Feb. 7, 1967 F. R. MARQUARDT 3,302,570

ARMOR PIERCING, FRAGMENTING AND INCENDIARY PROJECTILE

Filed July 23, 1965

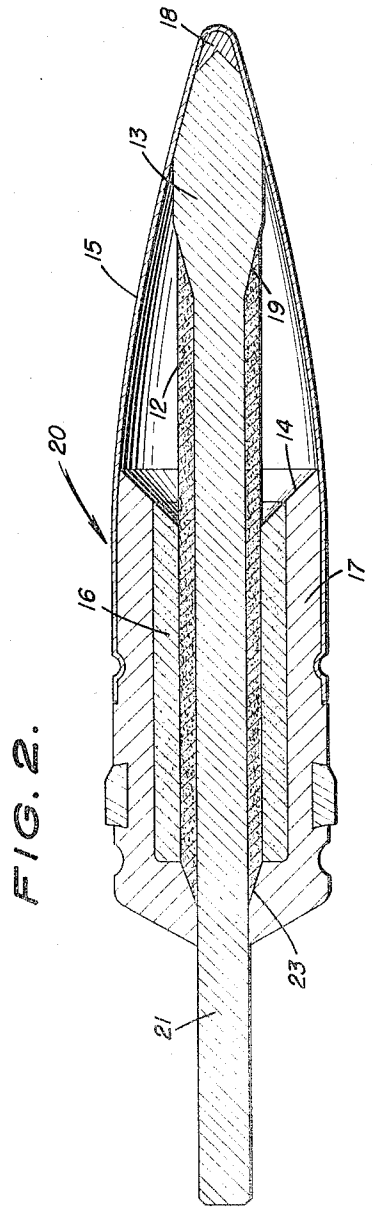

FIG. 2.

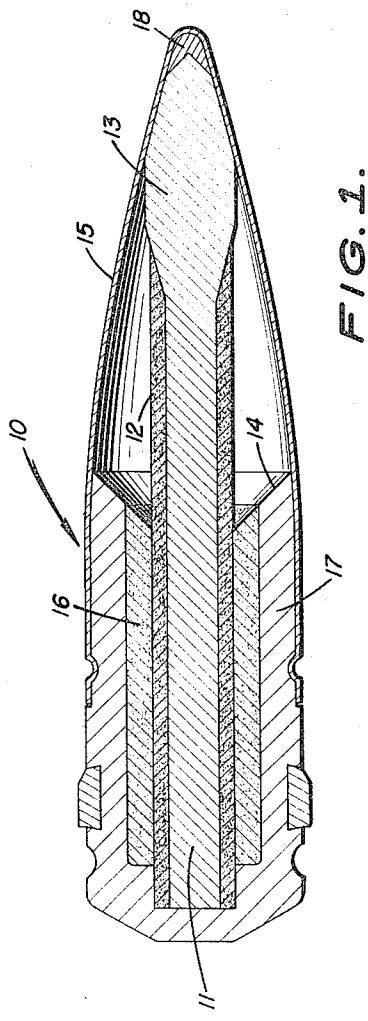

FIG. 1.

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3,302,570

Patented Feb. 7, 1967

3,302,570

ARMOR PIERCING, FRAGMENTING AND INCENDIARY PROJECTILE

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Filed July 23, 1965, Ser. No. 474,329

12 Claims. (Cl. 102—52)

This invention relates generally to ammunition, and more particularly it pertains to armor piercing incendiary type projectiles.

Hardened steel armor has been and is still used as a countermeasure against receiving lethal projectile or shape charge damage against vulnerable components of, or people in intricate machines such as personnel carriers, tanks, and equivalent armored vehicles.

An object of this invention, therefore, is to provide a new type armor piercing, fragmenting and incendiary projectile which reduces the countermeasure effectiveness of hardened steel armor by minimizing the amount of projectile energy or impulse required to pass through the armor.

In addition, another object of this invention is to provide a projectile which also maximizes the amount of damage to components and people supposedly protected by the armor.

