United States Patent [19]

Hillenbrand

[11] **3,795,196**

[45] **Mar. 5, 1974**

[54] **PROJECTILE WITH A LOOSE HARD CORE**

[75] Inventor: **Hans Hillenbrand,** Mullheim, Germany

[73] Assignee: **Mauser-Merke Aktiengesellschaft,** Oberndorf/Neckar, Germany

[22] Filed: **Dec. 27, 1972**

[21] Appl. No.: **318,997**

Related U.S. Application Data

[63] Continuation of Ser. No. 99,929, Dec. 21, 1970, abandoned.

[52] **U.S. Cl.** **102/52,** 102/93

[51] **Int. Cl.** **F42b 11/22,** F42b 13/04

[58] **Field of Search** 102/52, 93

[56] **References Cited**

UNITED STATES PATENTS

3,348,485	10/1967	Dufour	102/52
740,849	10/1903	Groff	102/52
741,328	10/1903	Groff	102/52
3,370,535	2/1968	Permutler	102/52

FOREIGN PATENTS OR APPLICATIONS

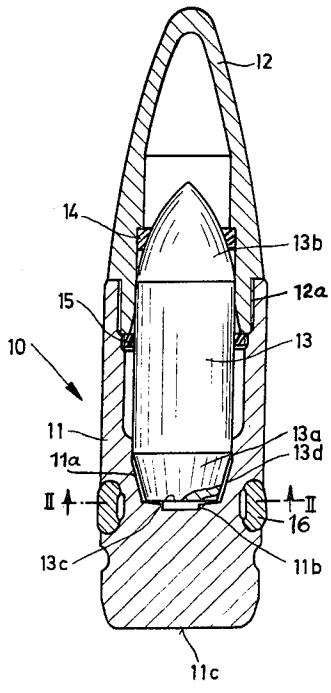
197,329	7/1938	Switzerland	102/52
762,887	1/1934	France	102/52
752,448	7/1956	Great Britain	102/52

Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—Harold Tudor
Attorney, Agent, or Firm—McGlew and Tuttle; Alfred E. Page

[57] **ABSTRACT**

In a projectile with a loose hard core therein the core is provided at its lower end face with at least one unevenness, such as a notch, a groove, a tooth or the like, so that upon firing the projectile the inner face at the bottom wall of the hollow body in which the core is loosely arranged, but secured against longitudinal displacement, will come into pressure engagement with said unevenness and will establish a coupling connection between the core and the hollow body so that the twisting movement of said body will be transmitted to said core.

10 Claims, 2 Drawing Figures



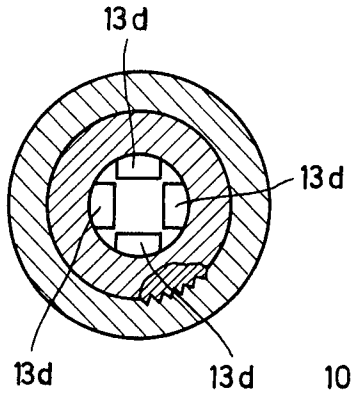


FIG. 2

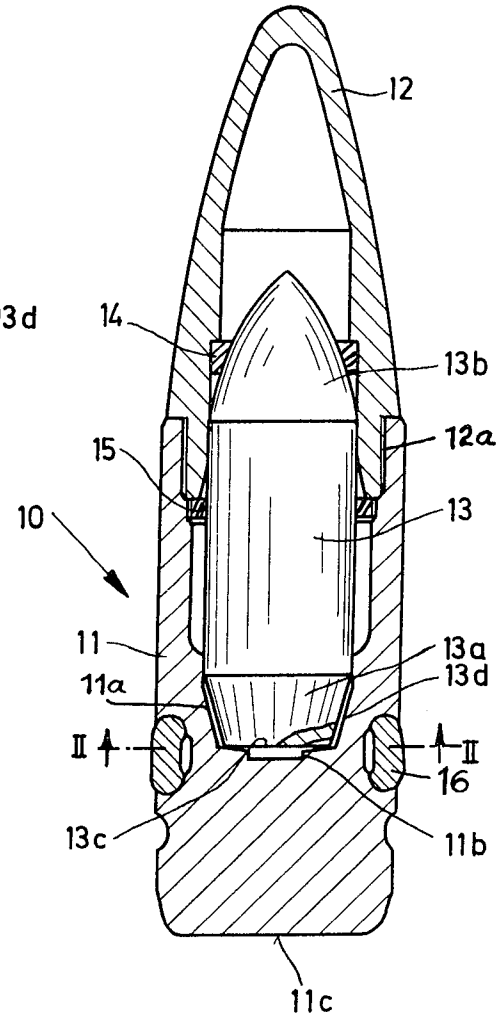


FIG. 1

INVENTOR
Hans Hillenbrand
BY Singer, Stern & Carlberg
ATTORNEYS

PROJECTILE WITH A LOOSE HARD CORE

This is a continuation of application Ser. No. 99,929, filed Dec. 21, 1970, now abandoned.

The invention relates to a projectile with a loose core therein and to means for transmitting the twisting movement of the projectile body to the core. In particular, the invention concerns projectiles provided with a hard core and/or to cartridge-case base projectiles in which the projectile body is coupled with the loose core which is concentrically disposed within the body.

The German Fla-guns of the last world war which were known as Type 2cm/30 and 2cm/38, respectively, fired already explosive grenades which at a total weight of about 300 g had a projectile weight of about 115 g. The muzzle velocity of such projectiles was approximately 911 m/sec., while the gas pressure in the combustion space was about 3,200 kp/cm^2 and the muzzle energy was about 4,750 mkp. With this type of grenades a propelling powder charge of about 39 g of the Type FP02 was used. The rifling in the gun barrel, which was about 1,450 mm long, transmitted to the projectile a rotation of about 50,000 RPM.

The German Fla-guns 3.7 cm/36/37 which were developed during the last world war employed already hard core projectiles which, when fired, were able to penetrate armor of 90 mm thickness at a distance of 300 m.

Hard core projectiles are projectiles whose core comprises substantially a tungsten carbide sintered with cobalt metal. These cores owing to their own high specific weight of $\gamma = 13$ and owing to the relative length of a plurality of calibers resulted in—which was to be expected—a very high cross-sectional load of the core and also in a substantial increase during the penetration of armor, even when the armor was fired upon at an angle >45°.

It is obvious that today one makes use of the knowledge gained during the last world war in the art of hard core projectiles. Obviously, this knowledge is subject to a continuous development, the more so since during the last war a number of problems connected with the production of hard core projectiles were not completely solved.

One of these problems was to obtain an intimate and effective connection between the hard core and the shell of the projectile, which is of importance in view of the very high number of revolutions to which the shell of the projectile is subjected.

After the war was developed a particular connection between the hard core and the projectile shell. For instance, one arranged at the bottom of the hard core a bar, web or strap which engages a groove in the shell of the projectile or in the cartridge case, respectively. This arrangement proved to be not very advantageous, particularly for reasons of manufacture, because the high-strength light-weight material of the shell of the projectile has the tendency to develop tension cracks which sometimes develop only after a longer period of time. Such tension cracks are due to the force of pressing the groove into the shell of the projectile and particularly to the cold working methods employed during the forming of such shells and also owing to the press fit of the web on the hard core with said groove.

An object of the present invention is to provide the known hard core projectiles with advantages, particularly such advantages permit a successful attack of armored targets and to further develop these advantages without, however, employing the disadvantages heretofore possessed by the hard core projectiles.

In accordance with the invention, a fixed coupling means is provided within the range of the lower end of the core. This coupling means faces a plane surface within the hollow projectile body and is spaced therefrom a very small distance which almost is zero, so that after the firing of the gun the gas pressure acting on the bottom of the projectile will automatically come into pressure engagement with the mentioned coupling means on the end of the core.

Another object of the invention is that the coupling means comprises an unevenness on the bottom surface of the core and consists at least of one groove, notch, tooth or the like, which has been ground into the bottom surface of the core.

Another object of the invention is that the coupling means, namely the mentioned unevenness comprising at least one groove, notch, tooth or the like which is produced by a heat-molding operation.

Still another object of the invention is to provide a coupling means comprising a plurality of grooves, notches, teeth or the like, arranged in the form of a toothed rim on the bottom surface of the core.

The invention has many advantages, such as follows: The construction of the hard core projectile of the invention is extremely simple and consists of only a few parts. It is of advantage that the hard core to be inserted into the body of the projectile does not have to be produced with extreme accuracy during its manufacture. The same applies to the production of the shell of the projectile, which in its interior is provided with a simple conical seat for the reception of a correspondingly shaped hard core.

A particular advantage of the projectile of the invention is that the grooves, notches or the like, arranged in the form of a gear rim on the bottom wall of the hard core, during the firing of the projectile will become embedded in the softer material of the shell of the projectile. In this manner a very effective and simple transmission of the twisting movement of the projectile body to the core therein takes place the more so when the core is concentrically arranged within the projectile body.

Extensive tests have confirmed, in the meantime, that the mentioned advantages are, indeed, obtained. It was confirmed that there will occur not the slightest slippage between the projectile body and the hard core during the firing and the penetration of the projectile of the invention and the impact diagrams obtained have been extremely good.

The drawing illustrates by way of example one projectile in accordance with the invention.

In the drawing:

FIG. 1 is a longitudinal axial section of a hard core projectile; and

FIG. 2 is a cross-section of the projectile substantially along the line II—II of FIG. 1.

Referring to the drawing, the projectile in its entirety is designated by **10**, the hollow body or the shell of the projectile is designated by **11**, the nose of the projectile by **12**, the hard core by **13**, and the rotating band by **16**.

The lower end **13***a* of the hard core **13** is conically shaped and seats loosely in a correspondingly conically shaped recess **11***a* provided in the projectile body **11**.

The upper pointed end 13*b* of the core 13 is held concentrically within the hollow nose 12 by a ring 14 arranged therein. For additional centering or supporting of the core 13 the latter has placed about its center portion a ring 15 which at the same time serves as an abutment for the lower end of the nose 12 which at 12*a* is in threaded engagement with the upper end of the hollow projectile body 11.

FIG. 2 illustrates particularly four grooves or notches 13*d* arranged in the circular bottom surface 13*c* of the core 13. These grooves or notches 13*d* may be ground into the core 13 or may also be produced therein by a heat-molding operation. The bottom surface 13*c* with the grooves or notches 13*d*, as clearly shown in FIG. 1, is arranged closely adjacent of a plane surface 11*b* provided within the interior of the projectile body 11. When the projectile is fired these grooves or notches, while the projectile moves through the not-illustrated gun barrel, will come into pressure engagement with the plane surface 11*b* so that the twisting movement of the projectile body 11 received by the rifling in the gun barrel will be automatically transmitted to the hard core 13.

This coupling operation between the grooves, notches, teeth or the like 13*d* in one hand, and the plane surface 11*d* on the other hand, takes place on account of the gas pressure exerted by the ignited propelling powder charge on the bottom surface 11*c* of the projectile body 11.

What I claim is:

1. A twist projectile particularly a sabot projectile for being propelled through a rifled gun barrel comprising: a hollow shell having a tapered front end and a closed rear end with an axially elongate hollow chamber therein with a transversely extending chamber base; said chamber base having a forwardly facing surface; a core positioned within said chamber and being loosely mounted within said chamber so as to be free to have axial pressure movement within said chamber against said forwardly facing surface, said core being of a harder material than said shell and having a rear face forming a core base overlying said chamber base, said core and said hollow shell defining an interengageable projection and recess surfaces in the vicinity of said core base and said chamber base which are movable into coupling engagement as the shell is acceleratingly propelled through the gun barrel and to cause said projection to lock against said shell surface and the core to be rotated with the shell.

2. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein said projection is in the form of a radially extending tooth.

3. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein said projection is in the form of a plurality of radially extending teeth.

4. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein said projection is constructed by material removed from separated areas on the base of the core defining said projection therebetween.

5. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein said core has radially extending grooves formed in the base to provide a plurality of said projections.

6. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein the core is radially supported at axially spaced locations within said chamber.

7. A projectile for being propelled through a rifled gun barrel constructed in accordance with claim 1: wherein the core is held centered at its base by a conical surface within the shell chamber.

8. A twist projectile with a hard core particularly a sabot projectile in which the hard core is concentrically and loosely arranged within a projectile jacket, comprising a hollow projectile jacket having an interior receiving space with a transversely extending bottom, a hard projectile core arranged within said projectile jacket and having a front pointed end and a rear substantially planar end loosely engaged on said bottom, holding means holding said projectile core within said receiving space at a spaced location from the forward end of said jacket, said projectile core and said jacket having surfaces bounding said rear planar end and said bottom respectively defining an interengageable projection and recess which upon firing become rearwardly interengaged in rotative coupling engagement whereby the spin of said projectile jacket is imparted to said projectile core.

9. A twist projectile according to claim 8, wherein said holding means holding said projectile core within said receiving space comprises at least one ring surrounding said projectile pointed end and extending between said projectile and said jacket.

10. A projectile according to claim 8, wherein said projectile jacket and said projectile core are complementarily tapered in the vicinity of the trailing portion of said projectile core to said bottom, said projectile jacket and said projectile core having at least one interengaged projection and recess in said tapered portion.

* * * * *