United States Patent [19]

Popovitch et al.

[11] **3,839,962**

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[54] **TEST PROJECTILE WITH PRIMARY AND TEST FUZES**

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[73] Assignee: **The United States of America as represented by the Secretary of the Army,** Washington, D.C.

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[21] Appl. No.: **409,500**

[52] **U.S. Cl.** **102/56,** 102/37.1, 102/37.6, 102/60

[51] **Int. Cl.** **F42c 21/00**

[58] **Field of Search** 102/34.4, 35.6, 37.1, 37.6, 102/49.5, 56, 60

[56] **References Cited**

UNITED STATES PATENTS

2,342,096	2/1944	Zimmerman	102/35.6
2,834,293	5/1958	Beach et al.	102/35.6 X
3,374,740	3/1968	Voda	102/49.5 X
3,513,777	5/1970	Hannold	102/34.4 X

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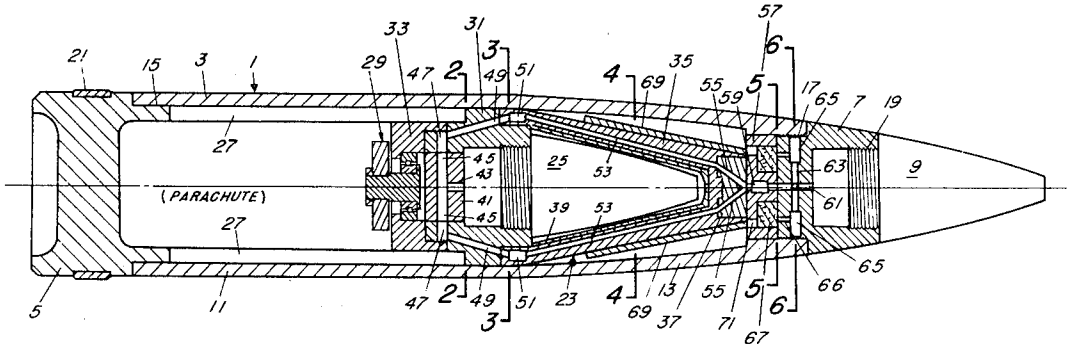
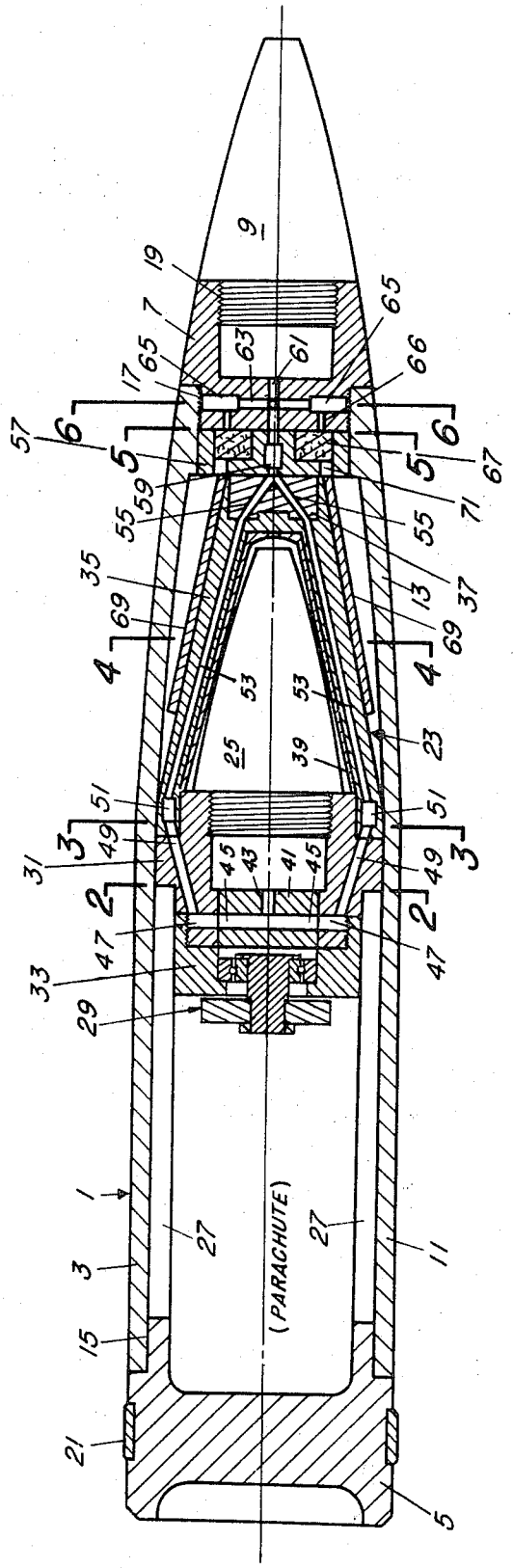
[57] **ABSTRACT**