Former projectile designs contained a hardened steel penetrator that was the full diameter of the projectile and shorter than the projectile length to reduce weight so that the initial launch velocity would be high, thus obtaining maximum initial penetrator energy. A low-weight windshield was used to reduce aerodynamic drag, thus reducing the amount of energy lost as a function of firing range to target. In an attempt to increase damage at the target, some of the former projectile designs contained an incendiary material forward of the hardened steel penetrator and enclosed by the light-weight windshield.

The net effect obtained was incendiary flash on the outside of the armored target before the projectile penetrator started to pierce the armor with the result that no incendiary material would pass through the armor and contact components or people behind the armor. Because the projectile penetrator was large in diameter, a large amount of armor would have to be displaced to allow penetration. Thus the armor absorbed a large amount of the penetrating energy of the projectile and thinner armor could prevent passage of the projectile. Also by making the armor of a high hardness steel material, many such hardened steel projectiles would be shattered upon impact, reducing projectile penetration considerably.

Accordingly, it is a further object of the present invention to provide a projectile which will overcome the above-mentioned disadvantages and increase the penetration capability with less energy being expended.

Another object of this invention is to provide an armor penetrating projectile which fragments in such a way as to obtain greater "after armor" damage.

Yet another object of this invention is to provide in an armor piercing projectile, a pair of incendiary means, one of which follows through to be effective on the far side of armor and one operating on the near side thereof.

Still another object of this invention is to provide a follow-up plug cutter means to increase the fragmentation of armor in an armor penetrating projectile and cause more far side damage.

A further object of this invention is to provide a projectile which reduces the initial impact shattering by providing nose cushion and lubrication means for the armor piercing element of the projectile.

Other objects and attendant advantages of this invention will become more readily apparent and understood from the following detailed specification and single sheet of accompanying drawings in which:

FIG. 1 is a longitudinal section of an armor piercing fragmenting incendiary projectile embodying features of this invention; and

FIG. 2 is a view similar to FIG. 1 of a modified embodiment of the invention.

Referring now to the details of the drawings, with special attention ot FIG. 1, reference numeral **10** is a projectile intended for firing from a gun. This projectile **10** consists of an axially located penetrator **11** made of a rather slender but relatively very long rod of high density hard metal such as depleted uranium or an alloy of tungsten carbide and cobalt. This penetrator **11** is formed with an enlarged, tapered, blunt-pointed head **13**.

A high density incendiary material, shown by reference numeral **12**, surrounds the elongated portion of penetrator **11**, but is slightly smaller in diameter than the forward head **13**. The weight of the incendiary **12** assists penetration through the armor and passes through the hole.

Because of impact shocks and heat generated as the armor is pierced, the latter half of the long penetrator **11**, as well as the incendiary material **12**, surrounding the penetrator **11** fracture into lethal particles. The incendiary material is thus ignited and continued flight of the fractured penetrator **11** and incendiary material **12** through the hole causes considerable damage to internal components and people.

To prevent complete fracture of the penetrator **11** at high angles of impact obliquely, a soft metal nose **18**, is placed forward of the head **13** of the penetrator **11**.

A light-weight windshield **15** is provided to reduce aerodynamic drag of the projectile **10** and thus minimize energy loss during flight to the target. Outside armor damage can be obtained by placing a light-weight incendiary material **16** around the heavy incendiary **12**, with the objective of not passing through the hole formed by the penetrator **11**.

A projectile body **17** is required to obtain a high launch velocity out of a gun barrel and to stabilize the projectile **10** during flight to the target. By forming and hardening the front end **14** of the hollow projectile body **17** to a sharpened "cookie-cutter" shape as shown, more internal damage is obtained when thin armor is impacted since a larger hole is formed in the armor by cutting out a plug which is also fractured and tossed internally against components and people. The mass (weight) of the projectile body **17** adds energy to the penetrator **11** and incendiary **12**, during the penetration process until the front end of the projectile body **14**, contacts the target surface. Thus, still greater penetration and back-of-armor damage is obtained as a result of energy retention in the material passing through the hole made in the armor. The low density incendiary **16**, is used to reduce weight during acceleration down the gun barrel and thus obtain a higher initial projectile velocity (higher initial energy).

