Sept. 19, 1961 H. F. DUNLAP ET AL 3,000,316

PROJECTILE

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FIG. 1

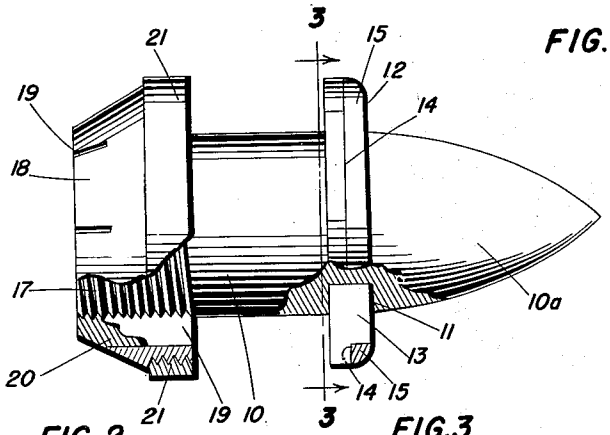


FIG. 2

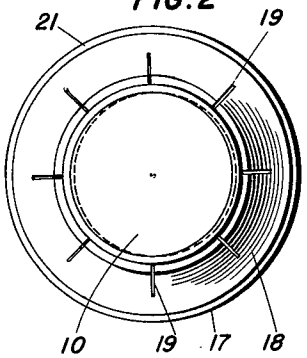


FIG. 3

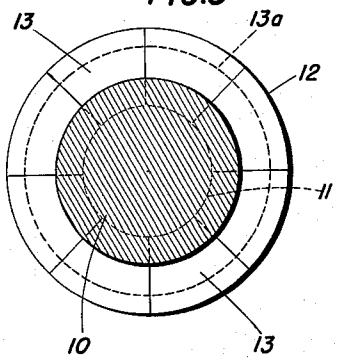


FIG. 4

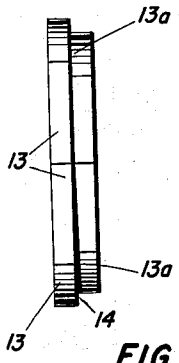


FIG. 6

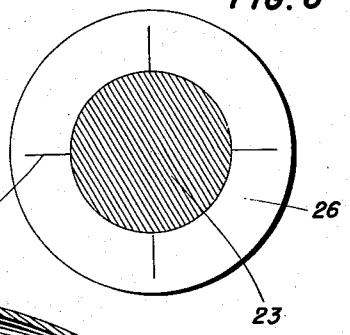
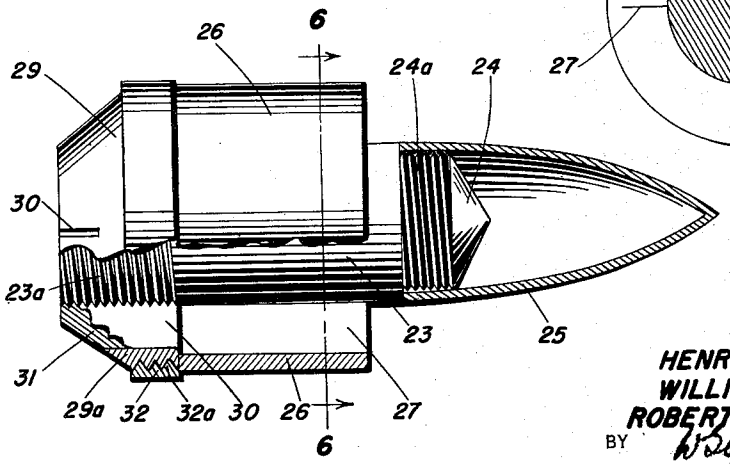


FIG. 5



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PROJECTILE

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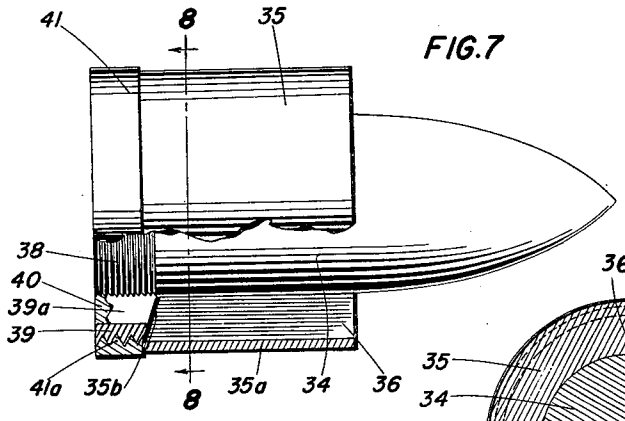


FIG. 7

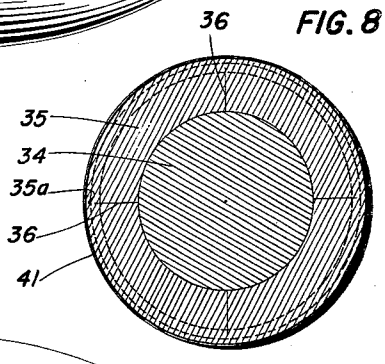


FIG. 8

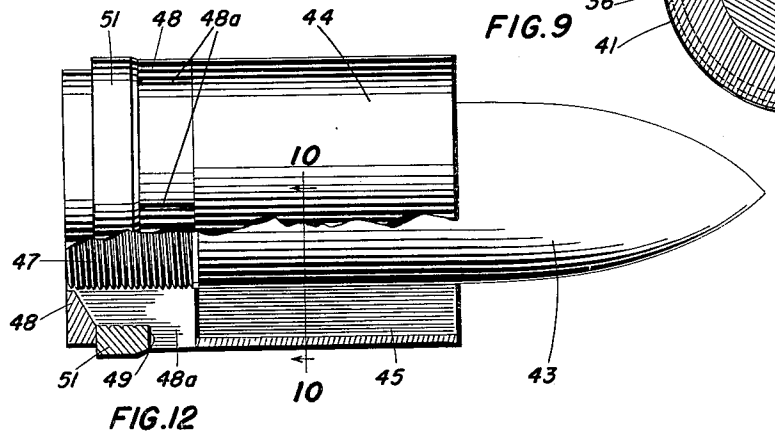


FIG. 9

FIG. 12

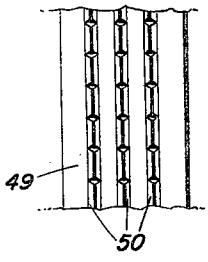


FIG. 10

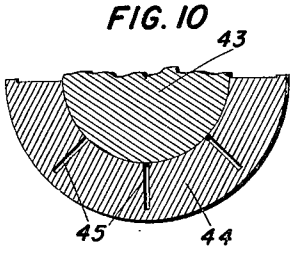
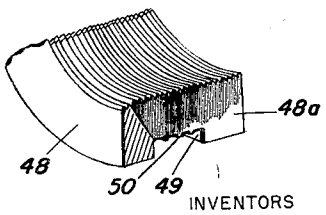


FIG. 11



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3,000,316

PROJECTILE

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Filed July 10, 1944, Ser. No. 544,192
1 Claim. (Cl. 102—93)

This invention relates to rotary sabot projectiles of the type which includes a subcaliber core having a substantially full caliber sabot for supporting and centering the core in a gun barrel and releasable from the core when the projectile emerges from the gun muzzle. More particularly, the invention has reference to a novel projectile of the character described in which the sabot is in the form of a ring threaded on the rear end portion of the core and releasable therefrom by centrifugal force.

One object of the invention resides in the provision of a sabot projectile having a subcaliber core, a substantially full caliber sabot threaded on the rear end portion of the core, and a turning band mounted on the sabot, the threads between the sabot and core being in such a direction that the sabot is tightened on the core by rotation of the turning band through action of the gun rifling.

Another object of the invention is to provide a sabot projectile of the character described in which the threaded sabot is at least partially segmented by longitudinal, radial weakening cuts to facilitate fracturing of the turning band and release of the sabot under centrifugal force.

Still another object is to provide a sabot projectile of the character described in which the weakening cuts in the sabot are filled with a malleable material, such as copper, beaten into the cuts so as to seal the sabot against leakage of the powder gases and to resist loosening of the sabot on the core.

A further object of the invention is to provide a projectile comprising a subcaliber core having a substantially full caliber segmented sabot for supporting the turning band, the rear end portion of the sabot being tapered toward the base of the core so that the powder gases in the gun barrel exert a turning moment on the sabot segments which opposes the normal tendency of the gases to upset these segments.

An additional object of the invention is to provide a sabot projectile of the character described which is simple in construction, has relatively few parts, and may be easily assembled.

These and other objects of the invention may be better understood by reference to the accompanying drawings, in which

FIG. 1 is a view in side elevation, partly in section, of a sabot projectile made in accordance with the invention;

FIG. 2 is a rear elevational view of the projectile shown in FIG. 1;

FIG. 3 is a sectional view on the line 3—3 in FIG. 1, showing the bourrelet;

FIG. 4 is a side elevational view of the assembled bourrelet segments;

FIG. 5 is a view similar to FIG. 1 showing a modified form of the projectile;

FIG. 6 is a sectional view on the line 6—6 in FIG. 5;

FIG. 7 is a view in side elevation, partly in section, of another form of the projectile;

FIG. 8 is a sectional view on the line 8—8 of FIG. 7;

FIG. 9 is a view in side elevation, partly in section, of still another form of the projectile;

FIG. 10 is a sectional view on the line 10—10 in FIG. 9;

FIG. 11 is a perspective view with part of the sabot illustrated in FIG. 9, showing details of the threads and the turning band groove, and

FIG. 12 is a developed view of the turning band groove of the sabot illustrated in FIGS. 9 and 11.

Referring to the drawings, the projectile shown in FIGS. 1 through 4 comprises a subcaliber steel core **10** having an ogive **10***a* and an annular groove **11** near the ogive and in which a substantially full caliber bourrelet **12** is mounted. The bourrelet, as shown, comprises a plurality of segments **13** fitted closely together and seated in the groove **11** to form a ring-like structure on the core. At its front end, the bourrelet is formed with an annular recess **13***a* in the periphery of the bourrelet, the recess being partly defined by a shoulder **14**. The bourrelet segments **13** are held closely together in the groove **11** by a retaining ring **15** fitted tightly in the groove **13***a* and engaging the shoulder **14**. The ring being shrunk or otherwise mounted on the bourrelet. The bourrelet segments **13** and the retaining ring **15** may be made of steel or other suitable material.

At its rear end portion, the core **10** is externally threaded, as shown at **17**. A sabot **18**, which may be made of steel, is screwed on the thread **17** and tightened against the front end of the thread course. The sabot **18** is in the form of a ring having substantially full caliber dimension and partially segmented by longitudinal, radial slots **19** extending from the rear end of the sabot but terminating short of its front end. The slots **19**, as shown, radiate from the inner diameter or threaded portion of the sabot but terminate short of the outer surface of the sabot. In order to seal the sabot against leakage of gas through the slots **19**, we provide suitable seals **20** in the front ends of the slots. Preferably, the seals **20** comprise a malleable metal, such as copper, which is beaten into the slots so as to fill completely the rear ends thereof. In this connection, it will be observed that the seals **20**, in their final form, are wedged into the threads **17** on the core and serve to resist loosening or unscrewing of the sabot on the core. A turning band **21**, which may be made of annealed copper, is mounted on the forward portion of the sabot **18** and supplements the uncut portions of the sabot in holding the segments together on the threaded portion **17** of the core.

The rear or trailing end portion of sabot **18** is tapered sharply from the turning band **21** to the base of the projectile. Accordingly, the outer peripheral surface of the sabot is of generally frusto-conical form with its reduced end adjacent the base of the core.

In operation, when the projectile is fired from the gun, the high pressure from the powder propellant acts upon the base of the core **10** and also upon the rear ends of the sabot and the turning band. As the projectile moves through the gun barrel, the turning band **21** is engraved by the usual rifling in the barrel to impart rotation to the core **10** through the sabot. The torque transmitted from the turning band to the sabot acts to tighten the sabot against the front end of the thread course **17** on the core, whereby rotation of the band is transmitted to the core without lost motion between the parts. Also, the seals **20** in the sabot slots **19**, by reason of their close engagement with the core thread **17**, form a thread lock to oppose rotation of the sabot relative to the core during transmission of this torque. During movement of the projectile along the gun barrel, the core **10** is supported and centered in the barrel by the bourrelet **12** and the sabot **18**, and the latter are held on the core by the confining effect of the gun barrel, against the action of centrifugal force incident to the high speed rotation of the projectile.

