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(54) Title: A GRENADE ROUND

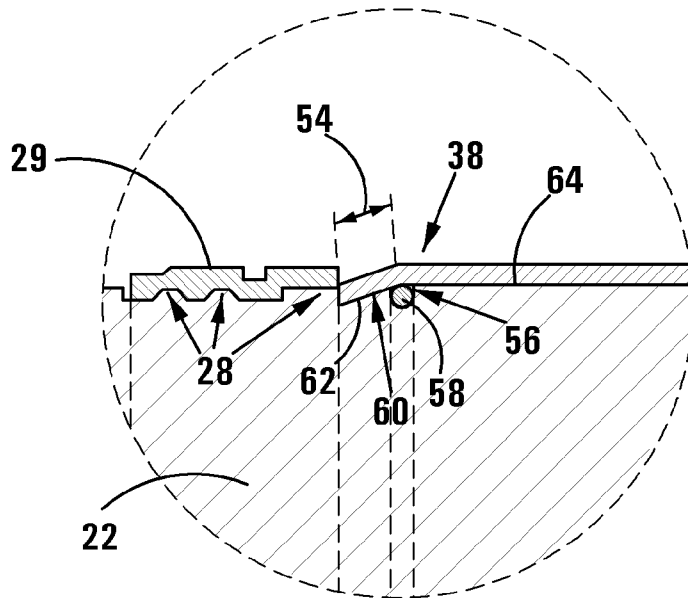


FIG 4

(57) Abstract: A grenade round comprises a projectile 22, a case and a propellant propulsion system. The case has a cylindrical side wall having an open front end to which the projectile is connected. The case is secured to the projectile by frictional and mechanical engagement of a distal end part 54 of the case which is deformed inwardly to engage a circumferential flat abutment face 62 of the projectile adjacent a circumferential sealing groove 56 in which an O-ring seal 58 is seated. The abutment face has a taper angle of no less than 10 degrees relative to a longitudinal axis of the projectile.

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A GRENADE ROUND

FIELD OF INVENTION

This invention relates to a grenade round.

BACKGROUND TO INVENTION

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Known grenade rounds comprise, broadly, a projectile and a case which houses a propulsion system. The propulsion system is typically referred to as a "high-low" system. A high pressure propellant chamber is provided in the base of the case, while the propellant chamber has one or more openings at one end, which lead into a low pressure chamber defined at a rear end of the projectile. A primer which is contained in a primer chamber at an opposite end of the propellant chamber, is detonated by a mechanical striker of a firing weapon. The detonation of the primer causes the propellant within the high pressure chamber to initiate causing expanding propellant gases to enter the low pressure chamber. The relatively low pressure gases act on the projectile causing it to be propelled along the barrel of a firing weapon.

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The case has a base wall with an orifice for housing an initiating primer which is acted upon by the mechanical striker for detonating the primer and a cylindrical side wall extending from the base wall. The base wall defines a proximal end of the case, while

an opposite distal end thereof defined by the cylindrical side wall, is open. In order to secure the case to the projectile, a rear end portion of the projectile is located within a distal end region of the case. A distal engagement part of the distal end region of the case is deformed inwardly in a crimping action so as to frictionally and mechanically engage the projectile.

The projectile defines a front end, a rear end which is received within the case and defines a longitudinal axis which extends between its front and rear ends. Gases in the low pressure chamber resulting from initiation of the propellant, act on the rear end of the projectile causing it to separate from the case and be propelled along the barrel of the firing weapon.

The projectile defines a circumferential sealing groove within which an annular sealing member is seated. The sealing member is provided to form a fluid-tight seal between the case and the projectile.

It is known to provide a flat abutment face which extends circumferentially around the projectile adjacent the sealing groove. The abutment face is located at a side of the sealing groove relatively closer to the front end of the projectile and extends along a plane parallel to the longitudinal axis of the projectile.

The distal engagement part of the case is deformed inwardly so as to frictionally and mechanically engage the flat abutment face of the projectile. More particularly, the distal engagement part of the case is deformed inwardly against the flat abutment face of the projectile and in the process, the wall of the distal engagement part of the case is compressed.