When it is desired to obtain the greatest penetration depth (defeat of thicker armor), the penetrator **21** can be made still longer in a projectile **20** as shown in FIG. 2. The rear end **23** of the dense incendiary **16**, is tapered to form a wedging seal around the rearwardly extended penetrator **21**, when the projectile **20** is accelerated by the high pressure propellant gas.

The wedge surface **19** behind the enlarged head **13**, applies support to accelerate the penetrator **11**, at the same rate the rest of the projectile **20** is being accelerated. The longitudinal force created at wedge surface **19** is resisted at the slope of rear end **23** and is the source of force that creates the wedging seal, preventing high pressure propellant gas from entering the projectile **20** and igniting the

light-weight incendiary material **16**, and/or prevents the incendiary **16**, and the light-weight windshield **15** from being blown free of the rest of the projectile body and penetrator **21**.

A third alternate design, not shown, where it is not desirable to have incendiary pass through the hole made by the penetrator, would be to omit the material **12**. This type of penetrator **11** or **21** would then have an elongated portion of slightly smaller diameter than the head **13** which is desirable because as penetration through armor takes place, the armor tends to recover (closing the hole slightly) trapping some of the fractured penetrator material in the armor cavity. The reduced after-portion of the penetrator fragments during the penetration process while the forward portion or head **13** remains intact as previously related.

It is well known that hardened armor plate that is free of low melting temperature impurities is more resistant to high density penetrators than hardened armor plate that contains a moderate amount of low melting temperature impurities. The soft nose **18** is not only a soft material to prevent initial shatter of the penetrator **11**, but is also of a low melting temperature such that upon impact of the projectile **10**, or **20** with hardened armor plate that is free of impurities, the nose **18** melts and forms an alloy and provides a lubricant for the penetrator **11** or **21** as it pierces the armor plate. Thus greater penetration is obtained and less energy is lost from the penetrator **11** or **21** with the result that greater after-armor damage can be accomplished by the partially fragmented penetrator after penetration.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A projectile for piercing armor, comprising structure defining a projectile body, an elongated penetrator of relatively smaller diameter extending forward from said body and terminating in an enlarged head for piercing said armor, incendiary material surrounding said penetrator and terminating at said enlarged head, said incendiary material having a smaller diameter than that of said enlarged head for piercing said armor therewith, and windshield structure defining a smooth surface of transition between said body and said enlarged head.

2. The projectile of claim **1** wherein the rearward end of said penetrator terminates in said projectile body.

3. The projectile of claim **1** wherein the rearward end of said penetrator extends rearward of said projectile body.

4. The projectile of claim **3** wherein said incendiary material terminates at the end opposite said enlarged head in a tapered wedge within said projectile body.

5. The projectile of claim **1** wherein the forward end of said enlarged head terminates in a blunt point.

6. The projectile of claim **1** wherein the forward end of said projectile body terminates in a sharp edge.

7. The projectile of claim **1** and additionally, a soft metal nose positioned over the forward end of said enlarged head.

8. The projectile of claim **1** and additional incendiary material positioned in said projectile body and having a larger diameter than that of said enlarged head.

9. The projectile of claim **8** wherein the first mentioned incendiary material is of high density and said additional incendiary material is of low density.

10. The projectile of claim **1** wherein said penetrator is axially located with respect to said projectile body.

11. A projectile for piercing armor, comprising structure defining a projectile body, an elongated penetrator of relatively smaller diameter extending axially forward from said body and terminating in an enlarged head for piercing said armor, high density incendiary material laterally surrounding said penetrator and terminating at said enlarged head, said incendiary material having a smaller diameter than that of said enlarged head for piercing said armor therewith, low density incendiary material positioned within said projectile body, and windshield structure defining a smooth transition between said body and said enlarged head.

12. The projectile of claim **11** wherein the forward edge of said projectile body is sharp-edged for piercing thin armor.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,302,570 February 7, 1967

Frank R. Marquardt

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 4, for "assignor to" read -- assignor of fifty percent to --.

Signed and sealed this 17th day of October 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents