

[54] **SABOT PROJECTILE**

3,498,222 3/1970 Brikigt 102/52

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[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

An undercalibrated projectile has its core covered by a cap of plastic extending with a cylindrical portion into a sabot which is connected by an automatically releasable coupling with the rear end of the core of the projectile. The coupling comprises an annular helical spring placed around a core formed by a spring ring and this spring combination engages lockingly an annular groove on the rear end of the core of the projectile and also engages tensionally an annular groove in the inner wall of the sabot; the last named annular groove having a cross section which is much larger than the cross section of the annular helical spring and an inner diameter which is greater than the outer diameter of the annular helical spring.

3 Claims, 3 Drawing Figures

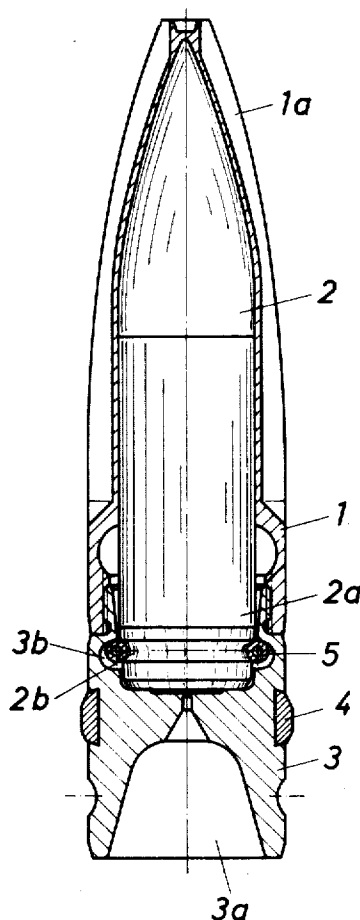


Fig. 1

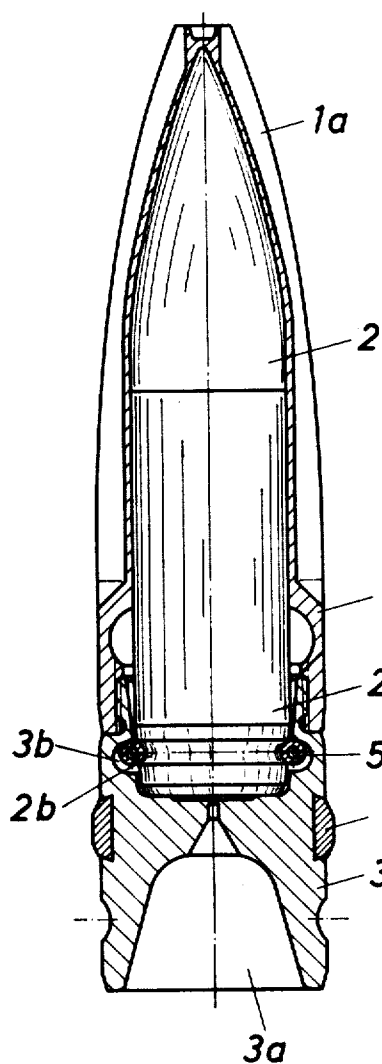


Fig. 2

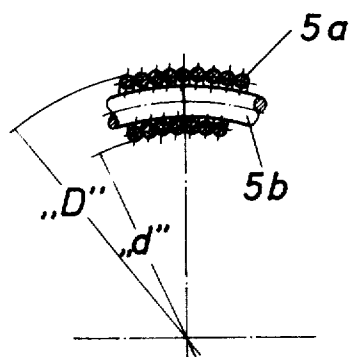
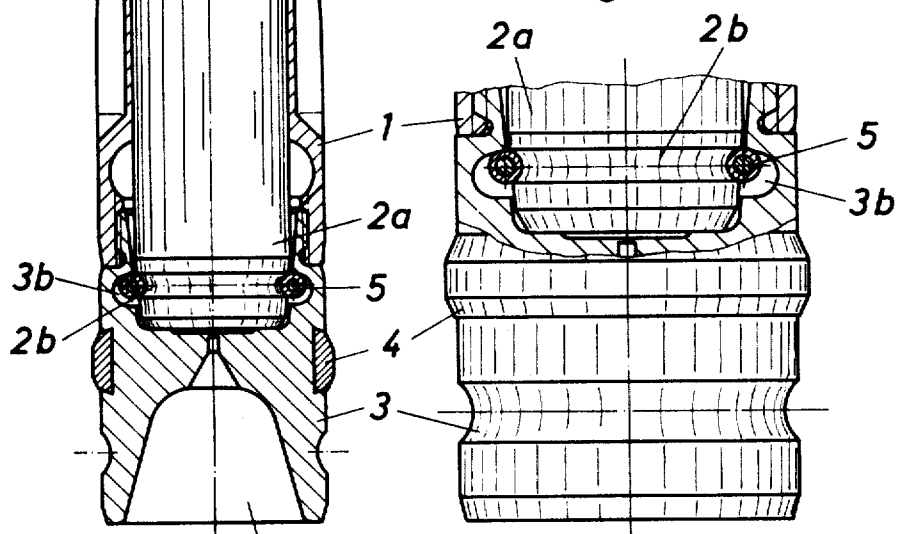


Fig. 3



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SABOT PROJECTILE

The invention relates to an undercalibrated projectile comprising a core provided with a cap from which the rear end of the core may extend outwardly and into a sabot which is connected in axial direction with the core in such a manner that the coupling between the core and the sabot is automatically released upon firing in response to the rotative speed and the centrifugal effect of the core.