A test projectile comprises a primary nose fuze, a parachute recovery payload including a test fuze, and means comprising two independent firing trains made up of connected flash passages and detonators connecting each fuze with an explosive charge for separating the payload from the projectile body when either of the two fuzes is selectively actuated during flight of the projectile. In one embodiment, the explosive charge comprises a plurality of detonators arranged to rip the forward wall or skin of the projectile body into four "banana-peel" segments, to release the payload from the projectile body. In another embodiment, the base of the projectile body is separatably attached to the main body portion by shear pins, and the explosive charge is arranged to break the shear pins and expel the payload through the rear end of the projectile. The test projectile is provided with a flash mix and/or a flare mix ignited by the explosive charge, for showing the time and location of the ejection, and the final location of the ejected payload.

10 Claims, 9 Drawing Figures

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(PARACHUTE)
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FIG. 1

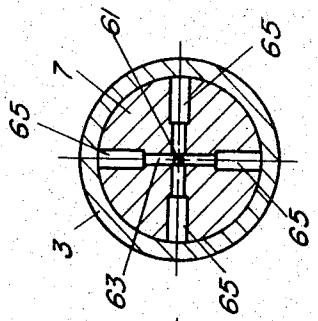

FIG. 6

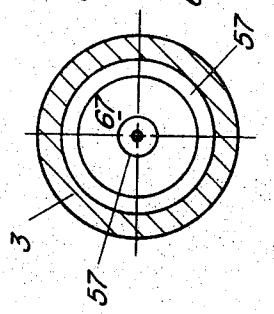

FIG. 5

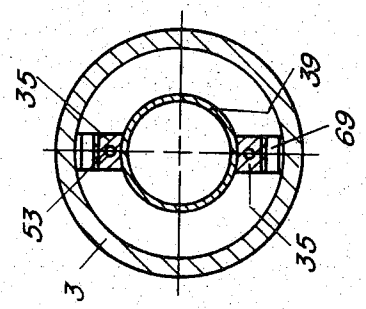

FIG. 4

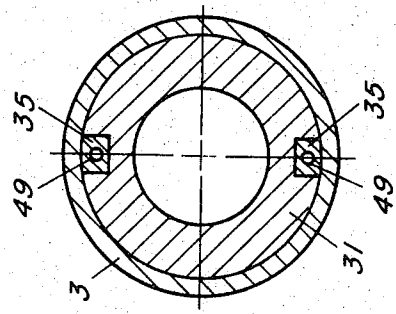

FIG. 3

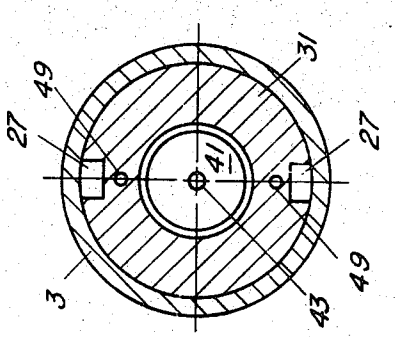

FIG. 2

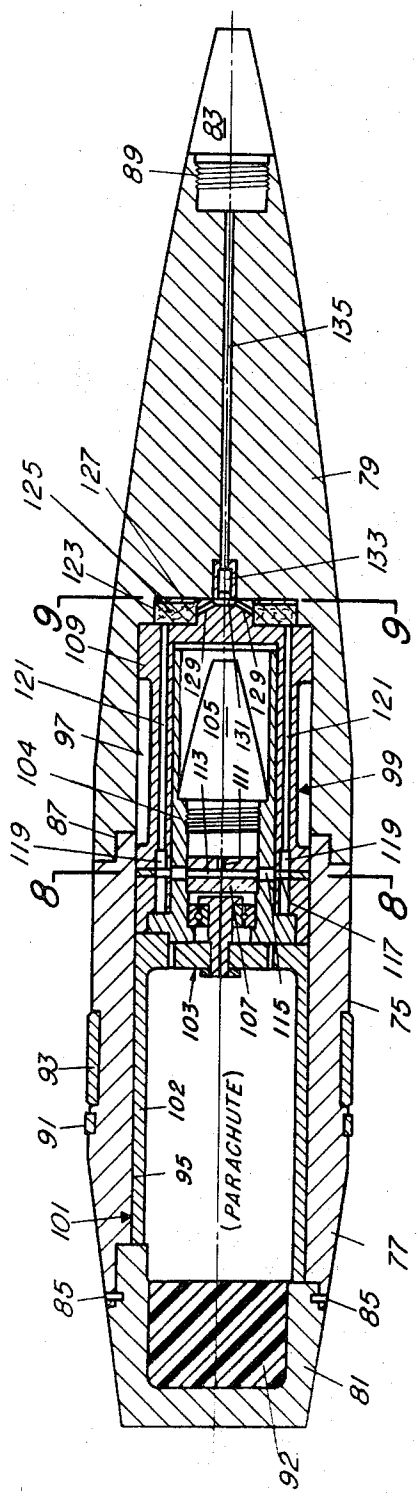

FIG. 7

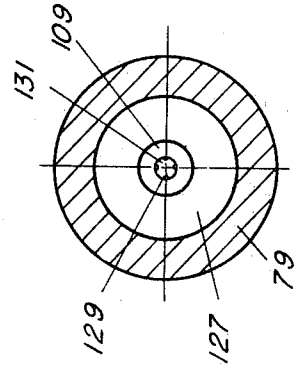

FIG. 9

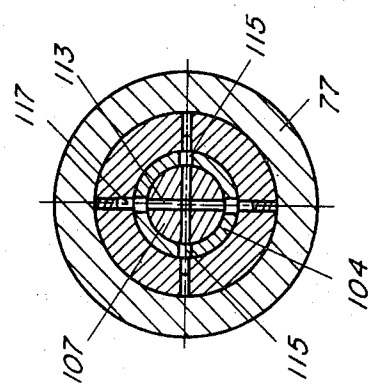

FIG. 8

TEST PROJECTILE WITH PRIMARY AND TEST FUZES

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, a test projectile is provided with the usual primary nose fuze, a removable payload comprising a canister containing a test fuze and a parachute attached to the canister, and means including explosive charge means and flash passage means independently connecting each fuze with the explosive charge means for separating the payload from the projectile body when either fuze is actuated. The test fuze may be identical with or similar to the primary fuze. Either fuze may be actuated first, or the two fuzes may be actuated simultaneously. Actuation of either fuze may ignite a pyrotechnic flash mix to produce a high intensity light of short duration to show the burst location. A slower burning flare mix may be ignited by the flash mix to show the location of the payload for in flight observation and for ground spotting for payload recovery.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal section view of a test projectile embodying the present invention.

FIGS. 2, 3, 4, 5 and 6 are transverse section views taken along lines 2—2, 3—3, 4—4, 5—5 and 6—6, respectively of FIG. 1.

FIG. 7 is a longitudinal section view of another test projectile also embodying the invention.

FIGS. 8 and 9 are transverse section views taken along lines 8—8 and 9—9, respectively, of FIG. 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 through 6 illustrate the invention embodied, for example, in a 105 mm. parachute recovery projectile for a 105 mm. XM103 howitzer. The projectile 1 comprises a hollow body including a main body portion 3, a base 5, a fuze adapter 7, and a primary nose fuze 9. The body portion 3 comprises a hollow cylindrical rear portion 11 and a hollow ogive forward portion 13 integral therewith. The body portion 3 is attached to the base 5 by threads 15 and to the adaptor 7 by threads 17. Fuze 9 is ogive-shaped and attached to adaptor 7 by threads 19. The base 5 may be provided with a rotating band 21.

