# United States Patent [19]

**Mertens**

[11] **3,922,967**

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[54] **CLOSED-BREECH-GUN-FIRED ROCKET-ASSISTED PROJECTILE**


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[73] Assignee: **Avco Corporation,** Cincinnati, Ohio



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[21] Appl. No.: **455,988**

[52] **U.S. Cl.** ..... **102/38**

[51] **Int. Cl.**[2].... **F42B 13/10;** F42B 9/10; F42C 1/04

[58] **Field of Search** ..... 102/38, 49.7, 73, 93



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,884,859 | 5/1959 | Alexander et al. | 102/38 |
| 3,105,440 | 10/1963 | Brandt | 102/73 X |
| 3,326,128 | 6/1967 | Choate | 102/38 |
| 3,424,086 | 1/1969 | Lambert | 102/38 |
| 3,446,147 | 5/1969 | Engel et al. | 102/93 |
| 3,623,432 | 11/1971 | Schminke | 102/56 |
| 3,750,979 | 8/1973 | Nelms | 102/49.7 X |



*Primary Examiner*—Verlin R. Pendegrass

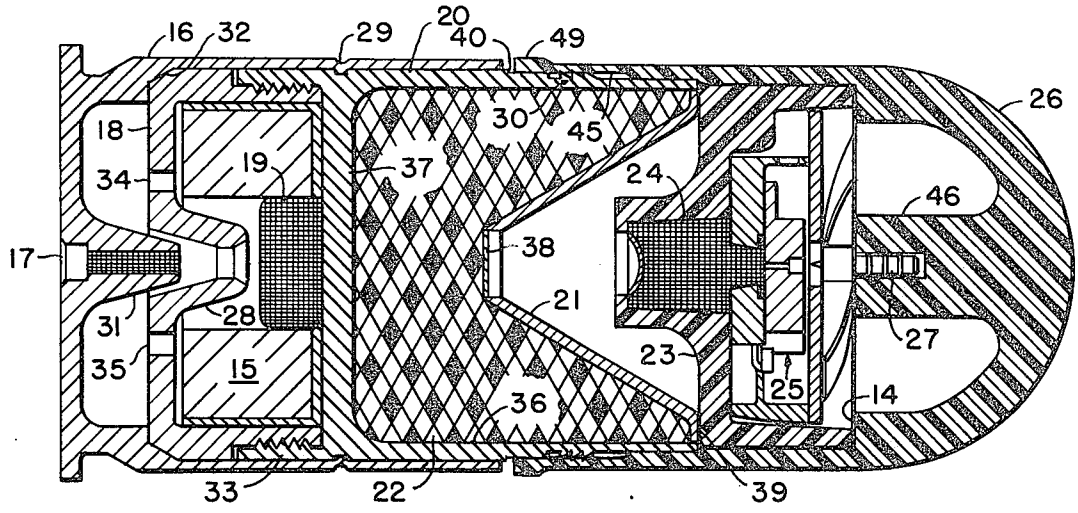
*Attorney, Agent, or Firm*—Charles M. Hogan



[57] **ABSTRACT**

Herein disclosed is a rocket assisted projectile having forwardly extending central propulsion nozzle and two auxiliary nozzles, an igniter mounted on the cartridge, and booster and propellant charges so related to the igniter and the inverted central nozzle that ignition of the propellant charge opens up the auxiliary nozzles and builds up pressure between the base of the cartridge and a rigid wall in the rocket motor, thereby effecting cartridge-projectile separation. Also disclosed are improvements comprising, inter alia, a plastic ogive providing a firing pin mounting and an integral band, and improvements in impact fuze and spitback housing constructions.