The Applicant has found that it is difficult to consistently achieve a uniform holding force with the abovementioned frictional and mechanical engagement of the projectile by the case, resulting in regions where the case is not properly secured to the projectile. This has been found by the Applicant to result in ingress of moisture into the case via the

regions where the case is not properly secured. A further problem arising from the aforesaid inconsistent and non-uniform holding forces, is that the performance of the grenade round is negatively affected. More specifically, the ballistic performance of the grenade round relies on consistent assembly of the case to the projectile, where
5 projectile release forces affect the launch velocity of the projectile due to differing pressure and mechanical pull characteristics affecting release of the projectile from the case. A relatively loosely engaged projectile will require less propelling force to overcome the frictional and mechanical engagement of the projectile by the case than a relatively more tightly engaged projectile. In fully automatic weapon systems, a loosely
10 engaged projectile can cause weapon stoppages due to the projectile being pulled free of the case during the feeding cycle of the weapon. This poses a potential danger to the weapon operator due to the fact that to clear such a stoppage requires manual clearing of the weapon by the operator which takes time and in addition, leaves the operator exposed. In addition, the operator will be required to follow protocol to dispose of a live
15 grenade projectile which he has recovered from the firing weapon.

A further problem which the Applicant has encountered with the above known method of securing a case to a projectile of a grenade round, is that the sealing member is not adequately held by the deformed distal engagement part of the case resulting in the
20 sealing member being prone to movement which negatively impacts upon its sealing capability. If the O-ring seal moves during assembly of the projectile to the case, the O-ring can become entrapped in a position where it does not perform its designated function of effectively sealing the interface between the case and the projectile. Incorrect O-ring entrapment can also lead to improper deformation of the case, leading
25 to an inconsistent release force being required to release the projectile when the propelling charge is combusted.

It is an object of the present invention to ameliorate the problems identified above in relation to the manner in which a case is secured to a projectile of a grenade round.

SUMMARY OF INVENTION

According to the invention there is provided a grenade round including:

- 5 a projectile defining a front end, a rear end and a longitudinal axis which extends between its front and rear ends, the projectile defining a circumferential sealing groove within which an annular sealing member is seated, the projectile defining a flat abutment face which extends circumferentially around the projectile and which is disposed adjacent a side of the sealing groove relatively closer to the front end of the projectile;
- 10 a case comprising a cylindrical side wall having an open distal end to which the projectile is attached and a base wall extending across the side wall at a proximal end of the case, the case having a distal end region within which a rear end portion of the projectile is received, a distal engagement part of the distal end region being deformed
- 15 inwardly to frictionally and mechanically engage the abutment face of the projectile; and
- a propellant propulsion system for initiating a propellant housed within the case for propelling the projectile along a barrel of a firing weapon,
- 20 the grenade round being characterised in that the projectile defines a circumferential case engagement groove wherein a wall formation of the projectile defining the case engagement groove, defines the abutment face, the wall formation extending circumferentially around the projectile, with the abutment face being straight when viewed in cross-section and tapering inwardly in a direction from the rear end of the
- 25 projectile towards the front end thereof.

The abutment face of the projectile may be disposed at a taper angle of no less than 10 degrees relative to the longitudinal axis of the projectile.

The projectile may define a circumferential sealing groove which extends circumferentially around the projectile and within which a resiliently deformable annular seal is seated.

- 5 The case engagement groove may be disposed adjacent the sealing groove at a side thereof relatively closer to the front end of the projectile.

The sealing groove of the projectile may be located at a point of inflection between the abutment face and an adjoining wall portion of the projectile.

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BRIEF DESCRIPTION OF THE DRAWINGS

- Further features of the invention are described hereinafter by way of a non-limiting
15 example of the invention, with reference to and as illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a sectional side view of a prior art grenade round;

- 20 Figure 2 shows enlarged detail A of the prior art grenade round of Figure 1;

Figure 3 shows a sectional side view of a grenade round in accordance with the invention;

- 25 Figure 4 shows enlarged detail B of the grenade round of Figure 3; and

Figure 5 shows an enlarged fragmentary side view of the projectile of the grenade round of Figure 3.

