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(54) Title: AMMUNITION CARTRIDGE WITH INDUCED INSTABILITY AT A PRE-SET RANGE

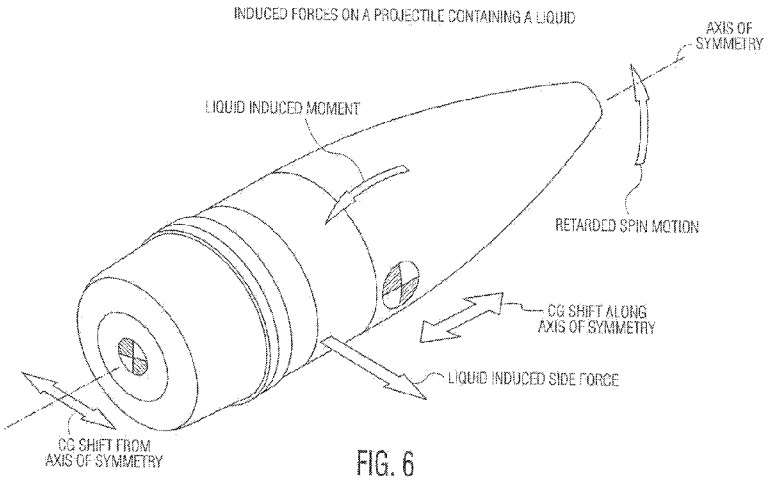

FIG. 6

(57) Abstract: A training ammunition cartridge comprises a projectile and a cartridge case with a pyrotechnic propellant. The projectile has a projectile body with at least one compartment therein forming a void and containing a material that transitions from a solid to a liquid after set-back and after exiting from a barrel of a gun. The void is of such configuration as to cause the liquid material therein to induce forces and moments that, after a period of stable ballistic flight, destabilize the projectile and shorten its flight. Alternatively, the projectile void contains a solid mass that is released to shift its position after set-back and after the projectile exists from the barrel of the gun, wherein the void is of such configuration as to cause the mass, upon shifting, to induce forces and moments that, after a period of stable ballistic flight, destabilize the projectile and shorten its flight.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/19570

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F42B 5/02 (2015.01)
CPC - F42B 5/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): F42B 5/02, F42B 10/48 (2015.01)
CPC: F42B 5/02, F42B 10/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Seach terms listed below.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; Google (Patent, Web, Scholar) Search terms used: liquid or fluid projectile or ammunition or cartridge void or cavity or space solid liquid training ammo destabilize shorten filled flight Simunition Range

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2005/0016412 A1 (Vasel et al.) 27 January 2005 (27.01.2005), entire document, especially Figs. 16-18, paras. [0110]-[0114]	1-12
Y	Engineering Design Handbook: Liquid Filled Projectile Design (Headquarters, U.S. Army Materiel Command, April 1969), published by Redstone Scientific Information Center, 23 July 1989 (23.07.1989), entire document, especially pgs. 1-1, 1-2	1-12
Y	US 3,460,478 A (Ormanns) 12 August 1969 (12.08.1969), entire document, especially Fig. 1	6-7
A	US 5,153,369 A (Hardt et al.) 06 October 1992 (06.10.1992), entire document	1-12
A	US 2012/175456 A1 (Hultman) 12 July 2012 (12.07.2012), entire document	1-12
A	US 2004/0089186 A1 (Brygdes-Price) 13 May 2004 (13.05.2004), entire document	1-12

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 January 2016	29 JAN 2016
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/19570

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-*-See Supplemental Sheet-*-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-12

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

-*-Box No. III - Observations where unity of invention is lacking-*-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-12, directed to a projectile filled with a solid material that transitions to a liquid.

Group II: Claim 13-28 directed to a projectile filled with a solid material.

Group III: Claim 29-33 directed to a projectile filled with a liquid material.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical feature of a void containing a material that transitions from a solid to a liquid after setback and after the projectile exits from a barrel of the gun, wherein the void is of such configuration as to cause the liquid material therein to induce forces and moments that, after a period of stable ballistic flight, destabilize the projectile and shorten its flight., not required by the claims of Group II or III.

The invention of Group II includes the special technical features of a void containing a solid mass which is released to shift its position after setback and after the projectile exits from a barrel of the gun, wherein the void is of such configuration as to cause the mass, upon shifting, to induce forces and moments that, after a period of stable ballistic flight, destabilize the projectile and shorten its flight., not required by the claims of Group I or III.

The invention of Group III includes the special technical features of a void filled with a liquid, and wherein the void is of such configuration as to cause the liquid to induce forces and moments that, after a period of stable ballistic flight, destabilize the projectile and shorten its flight, not required by the claims of Group I or II.

COMMON TECHNICAL FEATURES

Groups I, II, and III share the common technical features of an training ammunition cartridge comprising a projectile mounted on a cartridge case with a pyrotechnic propellant, the projectile having a projectile body with adequate structural integrity to withstand "set-back" forces that are applied when the projectile is fired from a gun, said projectile body having at least one compartment therein forming a void. However, these shared technical features do not represent a contribution over prior art as being anticipated by US 2005/0016412 A1 (Vasel et al.) which discloses an ammunition cartridge (Fig. 14; collectively: shotgun shell 2252, black powder, primer or other ignitable substance 2264, projectile 2254) comprising a projectile (Fig. 14; projectile 2254) mounted on a cartridge case (shotgun shell 2252) with a pyrotechnic propellant (black powder, primer or other ignitable substance 2264), the projectile (Fig. 14; projectile 2254) having a projectile body (nose 2220 and body 2222) with adequate structural integrity to withstand "set-back" forces that are applied when the projectile is fired from a gun (this less-than-lethal ammunition utilizes kinetic energy and as such the projectile body has the structural integrity to survive being fired; para [0013] "the projectile system is better maximizes its effectiveness by providing a kinetic impact against the target at a first location on or near the target"), said projectile body having at least one compartment (cavity 2226) therein forming a void (Fig. 18; "The nose 2220 and projectile body 2222 have hollow portions forming a cavity 2226").

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-III lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.