**11 Claims, 13 Drawing Figures**



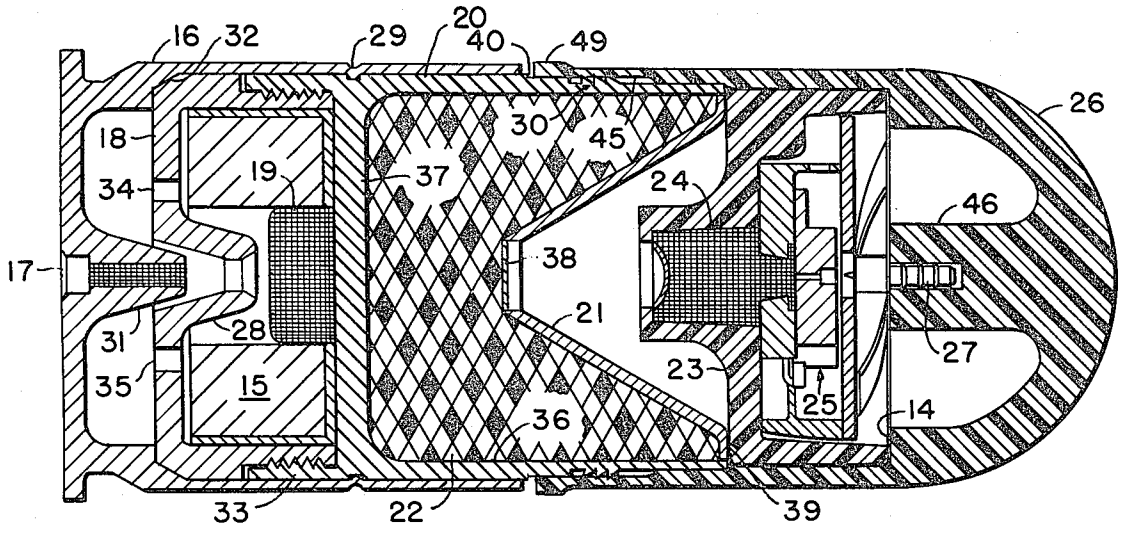



Fig 1


Fig 2

PRIOR ART

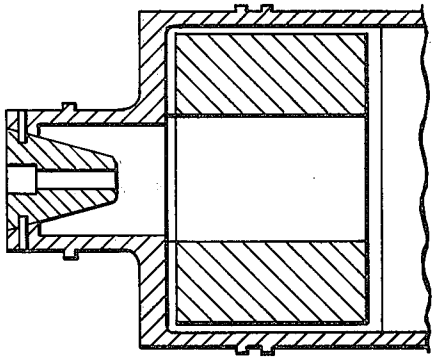


Fig 5

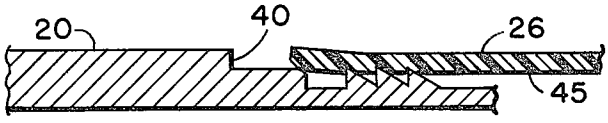



Fig 3

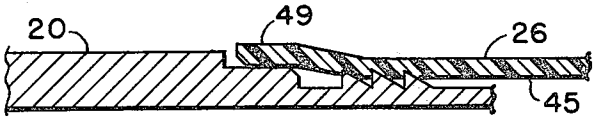



Fig 4

PRIOR ART

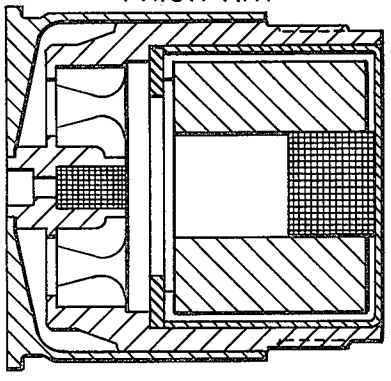


Fig 6

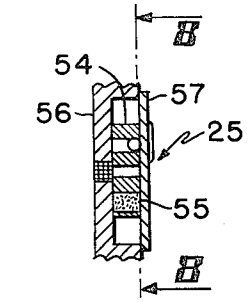



Fig 7

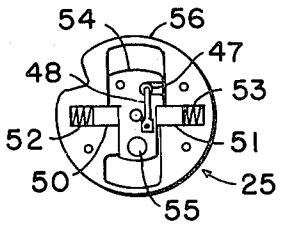



Fig 8

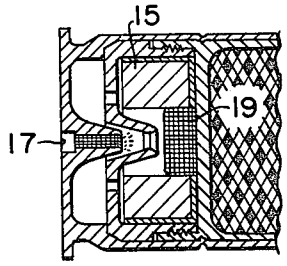



Fig 9

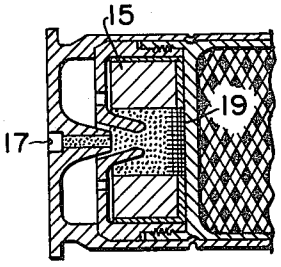



Fig 10

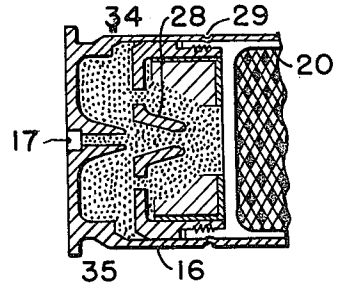



Fig 11

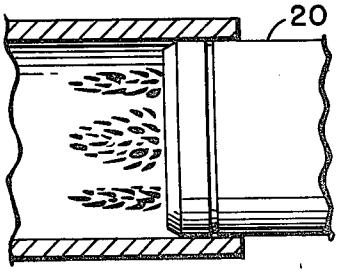



Fig 12

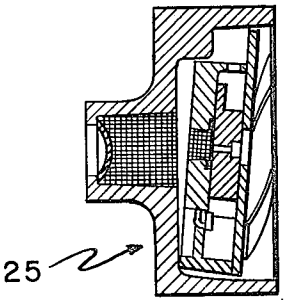



Fig 13

# CLOSED-BREECH-GUN-FIRED ROCKET-ASSISTED PROJECTILE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is an improvement in rocket assisted cartridges of the type fired from closed breech guns. One of the principal objects of the invention is to accomplish a major change in configuration and orientation of parts, forwardly extending central nozzle providing a substantial reduction in projectile length.

Another principal object of the invention is greatly to simplify the means by which controlled cartridge-projectile separation is accomplished. To this end there is provided a novel subcombination in which ignition and nozzle seals are omitted.

Another object of the invention is to provide an improved means for securing the ogive to the warhead.

Among the objects of the invention are to accomplish substantial economies by making the firing pin support integral with the ogive and by the provision of a plastic spitback housing.

It is also an object of the invention to utilize the ogive locking system to form a rotating band.