Removably disposed within the projectile body is a payload comprising a fuze canister 23, containing a test fuze 25, and a parachute (not shown) mounted on supporting strips 27 and attached to the canister 23 by a swivel 29. The canister 23 comprises an annular body member 31, an annular base 33 interlocked with swivel 29 and threaded onto body member 31, a yoke 35, a yoke nose 37, a fuze cover 39, and a detonator housing 41. The test fuze 25, which may be identical with or similar to the primary fuze 9, is disposed within the yoke 35 and cover 39, with its base threaded into the body member 31. The detonator housing 41, which abuts the base of fuze 25, is formed with an axial flash passage 43 and opposed radial flash passages 45 aligned with two detonators 47 in body member 31. The body member 31 is formed with two outwardly and forwardly slanted flash passages 49 exposed at the rear ends to detonators 47. The forward ends of passages 49 are exposed to two detonators 51 disposed within the two arms of yoke 35 at a plane near the beginning of the ogive portion 13. Two convergent flash passages 53 in the arms of yoke 35 connect the detonators 51 with convergent flash passages 55 in yoke nose 37. The passages 55 terminate in a single opening at the front face of the nose 37.

A re-entrant detonator housing 57, disposed in ogive portion 13 between yoke nose 37 and fuze adaptor 7, contains a central detonator 59 exposed to flash passages 55. Adaptor 7 is formed with an axial flash passage 71 and four radial flash passages 63 which connect the primary fuze 9 and the detonator 59 with four detonators 65 disposed in adaptor 7 within the forward end of ogive portion 13 and distributed around the wall of the latter. Detonator housing 57 also contains an annular mass 67 of pyrotechnic flash mix connected by flash passages 69 to detonators 65. As shown, the canister 25 may be provided with two layers or coatings 69 of pyrotechnic flare mix disposed on the outer surfaces of the arms of yoke 35 and exposed to the flash mix 67 through flash passages 71, to be ignited thereby. The parachute and swivel 29 may be identical with those of the conventional M314A2E1 illuminating cartridge, and hence, the details of the parachute itself have been omitted, to simplify the drawing.

In operation, the test projectile 1 is fired or launched from a gun barrel in the usual manner. At a selected time during flight, either fuze may be actuated first, or alone, or both fuzes may be actuated substantially simultaneously. If the forward or primary fuze 9 (alone) is actuated, the flash or flame from the fuze through passages 61 and 63 explodes the four detonators 65. The explosion of detonators 65 rips the forward ogive portion 13 into four "banana-skin" pieces, by the "exfoliation" method. Spin and air forces complete the exfoliation, exposing the canister and parachute to the air stream. If, instead, the rear or test fuze 25 is actuated, the flash from the fuze through passages 43, 45 and 49 explodes detonators 51, which continues the firing train through passages 53 and 55, detonator 59, and passages 61 and 63, to explode detonators 65. In either case, when the detonators 65 are exploded, the projectile body is ruptured and the time and location of the explosion are shown by simultaneous ignition of the fast-burning flash mix 67. The slower-burning flare mix 69 shows the location of the payload for recovery.

FIGS. 7, 8 and 9 illustrate the invention embodied in a 175 mm. parachute recovery projectile for the 175 mm., M113 artillery gun. The projectile 75 comprises a hollow body including a rear cylindrical body portion 77, a forward ogive body portion 79, a base 81, and a primary nose fuze 83. The base 81 is plugged into and separatably attached to the rear end of rear body portion 77 by shear pins 85; and the ogive portion 79 is rigidly attached to the rear portion 77 and fuze 83 by threaded connections 87 and 89, respectively. The rear body portion 77 may be provided with an obturator band 91 and a rotating band 93. The base 81 may contain a cushioning member 92 of suitable resilient material.

The rear body portion 77 is formed with a cylindrical internal payload bearing surface 95; and the ogive portion 79 is formed with a recess providing a cylindrical surface 97 which forms a continuation of the surface 95. Slidably disposed within surfaces 95 and 97 is a payload comprising a fuze canister assembly 99 and a parachute assembly 101. The parachute assembly 101 includes a tubular parachute support 102 slidably en-

