flight velocity and allows for an earlier opening of fire than other ammunition, and the short flight time forgives distance and pre-assessment errors. The high penetration velocity detaches hot fragments from the armour, causing fires and explosions inside the tank, destroying the tank's structures and the crew. Oxidation of depleted uranium (DU) during the penetration reduces penetration friction and causes an explosion inside the tank.

For firing fragmentation and high-explosive anti-tank grenades as well as missiles, the calibre (100–125 mm) of the primary weapon of the main battle tank (MBT) is larger than the arrow. Therefore, the thin arrow is tied to its socket with a sealing and centring sabot, which is, for example, an aluminium sealing sleeve consisting of sectors. The sabot guides the arrow through the bore and opens due to air resistance, separating from the arrow as the sectors scatter across the forefield. The arrow may penetrate several metres of armour steel. Today, a subcalibre arrow projectile is the main anti-tank projectile against heavily armoured targets such as main battle tanks.

The projectile solution according to the invention can be considered as belonging to the group of arrow projectiles. It eliminates or reduces problems associated with the use of traditional arrow projectiles, for example, by making sealing sleeves unnecessary. The structure of the projectile allows for a rifle-free barrel, which enables firing with heavy loads. The velocity of projectiles fired with heavier loads is higher, which results in a stable trajectory and a high impact velocity on the hit target. At the same time, the effect of rifles on hit accuracy is eliminated, which becomes significant when shooting at long distances. With a pressurized arrow projectile, the tail of the projectile can be stabilized in its open position, and when the projectile hits the target, the internal pressure of the projectile effectively fragments the projectile, causing greater destruction in the target.

The solution according to the invention comprises a precision weapon projectile manufactured by fine mechanics, which is fired with a smooth barrel. When the projectile is in the barrel of the weapon, the propellant gas generated upon firing pushes out a tail from the rear of the projectile, which stabilizes the trajectory of the projectile after the projectile leaves the barrel. The projectile has a valve structure that keeps the pressure generated in the barrel by the propellant gas inside the projectile. The pressure remaining inside the projectile locks the opening tail of the projectile effectively and immovably in place, resulting in an extremely stable trajectory. At the same time, the pressure remaining inside the projectile enhances the destructive effect of the projectile on the target. The use of a smoothbore barrel makes it possible to use higher muzzle velocities than before and thereby to increase the firing distance and accuracy, especially at long firing distances. The projectile can be set into rotational motion, similar to the motion achieved by rifles, by means of tail design. The solution according to the invention eliminates the manufacture of rifling from the manufacturing process of the weapon barrel, making the manufacturing process simpler. The solution according to the invention is particularly, but not exclusively, suitable for large-calibre weapons. Typically, the solution according to the invention is advantageous for projectiles with a diameter of ½ inch and above.

In the following, the invention is described in more detail by the aid of examples with reference to the attached simplified drawings, wherein

Fig. 1 presents, as a simplified diagram, a preferred embodiment of the projectile according to the invention before the projectile is fired,

Fig. 2 presents, as a simplified diagram, a preferred embodiment of the projectile according to the invention after the projectile has been fired,

Fig. 3 presents a preferred embodiment of the valve structure of the projectile, and

Fig. 4 presents another preferred embodiment of the valve structure of the projectile.

The terms anterior, frontal and similar hereinafter refer to the direction or surface corresponding to the flight direction of the projectile, and correspondingly, the terms rear, back and similar refer to the direction or surface opposite to the flight direction of the projectile. Longitudinal direction refers to the direction of the barrel of the weapon.

Figure 1 presents, as a simplified diagram, a preferred embodiment of the projectile 1 according to the invention before the projectile is fired. The projectile comprises a jacket 2 and a core 3. The jacket 2 and the core 3 are typically of the same material, and the solution according to the invention is suitable for use in all projectiles according to prior art. The projectile 1 is attached to the casing 4, in which case the casing contains the detonator and gunpowder needed to fire the projectile, which are not presented in Figure 1. When the weapon is fired, the detonator ignites the gunpowder and as the gunpowder burns, it produces propellant gas that sets the projectile in motion. The pressure of the generated propellant gas in the casing and later in the barrel propels the projectile through the barrel that gives direction to the projectile.

The core 3 of the projectile 1 has a cylindrical cavity 5, in which the stabilizing part 6 of the projectile, i.e. the tail part, is placed at least partially. The cavity 5 is at least partially closed at the rear part by a closing element 25. The stabilizing part 6 consists of a fin part 7 and a shaft 8, with the fin part being attached to the first end 20 of the shaft, and a piston 9 that enables the longitudinal movement of the stabilizing part and stops the movement, which piston is attached to the second end 30 of the stabilizing part. The piston 9 of the stabilizing part 6 is located in the cavity 5 of the core 3 and can move longitudinally inside the cavity.

The closing element 25 of the cavity 5 has an opening 26 for the shaft 8 of the stabilizing part 6. The shaft 8 of the stabilizing part 6 can move in the longitudinal direction inside the opening 26 of the closing element 25. Before firing the projectile 1, the stabilizing part 6 is positioned in its first extreme position according to Figure 1, when the piston 9 at the second end of the stabilizing part is in its anterior extreme position. The piston 9 of the stabilizing part 6, together with the cavity 5 formed in the core 3, forms a space 11 for the propellant gases of the projectile 1, which gases are released upon firing the projectile. Propellant gases enter the space 11 along a channel 12 formed inside the shaft of the stabilizing part 6. The channel 12 has a valve structure 40 that allows the propellant gas to enter the cavity 5 but prevents the propellant gas from leaving the cavity. The operation of a preferred embodiment of the valve structure 40 is described in more detail in conjunction with Fig. 3. Alternatively, the valve structure 40 may also be placed in the rear part of the shaft 8 of the stabilizing part 6, at the inlet of the channel 12. In this case, the valve structure is preferably similar to Figure 4, for example.

The fin part 7 of the stabilizing part 6 is positioned in contact with, or nearly in contact with, the rear part 13 of the projectile 1 before the projectile is fired. The rear part 13 of the projectile 1 is formed by the closing element 25 that at least partially closes the cavity 5 formed in the core 3 of the projectile. The closing element 25 is attached to the projectile to the inner surface of the rear part of the cavity 5 with threads 27. As the fin part 7 of the stabilizing part 6 projects out of the cavity 5 of the projectile 1 by the pressure generated into the open space 11 by the propellant gas, it stabilizes the trajectory of the projectile 1 after the projectile has left the barrel of the weapon. The fin part 7 contains two or more fins. By keeping the pressure generated by the propellant gases in the open space 11 inside the projectile 1 and is not allowing it to escape through the channel 12 after the projectile leaves the barrel, the stabilizing part 6 can be maintained in an extremely rigid position without the stabilizing part 6 being able to move at all during the flight of the projectile. The clearances between the closing element 25 and the shaft 8 of the stabilizing part 6 or the piston 9 can be made such that no separate seal is required between said parts. On the other hand, the solution according to the invention may also include sealing between the said parts. The sealing can be implemented, for example, in the form of an O-seal between the rear surface 16 of the piston 9 and the closing element 25. The sealing can also be achieved by making the shaft 8 of the stabilizing part 6 slightly conical so that it tapers slightly towards the fin part 7. In this case, the shaft 8 of the stabilizing part 6 is automatically sealed against the wall of the opening 26 of the closing element 25 as the stabilizing part protrudes from the projectile 1.

It is also possible to make at least one other channel 41 in the projectile 1, through which the pressure of the propellant gas can at least partially escape from the projectile cavity 5. It is advantageous to place a valve structure 42 in the channel 41, which makes it possible to maintain the desired amount of pressure inside the projectile 1. So, the valve structure 40 in the channel 12 allows the propellant gas pressure to enter the projectile 1 and prevents it from escaping through the channel 12 and the valve structure 42 in the channel 41 allows part of the pressure inside the projectile to exit through the channel 41. With this solution the internal pressure of projectile 1 is brought to the desired level. However, the channel 41 with its valve structure 42 is an option and does not have to be included in the structure of the projectile 1. The channel 41 with its valve structure 42 may be located, according to Figure 1, on the central axis of the projectile 1 from the cavity 5 towards the tip of the projectile. It is also possible to make one or more channels 41 with valve structures 42 through the side of the projectile 1 or even through the rear surface of the projectile. The valve structure 42 located in the channel 41 is, for example, similar to the valve structure 40 of the channel 12 that is described in more detail in Figure 3. Alternatively, the valve structure 42 may be placed at the end of the channel 41 that is on the side of the cavity 5. In this case, the valve structure is preferably similar to Figure 4, for example.

In this example, the casing 4 is attached only to the closing element 25, but it should be understood that the casing can also extend to the area of the jacket 2 of the projectile 1, in which case the casing is attached to both the jacket of the projectile and the closing element. Similarly, the closing element 25 may have a smaller diameter than the diameter of the jacket 2 of the projectile 1 at the end on the side of the casing 4, in which case the casing is attached only to the jacket of the projectile.

On the outer surface of the jacket 2 of the projectile 1 there are sealing rings 14, which seal the gap between the projectile and the weapon barrel. There may be one or more sealing rings 14 around the projectile. These sealing rings 14 prevent propellant gas from escaping to the front of the projectile 1 in the barrel of the weapon after the projectile is fired and enable the projectile to have maximum acceleration and firing speed. Sealing rings are typically made of copper, a copper-bronze alloy or a similar material suitable for sealing.

Figure 2 presents, as a simplified diagram, a preferred embodiment of the projectile 1 according to the invention after the projectile has been fired. The propellant gases released upon firing the weapon are able to penetrate into the space 11 formed within the core 3 of the projectile 1 through the channel 12 passing through the shaft 8 of the projectile's stabilizing part 6 and the valve structure 40 therein. The pressure of the propellant gas causes the space 11 to expand, whereby the propellant gases push the piston 9 at the end of the shaft 8 of the stabilizing part 6 from its first extreme position to its second extreme position and maximize the space 11 in the cavity 5 of the core 3 of the projectile 1. In its second extreme position, the rear surface 16 of the piston 9 is pressed against the closing element 25. While in this position, there may, for example, be an O-ring seal between the rear surface 16 of piston 9 and the closing element 25. The shaft 8 of the stabilizing part 6 and the opening 26 of the closing element 25 are dimensioned such that when the stabilizing part moves from its first extreme position to its second extreme position, due to the pressure of the propellant gases, the shaft of the stabilizing part locks into its second extreme position. Locking is achieved, for example, by making the shaft 8 of the stabilizing part 6 slightly thicker, at least in the vicinity of the piston 9, so that it can be stuck in the opening 26 of the closing element 25 as the stabilizing part moves to its second extreme position. When the shaft 8 of the stabilizing part 6 is firmly attached to the opening 26 of the closing element 25, a ridge can be made on the fins 7 of the stabilizing part, which ridge enables the projectile 1 to be rotated around its own longitudinal axis. The ridge of the fins 7 produces the same effect for the projectile 1 as rifling of a weapon barrel. In the solution according to the invention, the barrel of the weapon is therefore unrifled. The fins may also be shaped in another way to get the projectile rotating around its longitudinal axis.

The solution according to the invention may also consist of more than one shaft 8 regarding the stabilizing part 6, in which case the parts of the shaft are opened telescopically and locked in their opened extreme position due to friction. The locking is achieved by making the parts of the shaft 8 slightly conical, at least at the ends of the shaft parts, so that in the opened position of the shaft, the outer diameter of the end of the inner shaft part is slightly larger than the inner diameter of the outer shaft part. In the closed position, the parts of the shaft 8 are nested and only open due to the pressure of the propellant gases and wedge into the locked position. The fin part 7 may be attached to any part of the shaft 8, in which case one or more shaft parts may still extend behind the fin part. The fin part 7 can also be attached to one or more parts of the shaft 8. Due to the telescopic structure, the length of the projectile 1 can be increased and, if desired, the fin part 7 can be placed further from the jacket 2 of the projectile. With such a solution, the trajectory of the projectile 1 can be further stabilized. When the valve structure 40 is placed in the rearmost part of the telescopic shaft 8, the pressure remaining inside the projectile 1 causes the tail to stiffen into a stable structure. This further improves the accuracy of the projectile. Due to the valve structure 42 in the channel 41 of the projectile 1, it is possible to adjust the pressure inside the projectile to a desired level that is lower than the maximum pressure created by the propellant gas.

Figure 3 presents a preferred embodiment of the valve structure 40 located in the channel 12 of the shaft 8 of the stabilizing part. A similar valve structure is also suitable for use in the valve structure 42 in the channel 41. The valve structures 40 and 42 may be as described, but it is obvious to a person skilled in the art that the valve structure can also be a valve structure according to other prior art.

The valve structure 40 consists of a ball 50, a spring 51 and a support part 53 attached to the channel 12 with threads 52. The channel 12 expands slightly at the valve structure 40, in which case the ball 50 is pressed against the walls of the channel 12, pressed by the spring 51. When the pressure of the propellant gas reaches the channel 12 of the projectile according to arrow 54, the propellant gas pushes the ball 50 towards the interior of the projectile and compresses the spring 51, allowing the propellant gas to penetrate inside the projectile. The spring force is dimensioned so that the pressure of the propellant gas causes the ball 50 to move towards the support part 53. When the pressure outside the projectile is lower than the pressure inside the projectile, the valve structure remains closed and the ball 50 remains pressed against the walls of the channel 12 by the spring 51. The support part 53 is attached to the channel 12 with the threads 52, whereby the support part holds the other end of the spring 51 in place. A hole extends through the support part 53, whereby the channel 12 continues through the spring 51 and the support part 53 into the projectile.

There is a corresponding valve structure in the channel 41 according to Figures 1 and 2. The amount of pressure remaining inside the projectile 1 is adjusted by the spring force of the spring 51 of the valve structure 42 in the channel 41.

Figure 4 presents a preferred embodiment of the valve structure 40, when the valve structure 40 is placed in the rear part of the shaft 8 of the stabilizing part 6 presented in Figures 1 and 2 at the inlet of the channel 12. The embodiment of the valve structure 40 presented in Figure 4 may be similar to the valve structure 42 when it is placed at the end of the channel 41 that is on the side of the cavity 5. The channel 12 is made wider at its inlet so that the ball 50 can move in the channel and there is a gap between the ball and the edges of the channel through which the propellant gases can pass into the projectile. The dimensions presented in Figure 4 do not correspond to the most preferred embodiment, but for example the gap between the ball 50 and the walls of the channel 12 is presented larger in Figure 4 for clarity.

The ball 50 is held in place against the support part 53 by the spring force of the spring 51 when the external pressure is less than the pressure inside the projectile combined with the pressure required to cancel the spring force. The spring 51 is preferably conical in shape, so that it stays well in place in the channel 12. The support part 53 is attached to the shaft 8 of the stabilizing part 6 with threads 52. The valve structure 40 lets the pressure of the propellant gas inside the projectile and prevents it from escaping through the channel 12. The valve structure 40 in channel 12 and the valve structure 42 in channel 41 may be similar or different to each other.

The charge of the projectile according to the invention is greater than that of a corresponding prior art projectile, resulting in a higher muzzle velocity for the projectile. A higher muzzle velocity provides a more stable trajectory and a higher impact speed on the target. At the same time, the hit accuracy of the projectile improves compared to traditional projectiles. Hit accuracy is further improved as the internal pressure of the projectile causes the tail structure to remain very rigid. This is noticeable especially at long firing distances. The tail protruding from the projectile eliminates the effects of rifling on the projectile's trajectory and hit accuracy. The rifles affect the stability of the weapon and tend to turn the barrel/bore of the weapon while the projectile is in the barrel/bore of the weapon. The effects of rifling on hit accuracy are especially evident when firing precision-required shots at distant targets.

Similarly, a part of the pressure of the propellant gas can be released through the rifling, so a smoothbore solution, such as that of the invention, utilizes the generated pressure more efficiently.

The projectile according to the invention also produces a three-part impact on the hitting target, which is particularly effective against armoured targets. When the projectile hits the target, the first impact comes from the impact of the jacket and the core of the projectile. The second impact comes from the fragmentation of the projectile caused by the release of the internal pressure of the projectile when the projectile hits the target, which fragmentation enhances the destructive effect of the projectile. At the moment of impact, when the projectile fragments, the stabilizing part, with its piston and fins, can move forward. When the stabilizing part hits the target, slightly later than the jacket and the core, the stabilizing part causes a third impact on the target, which enhances the penetration ability of the projectile. In case of an embodiment with a telescopic shaft 8, there will be several impacts as the telescopic structure collapses after the impact.

It is clear to a person skilled in the art that the invention is not limited exclusively to the examples presented above but can vary within the scope of the claims presented below.

CLAIMS

1. A pressurized projectile (1) comprising a jacket (2), a core (3) and a stabilizing part (6), which stabilizing part (6) consists of a shaft (8) and a fin part (7) attached to the shaft (8) at the first end (20) of the stabilizing part (6), and that the core (3) of the projectile (1) has a cylindrical cavity (5) which is at least partially closed by a closing element (25), which closing element (25) has an opening (26) for the shaft (8) of the stabilizing part (6), whereby a piston (9) is attached to the second end (30) of the shaft (8) of the stabilizing part (6), which piston is placed in the cavity (5) to form a space (11) on the front side of the piston (9), and through the shaft (8) of the stabilizing part (6) passes a channel (12) to the space (11), **characterized** in that the channel (12) has a valve structure (40) that lets the propellant gas pressure enter the cavity (5) inside the projectile (1) and prevents the propellant gas from exiting the inside of the projectile (1) through the channel (12), and that the projectile (1) has one or more channels (41) equipped with a valve structure (42), through which the pressure of the propellant gas can exit the inside of the projectile (1).
2. Projectile (1) according to claim 1, **characterized** in that there is a seal between the rear surface (16) of the piston (9) of the stabilizing part (6) and the closing element (25).
3. Projectile (1) according to claim 1 or 2, **characterized** in that the shaft (8) of the stabilizing part (6) widens when moving towards the piston (9) and is larger in diameter at the base of the piston (9) than the opening (26) of the closing element (25) in order to fasten the stabilizing part (6) with friction to the closing element (25).
4. A projectile (1) according to one of the claims 1–3, **characterized** in that the shaft (8) of the stabilizing part (6) consists of more than one part, which parts can be opened and closed in a telescopic manner, and attach to each other in the opened position by means of friction.
5. Projectile (1) according to claim 4, **characterized** in that the fin part (7) is attached to any one of the parts of the telescopic shaft (8).
6. Projectile (1) according to claim 4, **characterized** in that there are two or more fin parts (7), whereby the fin parts (7) are attached to two or more parts of the telescopic shaft (8).
7. A projectile (1) according to one of the preceding claims, **characterized** in that the fin part (7) of the stabilizing part (6) is shaped to set the projectile (1) in a rotational motion around its own longitudinal axis.

8. Projectile (1) according to one of the preceding claims, **characterized** in that the closing element (25) is attached to the inner surface of the cavity (5) with threads (27).
9. A projectile (1) according to one of the preceding claims, **characterized** in that the jacket (2) of the projectile (1) has at least one sealing ring (14), which seals the projectile (1) against the inner surface of the barrel.
10. Projectile (1) according to one of the preceding claims 1–9, **characterized** in that the casing (4) is attached to the closing element (25).
11. Projectile (1) according to one of the previous claims 1–9, **characterized** in that the casing (4) is attached to the closing element (25) and the jacket (2) of the projectile (1).
12. Projectile (1) according to one of the previous claims 1–9, characterized in that the casing (4) is attached to the jacket (2) of the projectile (1).