Objects of the invention further comprise spitback housing and ogive improvements and a free mounting of fuze parts such that a prior art inertia member is dispensed with.

2. The Prior Art

The most pertinent prior art known to the inventor and found on search by Applicant's representative preparing this specification comprises the following United States patents:

| Patent No. | Issued | Inventor | Title |
|---|---|---|---|
| 2,884,859 | May 5, 1959 | Alexander | Rocket Projectile |
| 2,945,421 | July 19, 1960 | Pion | Spin Rocket and Rotating Screw Type Launching Apparatus |
| 3,176,615 | Apr. 6, 1965 | DeMatthew | Gun-Propelled Rocket-Boosted Missile |
| 3,204,530 | Sept. 7, 1965 | McGowan | Rocket Boosted Automatic Weapon and Ammunition System |
| 3,204,559 | Sept. 7, 1965 | DeMatthew | Rocket Propellant Charge Igniter |
| 3,264,995 | Aug. 9, 1966 | Libby | Mechanical Fuze Operable on Grazing Impact |
| 3,326,128 | June 20, 1967 | Choate | Rockets and Combination of Rockets and Cases |
| 3,349,708 | Oct. 31, 1967 | Paget | Rocket Projectile |
| 3,371,608 | Mar. 5, 1968 | Webb | Fuze with Delay Firing and Impact Firing Features |
| 3,381,613 | May 7, 1968 | Webb | Safe and Arming Mechanism for Fuze |
| 3,434,419 | Mar. 25, 1969 | Dimond et al. | Rocket Assisted Projectile with Movable Piston Base Plate |
| 3,442,083 | May 6, 1969 | DeKlotz | Adjustable Variable Thrust Propulsion Device |
| 3,485,460 | Dec. 23, 1969 | Mertens | Variable Drag Ogive |
| 3,603,259 | Sept. 7, 1971 | Webb | Fuze Setback and Angular Acceleration Detent |
| 3,713,386 | Jan. 30, 1973 | Zaid | Range Limited Projectile System |
| 3,750,979 | Aug. 7, 1973 | Nemls et al. | Rocket Assisted Projectiles |

