

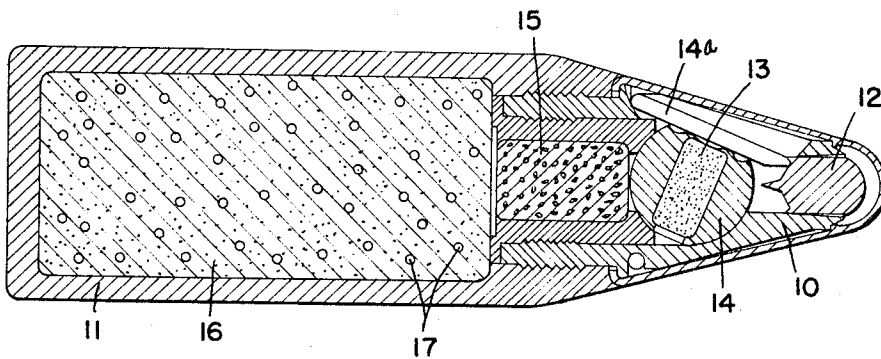
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INCENDIARY PROJECTILE

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INVENTOR.
GUS FRANCIS
WILLIAM H. SUTRICH

BY

L. J. Rotondi, A. C. Dupont & S. Dubroff

ATTORNEYS:

3,370,536

INCENDIARY PROJECTILE

Gus Francis and William H. Sustrich, Denver, Colo., assignors, by mesne assignments, to the United States of America as represented by the Secretary of the Army
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1 Claim. (Cl. 102—66)

This invention relates to an incendiary and structural damage projectile for use against aircraft or missiles and has for an object to obtain deeper penetration of projectile components and incendiary material into the body of a target than has heretofore been obtained.

One type of projectile heretofore intended for use against aircraft has been called the high explosive incendiary. This was found to damage the body of an aircraft to a comparatively shallow extent. There has been a need for deeper penetration of the incendiary material into the body of an aircraft where the fuel lines, gas tank and other vulnerabilities are located.

According to this invention that need has been filled in an unusual manner by the provision of a quantity of metal balls or compressed lead or tungsten dust when of smaller particle size than 20 mesh discharged from a projectile body, not by an explosive but largely by these masses and the incendiary material retaining the velocity of the projectile after the velocity of the projectile body has been slowed down by nose impact upon an aircraft and by the recoil effect of having a nose cone blown off. The use of an explosive loaded directly under the fuze or intermixed with the incendiary powder has been found to be less effective than is desired owing to the explosive shattering the body of the projectile and discharging the metal balls or powder in too wide a direction.

More specifically the present invention utilizes an impact type fuze and detonator in the tip portion of the usual conical nose. This nose detonator then fires a booster detonator also located in the conical nose portion of a 20 millimeter projectile but located adjacent the body of a projectile. This booster detonator performs a two-fold function. It shatters and blows the conical nose off the projectile body and also ignites an incendiary material in the body of the projectile. Inasmuch as there is no substantial amount of explosive in the body portion, the projectile body is not shattered and the metal balls or powder are not spread over a wide area. With the body intact it is believed capable of guiding the balls or powder as well as the burning incendiary material out of such unshattered body. A chief force for ejecting the metal powder or balls is believed to be the fact that these are able to retain much of their momentum after the projectile body has been slowed down in velocity and by a recoil effect on the body when the nose is blown off on impact with the outer surface of a target. Speed of projectile rotation together with its linear velocity determines the cone angle of dispersion of the metal balls and heavy metal powder. With the conical nose portion removed from the projectile body the powder or balls are free to be ejected under their own momentum without explosion large enough to shatter the projectile body. The presence of a mass of metal balls and the like has been found to be able to penetrate more deeply into an aircraft than would the fragments of the shell under an explosive force shattering the body of the projectile. This does not mean that the incendiary material may exert no propulsion effort upon the balls, but rather that the controlling consideration must be the absence of enough gas pressure in the projectile body to shatter it and widely disseminate the balls or powder.

Referring to the drawing, the single figure shows a longitudinal section through a preferred embodiment of this invention.

The projectile illustrated has two portions, the conical nose 10 and the main steel body 11. The nose 10 is not per se new and contains an impact responsive stab detonator 12 in the tip held in an unarmed position by a spring 14a which stab is movable rearwardly to ignite a fuze explosive 13 in the ball rotor 14 by percussion after said rotor has been armed by centrifugal force and held in its armed position. After ignition of detonator 13 a flame passes rearwardly through an opening in the metal booster cup 15 containing a second detonator for the purpose of igniting the incendiary material 16 surrounding the lead balls or shot 17 or heavy powder particles. Another purpose in the booster detonator in cup 15 is to shatter and blow the conical nose portion 10 out of the way while the incendiary powder 16 is catching fire.