When the projectile emerges from the gun muzzle and is thereby released from the confining effect of the gun barrel, the bourrelet ring **15** and turning band **21** are fractured under the centrifugal force, whereby the bourrelet and sabot are released from the core. The core,

therefore, proceeds along its trajectory without the aerodynamic drag which would otherwise be imposed upon it by the bourrelet and the sabot. The ring **15** is broken partly by the action of centrifugal force on its own mass and partly by the radial force to which it is subjected by the bourrelet segments. It will be understood that the sabot **18** is fractured by the centrifugal force at the weakened portions adjacent slots **19**, the shattering of the sabot being augmented by the reaction or counter-flexure of the sabot segments when relieved at the muzzle of the erstwhile powder gas pressure. The release of the bourrelet and sabot from the core occurs immediately upon emergence of the projectile from the gun barrel and is effected with a relatively low energy loss and without substantial interference with the flight of the projectile core.

It will be observed that the slots **19** partially divide the sabot into longitudinal segments, each of which acts substantially as a cantilever beam radiating from the threaded core portion **17**. The powder pressure in the gun barrel normally exerts a turning moment on these segment beams tending to upset them so that their outer ends fold forwardly on the core. However, with the new construction, by reason of the frusto-conical form of the rear portion of the sabot, the powder gases exert on the periphery of the sabot segments adjacent their rear ends a turning moment which opposes the turning moment previously described. In other words, the effect of the powder pressure on the frusto-conical portions of the sabot segments is to force or flex the rear end portions of the segments inwardly against the threads **17** on the core, causing the threads to bear deeply into each other, thereby resisting the tendency of the powder pressure to upset the segments. Also, the gun barrel in effect exerts a radial thrust inwardly on the turning band **21** which resists the turning moment acting to upset the segments.

The projectile shown in FIGS. 5 and 6 comprises a subcaliber steel core **23** having a nose **24** and a threaded portion **24***a* directly to the rear of the nose. A wind cap **25**, which may be made of aluminum, is screwed on the threaded portion **24***a* and tightened against the shoulder at the rear end of the threaded portion. A sleeve-like bourrelet **26** of substantitally full caliber dimension is closely fitted on the intermediate portion of the core. The bourrelet **26** may be made of steel, plastic, or other suitable material and is provided with a plurality of longitudinal weakening cuts **27** radiating from the inner diameter of the bourrelet but terminating short of its outer diameter.

To the rear of the bourrelet **26**, the core **23** is externally threaded, as shown at **23***a*. A steel sabot **29**, similar to the sabot **18**, is screwed on the threaded portion **23***a* and tightened against the rear end of bourrelet **26**. The sabot **29** has longitudinal slots **30** extending therethrough and radiating from the threads **23***a* so as to partially segment the sabot. The slots **30** are sealed by copper or other malleable metal **31** beaten into the rear end of the slots and forced into the threads **23***a*. A turning band **32** is mounted on the front end portion of the sabot and may be provided with internal tongues **32***a* press-fitted into annular grooves in the sabot to resist stripping of the band from the sabot when the projectile is fired from the gun. The rear end portion of the sabot **29** is tapered toward the base of the projectile core, as described in connection with the projectile shown in FIG. 1.

The operation of the projectile shown in FIGS. 5 and 6 is generally similar to that of the projectile illustrated in FIG. 1. However, the bourrelet **26** is held in position on the core **23** by its tight fit around the cylindrical surface of the core and also by engagement with the front face of the sabot, so that it is unnecessary to provide an annular groove or other positive means for securing the bourrelet. It will be understood that the bourrelet **26** is released from the core by fracturing of the bourrelet adjacent the radial cuts **27** under centrifugal force when the projectile emerges from the gun muzzle.

Referring to FIGS. 7 and 8, the projectile there shown comprises a subcaliber core **34** carrying a substantially full caliber sleeve-like bourrelet **35** provided with longitudinal radial cuts **36** for partially segmenting the bourrelet. The cuts **36** radiate from the inner diameter of the bourrelet but terminate short of its outer diameter so as to leave uncut portions **35***a* holding the segments together on the core.