Typical prior art patents for rocket-assisted projectiles have one or more nozzles at the rear of the warhead. In the case of the type involving a central nozzle no propulsion gases flow out the rear until a minimum



pressure occurs at which time shear pins are broken and a plug, on which the igniter is mounted, is blown from the nozzle. In this case the structure is not only too long but it also requires a means for controlling the ejected plug. A construction of this type is illustrated in FIGS. 19–21 of the McGowan U.S. Pat. No. 3,204,530 mentioned above. In an improved version of rocket-assisted projectile there is a pressure seal between a plurality of rearwardly oriented symmetrically angularly disposed nozzles and the propellant, the igniter being built into the motor. This construction requires a cartridge case seal which allows the gun firing pin to dimple, but not to penetrate the seal, at the time of initiation of the primer. Both of the aforementioned constructions involve nozzles extending rearwardly from the rocket motor, increasing the length of the projectile and requiring excess volume.

The invention eliminates the aformentioned disadvantages and limitations and accomplishes its objectives by the following features, to which particular attention is directed: (1) the forard direction of the central rocket nozzle; (2) the elimination of the primer disc and the rocket nozzle disc by controlled venting and a crimped-joint mode of cartridgeprojectile separation; (3) the minimizing of the number of nozzles; (4) an ogive warhead grip which forms a rotating band; (5) the plastic firing pin support and plastic spitback housing; and (6) the floating mounting of the fuze.

For a better understanding of the invention, together with other and further objects, advantages and capabilities thereof reference is made to the following description of the appended drawings.

## DETAILED DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a longitudinal central cross-sectional view of a preferred form of rocket-assisted closed-breech-gun-fired projectile in accordance with the invention;

FIGS. 2, 3 and 4 are fragmentary sectional views indicating the approach, the initial engagement, and the final locking of warhead body and ogive members of the improved projectile of FIG. 1;

FIGS. 5 and 6 are fragmentary longitudinal sectional views of the first and second prior art structures mentioned above, both designated by the label "prior art";

FIG. 7 is an axial sectional view of the fuze used in the FIG. 1 projectile;

FIG. 8 is a cross-sectional view as taken along section line 8—8 of FIG. 7, looking in the direction of the arrows;

FIGS. 9, 10, 11 and 12 are fragmentary sectional views, generally of the rear portions of the FIG. 1 projectile, showing four successive stages in the firing thereof; and

FIG. 13 is a cross-sectional view of the fuze, showing its operation on impact with a target.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring now specifically to FIG. 1, there is shown a preferred form of dual-purpose gun-fired rocket-assisted projectile in accordance with the invention. It comprises the following principal members, in combination: cartridge case 16, igniter 17, rocket motor housing 18, auxiliary booster charge 19, propellant 15, warhead body 20, liner 21, explosive 22, spitback housing 23, spitback charge 24, fuze subcomination 25, ogive 26, and firing pin 27.

As the description proceeds, particular attention will be directed to the following features: (1) nozzle 28 formed integral with motor housing 18, such nozzle being located at the rear and being oriented forwardly, i.e., in a reverse direction to that conventionally employed; (2) the absence of seals between the cartridge base and the rocket motor; (3) the cartridge crimp point 29; (4) the plastic composition of the spitback housing 23; (5) the support of the firing pin 27 by ogive 26; (6) the integral plastic band 49; (7) the locking formations including teeth 30; (8) the floating character of the fuze 25. The advantages of the foregoing features will be pointed out as the description proceeds.

The preferred embodiment of FIG. 1 is capable of use in all existing forty millimeter closed breech grenade launchers.

The cartridge case 16 is a deep drawn aluminum cylindrical cup which contains a centrally located, forwardly extending housing 31. The housing 31 is formed with an axial bore which contains a percussion type primer and a small charge of ignition mix collectively referred to as 17. The cartridge case is attached to the warhead body 20 by means of an annular crimp 29, which so functions that a minimum cartridge pressure is required in order to accomplish cartridge projectile separation. Crimp 29 could also comprise a plurality of angularly spaced dimples. The cartridge case also contains a shoulder 32 which limits rearward motion of the warhead body 20 when it is assembled to the cartridge case. The location of the shoulder 32 is such that the rocket igniter housing 31 will be centrally aligned and positioned with the desired spacing in relation to the nozzle 28. The igniter 17 is designed so that the venting provided by a functioned igniter will allow a preselected pressure to build up in the cartridge, thereby assuring that the rocket motor performs satisfactorily. At the desired pressure, cartridge-projectile separation occurs and the rocket projectile is launched.

The rocket motor or rocket propellant housing 18 is a machined or fabricated cylindrical aluminum body having a screw threaded reduced fore wall which is threaded into the rearwardly extending annular wall 33 of the warhead 20. This housing 18 is interiorly formed to contain, in concentric relation, an annular or centrally apertured propellant grain 15 and an auxiliary booster charge 19. This housing 18 has formed in its rear wall auxiliary nozzles 34 and 35. The forwardly extending central main rocket nozzle 28 is designed to permit the desired pressure to build up within the rocket motor and to be maintained as the propellant 15 burns during the rocket fire. The spin nozzles 34 and 35 are oriented in such directions as to generate rotational torque.

The machined steel warhead body 20 has a main forwardly extending cylindrical wall 36 and a rearwardly extending cylindrical wall 33 defining recesses between which there is a partition 37. The wall 36 is formed to contain the explosive charge 22, which may be of RDX, for example, and the charge is forwardly bounded or confined by a convex (as seen from the rear) or frustoconical copper liner 21 formed with a flat apex 38 and a flat annular rim 39 which is adapted to abut against the outer margins of the rear face of the spitback housing 23. The periphery of the forward margin of wall 36 of the warhead is formed with a first shoulder 40 (FIG. 2) and a second shoulder 41 spaced therefrom and projecting annular teeth 42, 43, 44, which are adapted to press radially outwardly the complementary portion 45 of ogive 26 and to form an integral rotating band 49, as shown in FIG. 4, while the warhead and the ogive are securely locked together, the grip being provided primarily by the plurality of locking grip rings 42–44. The successive stages by which this engagement is accomplished are illustrated in FIGS. 2, 3 and 4.

The forward end of the preferred embodiment of the invention comprises the ogive 26 and contents. The plastic ogive 26 is formed with an annular shoulder 14 and a rearwardly extending post 46. A firing pin 27 is secured within the post. Aft of the firing pin is the fuze assembly generally designated by the reference numeral 25. The spitback housing 23 is generally circular in configuration, is positioned between rim 39 and shoulder 14, and is formed with a frontal recess of sufficient diameter to receive the fuze assembly 25. The plastic spitback housing has an axial bore providing a mounting for the spitback charge 24, which may be of RDX, for example. This bore extends rearwardly and faces toward the liner 21.

Reference is now made to FIGS. 7 and 8 for a description of the fuze subcombination 25. Group 25 is generally similar to that shown in U.S. Pat. No. 3,603,259, George Webb, issued Sept. 7, 1971, herein incorporated by reference as fully as if set forth in full herein, in the sense that Group 25 includes a locking ball 47 biased by a leaf spring 48, weights 50 and 51, springs 52 and 53, and a slider 54. The construction and operation of the fuze are such that linear and angular accelerations accompanying the firing of the projectile disengage the locking ball from the slider and cause the weights 50 and 51 to be displaced outwardly, so that the slider 54 moves in such a position as to place a detonator charge 55 in position between the firing pin 27 and the charge 24, completing the fuzing train, with the result that the fuze is armed. The fuze 25 herein shown is secured within a plastic housing formed by members 56 and 57. This housing floats within the for-

ward recess in the spitback housing is such a way that impact with a target moves the fuze forwardly so that pin **27** impacts the firing train and causes the projectile to explode, this action being clearly shown in FIG. **13.**

Again making reference to the novel features of the dual-purpose rocket-assisted projectile herein described, it will be noted that the ogive **26** is an injection-molded solid plastic member formed to carry the firing pin **27** and to make an interlock with the warhead housing, at the same time providing an integral plastic band **49.** It will be understood that the ogive provides stand-off from a target, a requisite for dual-purpose warhead constructions.

The placement of the forwardly extending nozzle **28** at the rear of the motor housing is believed to be novel in the field of rocket-assisted ammunition. The forwardly extending nozzle is particularly well adapted to the association of the cartridge case and rocket igniter as distinguished from the association of rocket igniter and projectile.

The pressing of the plastic ogive onto the warhead by means of the one-way gripping system herein shown eliminates special seals or complementary threads or roll crimping.

The plastic spitback housing **23** effects substantial economy. Additionally it improves penetration of the warhead in that the plastic spitback member **23,** when fragmented, produces less damage to the liner **21.** It will be understood that the liner **21** inverts on impact.

The mounting of the firing pin **27** on the ogive post **46** eliminates the need of a separate firing pin mount and reduces the reaction of the fuze.

Among the particularly significant features of this invention is the elimination of rocket igniter and rocket motor pressure seals.

The fuze **25** contains two primary safety devices: (1) the secondary safety consisting of the spring-loaded ball **47,** locking the slider to the fuze cover **56;** (2) the spring-loaded brass weights **50-51** on either side of the slider **54,** locking the slider to the fuze body **56.** The secondary safety is designed to be released during projectile motion in the gun barrel (not shown). The ball **47** is moved down due to setback and is then moved outboard by torque, produced by the barrel rifling. Once the ball sees both forces in that order, it is permanently locked out of the safe position. Thereafter, its mass is utilized to shift the center of gravity of the slider **54** toward the armed position. Thus, if the ball **47** is not assembled in the fuze, the slider will fail to arm.

The two spring-loaded brass weights **50, 51** are designed to move outboard when the number of projectile revolutions per minute reaches a specified level by spin jet action during motor burn, after launch. Since the number of revolutions per minute is a factor directly related to distance (provided a correct motor burn occurs), the locking weights **50, 51** then become a simple timer to provide safe separation before the detonator **55** is allowed to move into an armed position.

The sequence of events during ignition and launch of the closed breach rocket system is:

a. The primer **17** ignites and propels a small quantity of powdered boron potassium nitrate forward into the motor chamber.

b. The burning mix impacts against and ignites the charge of rifle powder **19** contained in a bag in the forward end of the propellant grain **15.** This charge provides an initial pressure build-up within the motor chamber and causes gas to flow rearward through the controller gap nozzle **28.**

c. The surface of the propellant grain **15,** ignited during the rearward gas flow stage, begins to sustain its own combustion when pressure in the chamber passes approximately **400** pounds per square inch. Pressure build-up is controlled by the ratio of propellant surface area to the air gap area created by the cone-shaped igniter housing **17** and the main thruster nozzle **28.**

d. Gas flow through the nozzles **34, 35** begins almost simultaneously with ignition of the propellant **15.** It increases rapidly as both the rifle powder **19** and the main rocket propellant **15** ignite. Thus pressure in the cartridge case **16** begins to accelerate the warhead **20** forward with only a very slight delay after the primer **17** is fired.

e. After ignition, the rocket projectile is fired from the barrel in much the same manner as a standard cartridge type round.

f. After launch, the rocket propellant **15** continues to burn, providing impetus for the projectile to continue accelerating to a burnout velocity. During this time, the two small spin jets **34, 35** on either side of the main thruster nozzle **28** provide torque whereby the axial revolutions per minute of the projectile are increased to a rate that will maintain gyroscopic stability in relation to forward velocity, as well as arm the slider **54** (see FIG. **8**) at the desired arming distance from the launch site.

Reference is now made to FIGS. **9-12** in connection with the explanation of certain aspects of the sequence of operation of the FIG. **1** embodiment. FIG. **9** illustrates the conditions which prevail as the primer **17** is ignited. Note the forward passage of the ignition gases toward booster **19.** In FIG. **10** the auxiliary booster **19** is shown as substantially consumed and the propellant charge **15** begins to burn. By the time the FIG. **11** conditions are reached the nozzles **34** and **35** are uncovered and the propellant gases pass to the rear through nozzles **34, 35** and **28,** building up pressures until the crimp **29** fails and the cartridge **16** is severed from the warhead **20** as illustrated in FIG. **12.** In one successfully operating embodiment of the invention the severance pressure built up within the motor housing was **800** pounds per square inch.

While there has been shown and described what is at present considered to be the preferred embodiment of the invention, various modifications and changes may be made therein without departing from the proper scope as defined by the appended claims.

Having described my invention, I claim:

**1.** A closed-breech gun-fired rocket assisted projectile comprising the following, in combination:

a cartridge comprising a base formed with a forwardly extending central portion having a bore therein, said cartridge being further formed with an annular shoulder and a forwardly extending hollow cylindrical wall;

an igniter disposed in said bore and adapted to initiate the firing of said projectile from a gun;

a warhead housing of generally cylindrical configuration adapted to be frictionally fitted to said cartridge in such manner that sufficient gas pressure separates said warhead housing and cartridge, said warhead housing comprising a forwardly extending hollow wall and an intermediate partition and a rearwardly extending hollow wall;

a rocket propellant housing formed to be secured to the rearwardly extending wall of the warhead housing and positioned by said annular shoulder in spaced relation to the base of said cartridge, said rocket propellant housing having a rear wall formed to define a forwardly extending main nozzle, said propellant housing being further formed with a frontal recess and a rear wall having auxiliary nozzles oriented so that gases flowing therethrough produce rotation;

a booster centrally disposed within said recess and opposite said main nozzle;

a propellant disposed in concentric relation to said booster and in such manner that burning of said propellant opens said auxiliary nozzles;

an explosive contained within the forwardly extending wall of said warhead housing;

means for confining said explosive comprising a generally frusto-conically shaped liner positioned to be convex relative to the explosive and having an annular forward rim;

a plastic ogive formed with a rearwardly extending hollow cylindrical wall and an intermediate shoulder and a blunt face and a rearwardly extending central post;

a firing pin mounted on said post;

said forwardly extending wall of the warhead housing being formed with annular step-shoulders and teeth adapted to have the rearwardly extending wall of the ogive slid thereover in order to accomplish a forced fit, said rearwardly extending ogive wall being formed so that said fit provides an annular band at the margin of said rearwardly extending ogive wall;

a plastic spitback housing interposed between said annular rim and said intermediate shoulder of said ogive, said spitback housing comprising a rearwardly extending central bore and a forwardly disposed recess adapted to contain a fuze;

a spitback charge within the last-mentioned bore and a fuze within the last-mentioned recess, said fuze being adapted to be armed to locate said firing pin and said spitback charge in a firing train, said fuze being further adapted, on impact with a target, to impact said firing pin and to explode the projectile.

**2.** In a gun-fired rocket assisted projectile the combination of:

a cartridge comprising a base formed with a forwardly extending integral central portion having a bore therein, said cartridge being further formed with a stop and a forwardly extending hollow cylindrical wall;

an igniter disposed in said bore and adapted to initiate the firing of said projectile from a gun;

a warhead housing of generally cylindrical configuration adapted to be frictionally fitted to said cartridge in such manner that sufficient gas pressure separates said warhead housing and cartridge, said warhead housing comprising a forwardly extending hollow wall and an intermediate partition and a rearwardly extending hollow wall;

a rocket propellant housing formed to be secured to the rearwardly extending wall of the warhead housing and positioned by said stop in spaced relation to the base of said cartridge, said rocket propellant housing having a rear wall formed to define a main nozzle, said propellant housing being further formed with a frontal recess and a rear wall so formed with auxiliary nozzles that gases flowing therethrough produce rotation; and

an annular propellant disposed in said propellant housing in such manner that burning of said propellant progresses radially outwardly and opens said auxiliary nozzles, said main nozzle projecting forwardly into said annular propellant.

**3.** In a gun-fired rocket assisted projectile the combination of:

a cartridge comprising a base and a forwardly extending hollow cylindrical wall;

an igniter carried by said base and adapted to initiate the firing of said projectile from a gun;

a warhead housing of generally cylindrical configuration adapted to be joined to said cartridge in such manner that sufficient gas pressure separates said warhead housing and cartridge;

rocket propellant housing formed to be secured to the warhead housing and in spaced relation to the base of said cartridge, said rocket propellant housing having a rear wall formed to define a main nozzle and spin nozzles, and

an annular propellant disposed in said propellant housing, one of said housings being provided with a wall for separating the housing interiors, said main nozzle projecting forwardly into said annular propellant.

**4.** The combination in accordance with claim **3** in which the base of the cartridge has an integral forwardly extending bored central formation which carries the igniter.