gaging the surface **95** and containing a conventional parachute (not shown) connected by a swivel **103** to the canister assembly **99.** The canister assembly **99** includes a tubular canister housing **104** within which a test fuze **105** is threaded, a detonator housing **107** closing the rear of housing **104** and abutting the fuze **105,** and a cup-shaped support piston **109** encasing the housing **104** and slidably engaging the bearing surfaces **95** and **97.** Housing **104** is interlocked with the parachute swivel **103,** as shown in FIG. **1.** Detonator housing **107** is formed with an axial flash passage **111** and at least two, and preferably four, connected radial flash passages **113** which are exposed at their outer ends to the inner ends of detonators **115** extending radially through housing **104.** The outer ends of detonators **115** are connected by radial flash passages **117,** detonators **119** and flash passages **121** in piston **109,** to an annular recess **123** in piston **109** and ogive portion **79,** which contains a mass **125** of explosive propellant powder. The forward ends of flash passages **121** may be covered with a nylon disc to prevent the charge **125** from entering the passages. A layer **127** of pyrotechnic flash mix may be disposed adjacent to the mass **125,** to be ignited thereby. The propellant powder mass **125** is also connected to primary nose fuze **83** by means of at least two, and preferably four, flash passages **129** and a central recess **131** in piston **109,** and a detonator **133** and flash passage **135** in ogive portion **79.**

The operation of the test projectile of FIGS. **7–9** is the same as that of FIGS. **1–6,** except that the actuation of either fuze establishes a firing train from that fuze to the propellant mass **125** which, upon explosion, breaks the shear pins **85** and expels or ejects the entire payload, including the fuze canister assembly **99** and parachute assembly **101,** axially through the rear end of the projectile body. At the same time, the flash mix **127** is ignited to show the time and location of the payload ejection.

The parachute in each of FIGS. **1** and **7** may be any conventional parachute, such as that contained in the M 314A2E1 illuminating cartridge, shown on page 2–123 of Department of the Army Technical Manual TM 9–1300–203, "Artillery Ammunition," published April, 1967. The details of the parachute are not essential to an understanding of the invention, and hence, they have been omitted.

What is claimed is:

1. A test projectile comprising:

a. an elongated hollow body including a forward portion and a rear portion, a base portion closing the rear end of said rear portion and a primary fuze closing the forward end of said forward portion;

b. a payload in said body including

1. a canister, containing a test fuze, removably disposed substantially within said forward portion, and

2. a parachute removably disposed within said rear portion and attached to said canister; and

c. means, including explosive charge means within said body and flash passage means independently connecting each of said fuzes with said explosive charge means, for separating said payload from said projectile body when either of said fuzes is actuated.

2. A test projectile as in claim **1,** further comprising a light-producing material located near said explosive charge means to be ignited substantially simultaneous with said charge means.

3. A test projectile as in claim **1,** wherein said forward portion of said body is an ogive portion, and said explosive charge means is located within said ogive portion near the forward end of said canister.

4. A test projectile as in claim **3,** wherein said flash passage means connecting said test fuze with said explosive charge means comprises at least two branches each containing two detonators.

5. A test projectile as in claim **3,** wherein said explosive charge means comprises a plurality of explosive charges in the form of detonators distributed around the wall of said ogive portion for longitudinally ripping said wall to release said canister and parachute from said projectile body.

6. A test projectile as in claim **1,** wherein said canister comprises an annular portion surrounding the base of said test fuze, a base closing the rear end of said annular portion and a housing portion surrounding the remainder of said test fuze; said base, annular portion, and housing portion containing serially-connected portions of two branches of said flash passage means connecting said test fuze with said explosive charge.

7. A test projectile as in claim **5,** further comprising a flash material located near said explosive charges to be ignited thereby, and a flare material mounted on the outer wall of said canister and adapted to be ignited by said flash material.

8. A test projectile as in claim **1,** wherein:

a. said base portion is attached to said rear portion by shear pins;

b. the inner walls of said rear portion and part of said forward portion are cylindrical;

c. said parachute and said canister are respectively disposed within first and second axially adjacent hollow cylindrical housing members slidably disposed within said inner walls;

d. said explosive charge means is located in an annular recess between the front end of said second housing member and an axially adjacent solid part of said forward portion, for breaking said shear pins and slidably ejecting said housing members, said canister and said parachute through the rear end of said projectile body.

9. A test projectile as in claim **8,** wherein said second housing member and said canister contain serially-connected portions of at least two branches of said flash passage means connecting said test fuze with said explosive charge means.

10. A test projectile as in claim **1** wherein said primary fuze and said test fuze are identical.

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