The rear end portion of the core **34** is externally threaded, as shown at **38**, and a sabot **39** of ring-like form is screwed on the threaded portion **38**. The sabot may be made of steel or other suitable material and has a plurality of longitudinal slots **39***a* extending through it, the slots being sealed by copper or other malleable metal **40** beaten into the rear ends of the slots and against the threads **38**. A turning band **41** is fitted closely around the sabot and has internal tongues **41***a* disposed in annular grooves in the peripheral portion of the sabot. As shown at **35***b*, the front end of the sabot **39** is tapered sharply and fits closely against a complementary surface on the rear end of the bourrelet.

When the projectile shown in FIGS. 7 and 8 is fired from a gun, the torque incident to rotation of the turning band **41** by the gun rifling acts to tighten the sabot **39** against the front end of the thread course **38** on the core and against the rear end of bourrelet **35**, whereby rotation of the turning band is transmitted to the core without lost motion. As the projectile is accelerated in the gun barrel, the resulting force of setback of the bourrelet sleeve **35** against the sabot **39** acts to oppose the previously described tendency of the powder gases to upset the sabot segments. When the projectile emerges from the gun muzzle, the uncut portions **35***a* of the bourrelet are fractured by the centrifugal force due to the high speed rotation of the projectile, so that the bourrelet is released from the core. Also, the turning band **41** is broken by the centrifugal force, and the sabot is released by fracturing of its uncut portions under the action of the centrifugal force.

The projectile shown in FIGS. 9 through 12 comprises a subcaliber core **43** and a sleeve-like bourrelet **44** fitted closely around the core intermediate its ends. The bourrelet **44** has a plurality of longitudinal radial weakening cuts **45** which partially segment the bourrelet. On its rear end portion, the core has a thread course **47** on which a sabot **48** is screwed. The sabot is provided with longitudinal weakening cuts **48***a* radiating from its inner diameter to its outer diameter and dividing the sabot into longitudinal segments which are held together by an uncut portion of the sabot at its rear end. Intermediate its ends, the sabot has an annular external groove **49**, the bottom of which is scored as shown at **50**. A turning band **51** is mounted in the groove **49** and fitted tightly against the scored bottom **50** of the groove.

The operation of the projectile shown in FIGS. 9 through 11 is generally similar to that of the projectile illustrated in FIG. 7. It will be observed, however, that in the projectile shown in FIG. 9, it is not necessary to provide seals for the longitudinal weakening cuts **48***a* in the sabot, since the rear end portion of the sabot is uncut. The breaking of the uncut portion of the sabot is aided by the cantilever action of the sabot segments under centrifugal force on the front portions of the segments. Also, by reason of the scoring **50** on the bottom of the sabot groove **49**, the turning band is prevented from rotating relative to the sabot under the action of the rifling as the projectile is accelerated through the gun barrel.

The new projectile, in its various illustrated forms, is simple and compact in construction, has relatively few parts, and may be easily assembled. The sabot and bourrelet provide efficient supporting and centering means for the subcaliber core in the gun barrel and are quickly

and positively released from the core by centrifugal force as soon as the projectile emerges from the gun muzzle, with relatively low energy loss and without substantially interfering with the flight stability of the core.

We claim:

In a projectile, a subcaliber core having an external thread course, means for centering the core in an oversize gun barrel, said means consisting of an internally threaded sabot which is screwed onto the thread course, said sabot being at least partially slotted to insure its shattering when eventually yielding to centrifugal force, and a malleable filler forced into the slots and extruding into part of the thread course, respectively sealing the slots against gas escape and locking the sabot on said core.

References Cited in the file of this patent

UNITED STATES PATENTS

34,268	Rollins	Jan. 28, 1862
1,973,604	Brandt	Sept. 11, 1934
2,021,685	Fornaci	Nov. 19, 1935

FOREIGN PATENTS

131,034	Great Britain	Aug. 21, 1919
496,991	France	Aug. 25, 1919
784,108	France	Apr. 23, 1935
801,218	France	May 16, 1936
804,237	France	July 27, 1936