**5.** In a gun-fired rocket-assisted projectile the combination of:

a cartridge,

igniting means,

a warhead housing adapted to be joined to the cartridge, and so arranged in relation to the cartridge that separation of the warhead housing and cartridge occurs on firing, and

means for propelling said warhead housing comprising a rocket motor secured to the rear of the warhead housing and including an annular propellant and a rocket nozzle extending forwardly into the propellant.

**6.** In a rocket-assisted projectile of the type comprising

an igniter,

a rocket motor,

a warhead housing having a forwardly extending wall and

an explosive contained within said forwardly extending wall, the combination of:

means for confining said explosive comprising a generally frusto-conically shaped liner positioned to be convex relative to the explosive and having an annular forward rim,

a plastic ogive formed with a rearwardly extending hollow cylindrical wall and an intermediate shoulder and a blunt face and a rearwardly extending central post having a pocket,

a firing pin mounted in said pocket,

said forwardly extending wall of the warhead housing being formed with annular step-shoulders and teeth adapted to have the rearwardly extending wall of the ogive slid thereover in order to accomplish a forced fit, said rearwardly extending ogive wall being formed so that said fit provides an annular band at the margin of said rearwardly extending

ogive wall,
a plastic spitback housing fixed between said annular rim and said intermediate shoulder of said ogive, said spitback housing comprising a rearwardly extending central bore and a forwardly disposed recess adapted to contain a fuze,
a spitback charge within the last-mentioned bore, and a fuze within the last-mentioned recess, said fuze being adapted to be armed to locate said firing pin and said spitback charge in a firing train, said fuze being further adapted, on impact with a target, to impact said firing pin and to explode the projectile.

**7.** In a rocket-assisted projectile the combination of:
a rocket motor,
a warhead housing having a forwardly extending hollow wall,
an explosive contained within said forwardly extending wall,
a plastic ogive formed with a rearwardly extending hollow cylindrical wall,
said forwardly extending wall of the warhead housing being formed with annular step-shoulders and teeth adapted to have the rearwardly extending wall of the ogive slid thereover in order to accomplish a forced fit, said rearwardly extending ogive wall being formed so that said fit provides an annular band at the margin of said rearwardly extending ogive wall, and
means contained within said ogive for detonating said explosive on impact with a target.

**8.** In a rocket-assisted projectile the combination of:
a rocket motor,
a warhead housing having a forwardly extending hollow wall,
an explosive contained within said forwardly extending wall,
an ogive formed with an integral rearwardly extending hollow cylindrical wall, said walls being fitted together,
said ogive being further formed with a rearwardly extending central post having a pocket,
a firing pin fixedly mounted in said pocket, and
means contained within said ogive for striking said firing pin and detonating said explosive on impact with a target.

**9.** The combination in accordance with claim **8** in which the ogive is formed with a nose and an annular shoulder adjacent said nose, and further in which the means contained within said ogive comprises a plastic spitback housing fixedly positioned between said shoulder and said explosive, said spitback housing being forwardly recessed to carry a fuze and rearwardly bored to carry a charge,
said means contained within said ogive further including a fuze within said recess and a charge within the rearwardly extending bore of the spitback housing.

**10.** In a rocket-assisted projectile the combination of:
a rocket motor,
a warhead housing having a forwardly extending hollow wall,
an explosive contained within said forwardly extending wall,
an ogive having a rearwardly extending hollow cylindrical wall and a central boss formed with a pocket, said walls being fitted together,
a plastic spitback housing fixedly secured within said ogive,
a firing pin fixedly secured within the pocket in said boss, and
means contained within said spitback housing for striking said firing pin and detonating said explosive on impact with a target.

**11.** In a rocket-assisted projectile the combination of:
a rocket motor,
a warhead housing having a forwardly extending hollow wall,
an explosive contained within said forwardly extending wall,
an ogive formed with a rearwardly extending hollow cylindrical wall, said walls being fitted together,
said ogive being further formed with a rearwardly extending central post having a pocket,
a spitback housing fixedly secured within said ogive,
a firing pin mounted in said pocket, and
a fuze floatingly contained within said spitback housing for striking said firing pin and detonating said explosive on impact with a target.

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