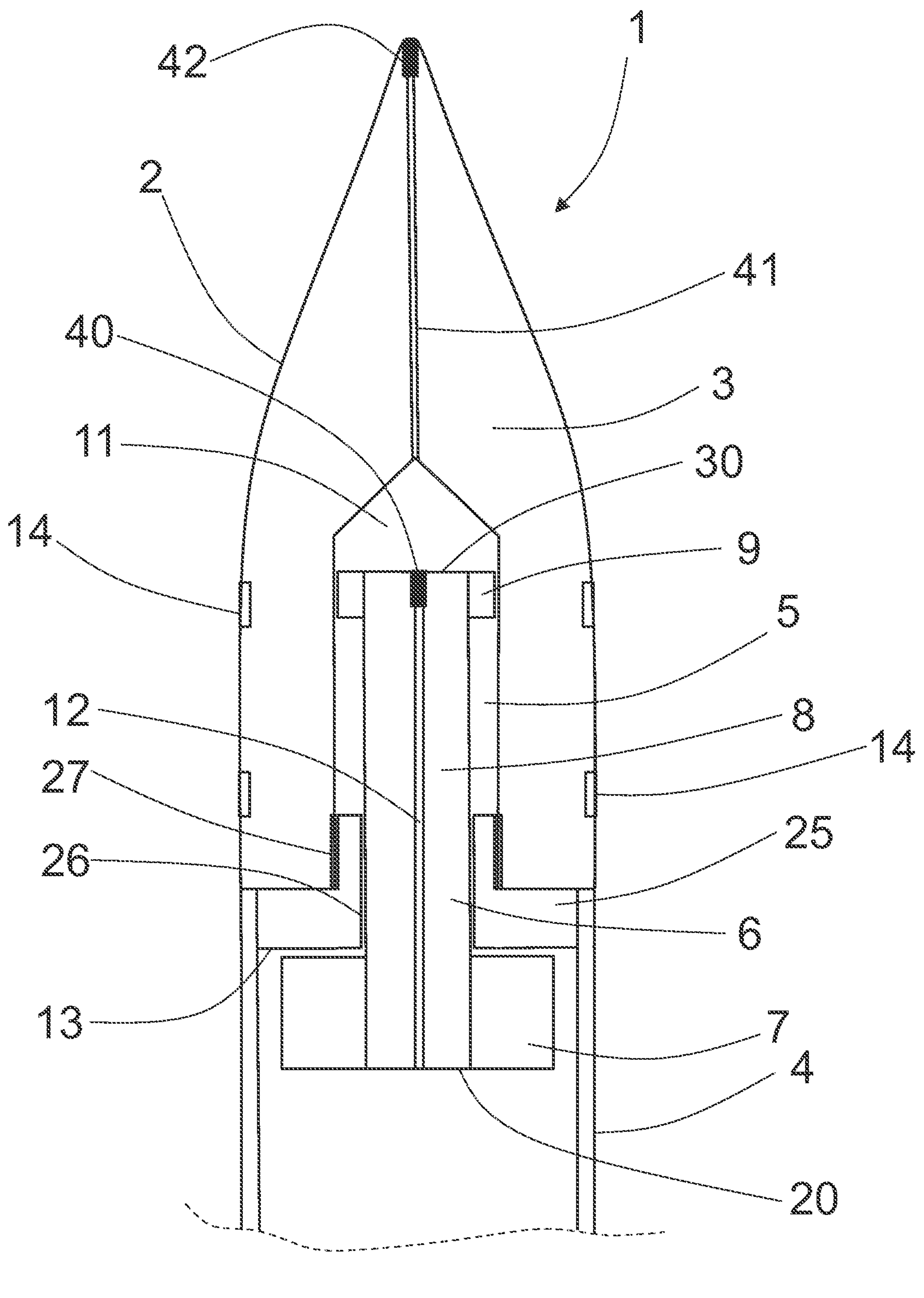

Fig. 1

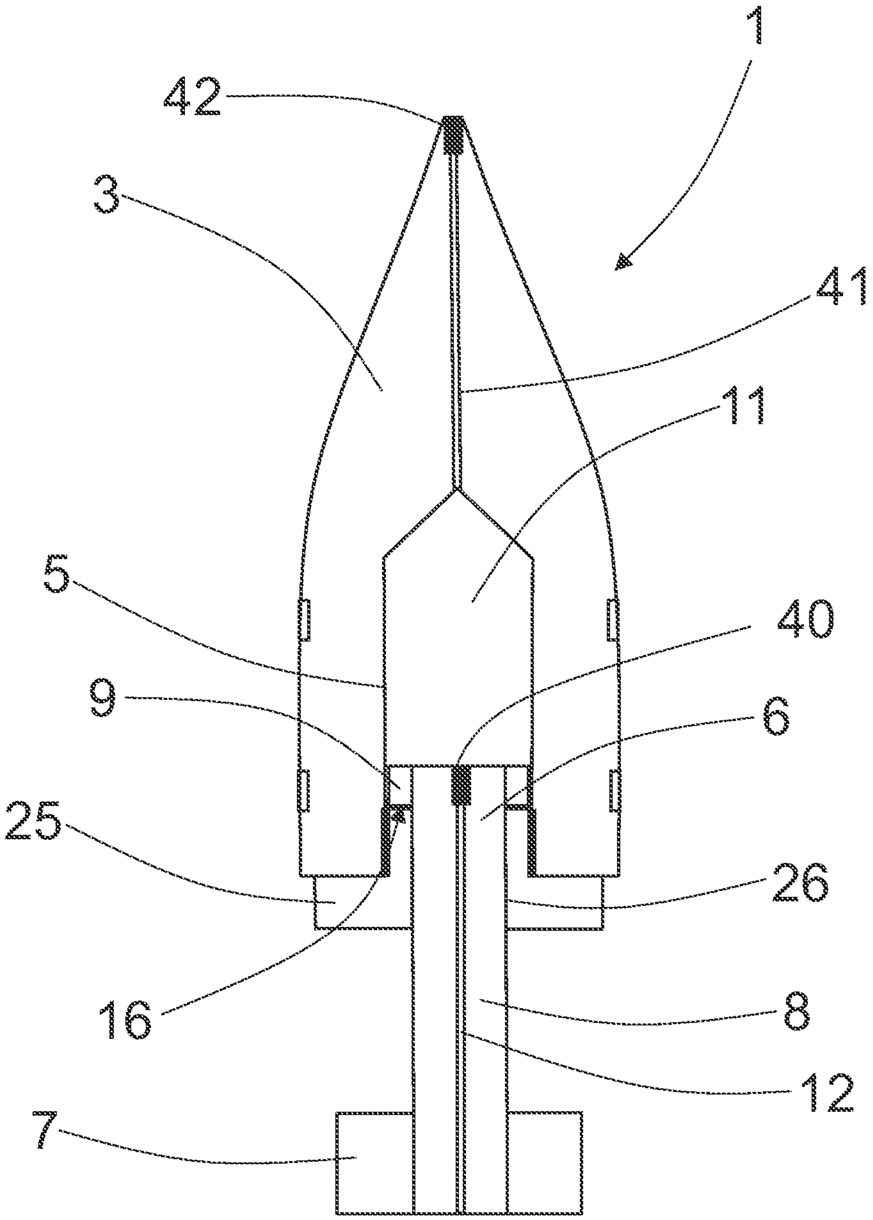

Fig. 2

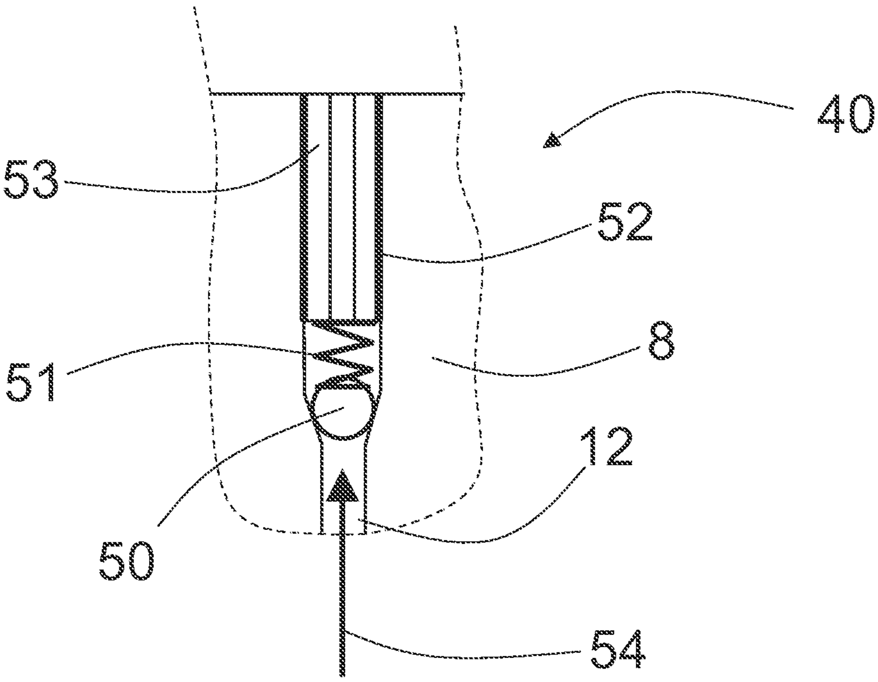

Fig. 3

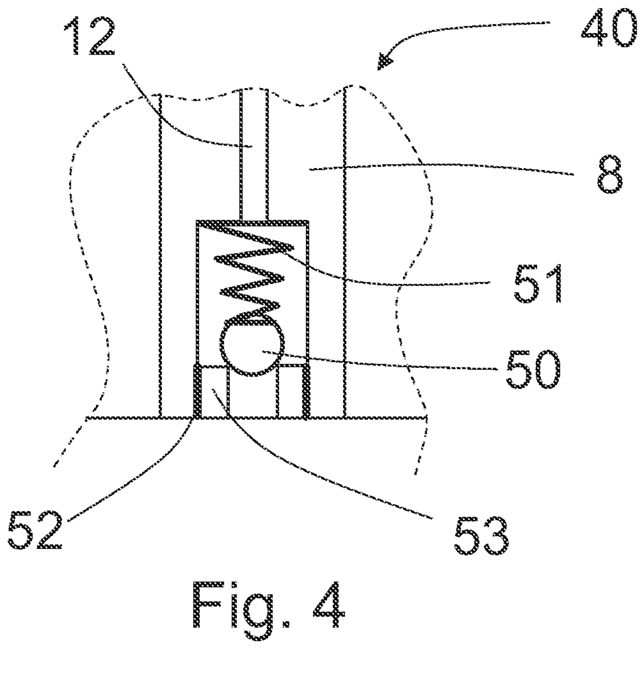

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2024/050110

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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: F42B

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

FI, SE, NO, DK

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

EPODOC, EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP, IPRally

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2586666 A (SECR DEFENCE [GB]) 03 March 2021 (03.03.2021) figures 2-6C; page 8, paragraph 1, page 9, paragraph 3, page 10, paragraphs 1-3, page 11, paragraph 1	1-12
A	US 6492632 B1 (POLLIN IRVIN [US]) 10 December 2002 (10.12.2002) figures 5-6; column 4, lines 22-67, column 5, lines 1-7	1-12
A	WO 0206760 A1 (BOFORS DEFENCE AB [SE]) 24 January 2002 (24.01.2002) figures 1-10; page 7, lines 17-39, page 8, lines 1-39, page 9, lines 1-5	1-12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 June 2024 (27.06.2024)	27 June 2024 (27.06.2024)

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CLASSIFICATION OF SUBJECT MATTER

IPC
F42B 10/14 (2006.01)
F42B 10/20 (2006.01)