After impact upon a target and blowing the nose cone off, the metal body 11 at least loses some of its velocity, but not so with the mass of heavy metal powder or the lead balls 17. These continue moving at near the velocity of the projectile at the time of impact, and after the conical nose 10 has been blown away they have a clear path out of the body 11 being guided to some extent by the cylindrical walls of the body 11. During ejection the incendiary material 16 is burning around the balls or powder 17. These have been found to penetrate more deeply and cause more structural damage to the aircraft. The reason for this new result is not certain. One theory is that the cumulative effect of the amassed powder or the 78 lead balls about .177 inch in diameter have such momentum that this is the cause of such deeper penetration. Perhaps a safe conclusion is that the momentum of the balls or powder mass becomes to some extent cumulative as the leading ball or powder portion slows and others behind it catch up to create a cumulative effect for penetration of successive target sheets.

The total weight of the balls or metal powder or both is 650 grains in a 20 mm. projectile. The incendiary material is about 98% zirconium of a 20 to 60 mesh particle size. About 1% is a 50-50 powdered alloy of magnesium and aluminum and about 1% is barium nitrate. The total weight of the projectile is 2035 grains. The steel projectile body 11 is not new apart from the present process and product combination. A new feature is believed to be the absence of an explosive in the body 11 likely to scatter the balls or powder mass. It is either the recoil effect of blowing off the nose or some recoil effect of a mild incendiary explosion or the penetration of an aircraft target without a usual body shattering explosive charge in the projectile to scatter the metal balls or powder that is believed to be a unique feature in the present invention. This does not mean that no slight explosive force may be present in the shell body, but only that the body walls 11 are not in danger of being shattered and sending the balls or powder in an unnecessarily wide field of dispersion. Also the burning incendiary material may generate heat and gas pressure in the body 11, but such is not in danger of rupturing the body 11 due to the comparatively slow burning of zirconium of the size stated. Some modifications of this incendiary material have been known to burn as long as 1000 milliseconds as is stated in the prior invention in Patent 2,951,752, dated Sept. 6, 1960, by Thomas Stevenson, Ser. No. 736,932, filed May 21, 1958, for "Incendiary Composition." A cone of dispersion of perhaps about 15° to 20° is believed to occur with the balls or powder.

The booster detonator is old per se and is known as the M47 type detonator. It must burn for a long enough time or with an intense enough heat to ignite the incendiary composition in the shell body. The booster in cup 15 for igniting the zirconium incendiary is of the type commonly used in explosive shells for the purpose of acting as a

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relay in an explosive series. The lead balls or tungsten powder is compressed for the purpose of holding the metal particles together under rotation or spin stabilization of the projectile and this compression is between about 5000 to 25,000 pounds per square inch. The reduction in projectile velocity may be due to some one or two or all of three possible causes, namely, impact on a target, or the recoil effect from blowing off the nose cone, or the recoil of firing the incendiary material and producing a mild explosive effect. The tungsten dust used was smaller than 200 mesh and compressed into pellets preferably of about the same size as the lead balls. As shown in the drawing the projectile body is thicker around at least part of the booster charge 15 to reduce the possibility of shatter.

We claim:

1. A projectile comprising a cylindrical body, incendiary material contained within said body and compressed under at least a 5,000 p.s.i. pressure and capable of burning for substantially 1,000 milliseconds, a plurality of metal masses at least as heavy as lead in said incendiary material, a conical nose on said body, a stab and ball rotor type nose fuze detonator, and a booster detonator between said ball rotor detonator and said incendiary material for igniting the latter, said booster detonator being located in a front portion of said cylindrical body and said incendiary material, said booster detonator being of a strength to blow said nose off said body on ignition, said projectile being of 20 millimeter size containing about 78 pellets each weighing at least about as much as a lead shot of .177 inch diameter, about 75 grains of an incen-

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diary material containing about 98% of zirconium having a particle size of 20 to 60 mesh and about 1% barium nitrate with about 1% of a mixture of a 50-50 alloy of magnesium and aluminum, whereby on reduction in velocity of said body, the nose is blown away quickly and the incendiary and metal masses are guided from said body as a burning agglomerated mass while said body is of a thickness to be unshattered as said burning incendiary and its metal masses issue therefrom in a cone of dispersion of about 20° and whereby said metal masses are capable of deeper penetration into an aircraft type target than is a prior high explosive projectile of the same caliber due to the projectile body remaining unshattered.

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BENJAMIN A. BORCHELT, *Primary Examiner.*

ARTHUR M. HORTON, *Examiner.*

30 W. E. STEWART, F. C. MATTERN, W. KUJAWA,
Assistant Examiners.