It has been proposed heretofore to employ under calibrated projectiles for the purpose of reducing the drop in velocity of the projectile so as to increase the energy of the projectile. In such projectiles the powder gases of a conventional propellant charge act upon a projectile core having a reduced cross section. In this manner a more favorable stress on the cross section and a correspondingly reduced air resistance is obtained.

The core of such a known projectile is arranged in a lightweight projectile part, namely, in the so-called sabot. Not only the cylindrical part of the projectile but also the sabot may be provided with guide rings. Such guide rings engage the rifling and effect a sealing of the gas in the gun barrel. The outer diameter of the guide rings corresponds to the diameter or the caliber of the gun barrel. When the projectile has left the gun barrel the sabot and also the guide rings drop away after the projectile has become separated from the sabot principally under the action of centrifugal force.

Projectiles provided with sabots and guide rings are well known, and particular attention is called to the guns K-5 (28 centimeter caliber) and K-12 (21 centimeter caliber) which use this type of projectiles. These projectiles have been very successful, particularly in their range which is about 150 km.

It is obvious that first of all particular attention has to be paid to the construction of the coupling between the projectile and the sabot because a reliable and timely separation of this coupling is necessary for the success or failure of each shot.

In a previously employed sabot projectile, the rear end of the projectile is provided with a ring-shaped projection which is used for receiving a spring ring having a substantially rectangular cross section. This spring ring is secured within the sabot in axial direction by means of a threaded sleeve, and the threaded sleeve itself is secured in radial direction by a threaded pin. The enumeration of the just-mentioned individual parts for coupling the projectile with the sabot and additional other individual parts, such as a guide sleeve threaded into a front portion of the sabot, should make it apparent that this previously employed sabot projectile is very expensive, complicated and, furthermore, the mentioned coupling elements make it clear that the mass of the prior rectangular spring ring in view of the constructional features, is relatively small. In view of this relatively small mass, the spring ring does not produce a sufficient excess of centrifugal force for obtaining a uniform engagement with a surface provided on the sabot. Accordingly, the function of the spring ring, namely, to effect a separation of the projectile from the sabot during firing is rendered questionable.

Furthermore, it was also proposed heretofore to provide a grenade with an undercalibrated core, but this grenade has faults and disadvantages similar to the ones mentioned in the foregoing. The faults are that the core of the grenade is provided with a cap whose point, com-

pared with its cylindrical portion, has a disproportionately thick wall so that it is very likely and possible that the cap at the point of the grenade does not tear open when the core is accelerated so that in an undesirable manner the cap is propelled with the core to the target.

In addition to these obvious disadvantages, the previously employed connection of the cap with the core at its rear end has several structural faults. In this known projectile the rear end of the core has, compared to the outer diameter of the core, an extremely small annular recess for the reception of a spring ring having a flattened out rectangular cross section. As a result of this cross section, the spring ring has a very insufficient amount of mass so that, again, a secure opening and a uniform engagement of the spring ring in the interior of the cap does not produce an excess of centrifugal force which would give the projectile the required twist for passing through the rifling of the gun barrel.

It is an object of the invention to provide a simple and inexpensive coupling between the core of the projectile and the sabot in which the necessary physical conditions are obtained which assure with safety a separation of the projectile from the sabot during firing.

In accordance with the invention, the coupling between the projectile and the sabot comprises substantially a ring-shaped spring element having a large mass, so that, on the one hand, an end portion of the core of the projectile engages closely the spring element, while on the other hand, the ring-shaped spring element engages tensionally an annular groove in the interior of the sabot, whereby the diameter of this annular groove is larger than the outer diameter of the spring element; and the sabot extends into the interior of the cap.

Another advantageous feature of the invention is that the ring-spring element comprises a helical tension spring which increases the mass of the coupling means and that in the interior of this helical tension spring is arranged a core comprising a spring ring which biases the helical tension spring to the core of the projectile and assures an axial, symmetrical form of the same.

According to still another object of the invention the inner diameter of the ring-shaped spring element is brought into locking engagement with an annular groove provided at the rear end of the projectile.

The invention is further distinguished by the fact that the annular groove in the sabot, which receives the ring-shaped element, has a diameter which is at least about the diameter of the cross-section of said spring element greater than the outer diameter of the ring-shaped spring element.

The advantages obtained with the invention are obvious and convincing and are as follows:

The sabot projectile of the invention has an extremely simple construction. The employed individual parts are very few in number and are suitable for mass production which requires very little skill, particularly as far as fittings, tolerances, or the like are concerned.

Of particular advantage is the extremely simple but effective coupling between the core of the projectile and the sabot.

In its rest position the coupling possesses a very high resistance to shear in axial direction while, on the other hand, the coupling under the influence of centrifugal forces which occur during firing, possesses in radial direction a very high elasticity and yieldability.

In view of the combination of the ring-shaped helical tension spring and the spring ring therein serving as a core, the mass of the combined spring elements is relatively great, so that also a very reliable opening of the same and at the same time an engagement with the annular groove in the sabot is obtained in view of a sufficient excess of centrifugal force. The combination of the mentioned spring elements of the invention permits the use of relatively large dimensions, so that, on the one hand a transfer of the mass forces of the core to the sabot and on the other hand, the assembly of the parts in a mass production procedure is very favorable.

Another advantage of the invention resides in the employment of the coupling element not only in the sabot but also in the core of the projectile, so that tensions are created in the notches on the core and that the shape of the annular grooves tends to be zero and are, therefore, harmless.

With these and other objects in view, the invention will now be described in greater detail with reference to the accompanying drawing, which illustrates a projectile having a predetermined caliber.

IN THE DRAWINGS

FIG. 1 illustrates in an axially sectional view a sabot projectile in accordance with the invention.

FIG. 2 illustrates a portion of the coupling member comprising in combination an annular helical tension spring having arranged therein as a core a spring ring.

FIG. 3 illustrates on an enlarged scale the coupling core on the projectile with the sabot.

Referring to FIG. 1, the projectile core 2 has mounted thereon a cap 1 provided with a number of circumferentially distributed axially extending groove-like notches 1a. This cap 1 is made of a plastic such as nylon, and is used as is customary in projectiles of this type, for resisting the mechanical stresses such as they occur prior to the firing of the projectile, during manipulation of the projectiles when they are transported or dropped with their points to the ground, and for resisting other stresses occasioned when bringing the gun into condition for firing, such as during the insertion of the projectile into the cartridge chamber. The cap 1 also is subjected to mechanical stresses when the gun is fired. After the sabot projectile has left the barrel of the gun the cap 1 is destroyed under the action of centrifugal force in that the cap is torn open from the center portion thereof. After this has happened, the undercalibrated projectile core 2, from which the cap has been removed, after having left the gun barrel, performs its outer ballistic flight path alone toward the target.

The sabot 3 is attached in axial direction to the projectile core 2 in the cap 1. The sabot 3 has in its rear face an axial recess 3a, serving on the one hand for the purpose of reducing the weight, and on the other hand serving to facilitate the passage of the ignition ray to a fluorescent substance, powder train or the like. The outer circumference of the sabot has mounted thereon a guide ring 4, which is intended to come into engagement with the rifling of the not illustrated gun barrel. This guide ring 4 also seals against the expanding pro-

pellling charge.

The rear end 2a of the projectile core is provided with an annular groove 2b which serves for the reception of a spring element having a great mass, and is designated in its entirety by 5. When the projectile is assembled, the spring element 5 is coupled tensionally with an annular groove 3b provided in the interior of the sabot 3. In order that the projectile core 2, when leaving the not illustrated gun barrel, directly after the firing, will be released from the sabot 3 the annular groove 3b has a diameter which is at least about the diameter of the cross section of the spring element greater than the outer diameter of the ring-shaped element 5. The latter, during firing, engages under the action of centrifugal force, the axial groove 3b and at the same time leaves the annular groove 2b in the rear end 2a of the core 2. The sabot 3 which in this manner has been released during the firing from the projectile core 2 in view of its relatively great air resistance drops to the ground, namely, in the immediate neighborhood of the muzzle gun barrel.

The coupling or spring element 5 comprises a helical tension spring 5a having an outer diameter (D) and an inner diameter (d) as illustrated in FIG. 2. In the interior of this helical tension spring 5a is arranged a spring ring 5b serving as a core of the tension spring 5a. The combination of the two springs 5a and 5b creates a coupling element whose total mass has been increased by a multiple. At the same time, during attachment of the coupling to the projectile core 2, the necessary axial symmetrical form is obtained.

What we claim is:

1. In a gun projectile, an undercalibrated core, a cap covering at least the major portion of said core rearwardly from the front end thereof, a sabot in axial alignment with said core and having a recess into which the rear end portion of said core extends, said rear end portion of the core being provided with a circumferential groove, an annular spring assembly of large mass encircling said core in positive engagement with said circumferential groove, and the wall of said recess in the sabot being provided with a circumferential groove for accommodating the portion of said annular spring assembly projecting radially outwardly from said groove in the core, said groove in the recess wall having a diameter that is greater than the outer diameter of said spring assembly, so that in firing said projectile from said gun said annular spring assembly is forced by centrifugal action deeper into said groove in the recess wall and out of said groove in the core, thereby releasing said core from said sabot.

2. The projectile according to claim 1, in which said annular spring assembly comprises a tension coil spring of great mass, and a spring clamping ring within said coil spring adapted to supply the required pre-stress of said annular spring assembly.

3. The projectile according to claim 1, in which the diameter of said groove in the recess wall is greater than the outer diameter of said annular spring assembly by at least approximately the cross-sectional diameter of said annular spring assembly.

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