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DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Figures 1 and 2 of the drawings, a prior art grenade round is designated generally by the reference numeral 1. The grenade round 1 is a 40mm high velocity grenade round comprising, broadly, a projectile 2, a case 3 and a propellant propulsion system designated generally by the reference numeral 4. The propellant propulsion system 4 is housed within the case whereas a base wall 5 and a cylindrical side wall 6 extending from the above base wall defines a proximal end 7 of the case, while an opposite distal end 8 of the case defined by the side wall, is open.

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A rear end portion of the projectile is located within a distal end region of the case. More specifically, a distal engagement part 9 of the distal end region of the case is deformed inwardly by being crimped around the projectile so as to frictionally and mechanically engage the projectile.

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The projectile defines a circumferential sealing groove 10 which extends circumferentially around the projectile and within which a resiliently deformable O-ring seal is seated. The purpose of the O-ring seal is to form a fluid-tight seal between the case and the projectile.

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The projectile defines a flat abutment face 12 adjacent the sealing groove 10, which extends along a plane parallel to a longitudinal axis P which extends along the length of the projectile. The distal engagement part 9 of the case is deformed inwardly so as to frictionally and mechanically engage the flat abutment face of the projectile. More particularly, the distal engagement part of the case is deformed inwardly against the flat abutment face and in the process, the wall of the distal engagement part of the case is compressed. The Applicant has encountered a number of problems with the manner in which the case 3 is secured to the projectile 2. These problems have been described hereinabove under the heading "Background to Invention".

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With reference to Figures 3 and 4 of the drawings, a grenade round in accordance with the invention, is designated generally by the reference numeral 20. The grenade round 20 is a 40mm high velocity grenade round comprising, broadly, a projectile 22, a case 24 and a propellant propulsion system designated generally by the reference numeral 26.

The projectile defines a number of circumferential rib formations 28 onto which a driving band 29 is fixedly secured. The driving band engages complementary guide formations defined at an inner side of the barrel of a firing weapon in order to provide the projectile with its flight characteristics.

The case has a cylindrical side wall 30 having an open front end 32 to which the projectile 32 is connected. The case includes a base wall 34 which is formed integrally with the side wall and which extends across the side wall. The base wall defines a proximal end 36 of the case, while the open end 32 of the case defines a distal end of the case. The case has a distal end region 38 within which a rear end portion of the projectile is received.

The projectile defines a front end 40, a rear end 42 and a longitudinal axis Q which extends between its front and rear ends.

The propellant propulsion system 26 provides a "high-low" propulsion system for propelling the projectile 12 from the case 20. The propellant propulsion system 26 includes a propellant chamber assembly comprising two insert bodies 44 and 46 which are connected to one another and to an inner side of the case and which together define a high pressure chamber 48 within which a propelling charge 50 is held. The case further defines a low pressure chamber 52 between the high pressure chamber and a rear end of the projectile 22.

The base wall of the case and the insert body 46 together define a primer chamber 52 in which a primer charge is located which is acted upon by a mechanical striker of a

firing weapon for detonating the primer charge and thereby initiating the propelling charge 50.

5 The case is secured to the projectile by frictional and angular mechanical engagement of a distal end region of the case with the rear end portion of the projectile. More particularly, a distal engagement part 54 of the case is deformed inwardly to frictionally and mechanically engage the projectile. The distal engagement part of the case defines the distal end of the case and is typically 4mm in length when viewed in cross section.

10 The projectile defines a circumferential sealing groove 56 which extends circumferentially around the projectile and within which a resiliently deformable O-ring seal 58 is seated. The sealing groove is of such a nature that it entraps the O-ring such the frictional rolling effect that occurs when inserting the projectile into the case during assembly of the projectile to the case, cannot displace or misalign the O-ring from its
15 designated position within the sealing groove. The prevention of movement of the O-ring during assembly of the projectile to the case, is critical to ensure a fluid-tight seal between the case and the projectile and provide a consistent mechanical and frictional release force for releasing the projectile from the case.

20 The projectile also defines a circumferential case engagement groove 60. A wall formation of the projectile defining the case engagement groove, defines a flat abutment face 62 which extends circumferentially around the projectile and which is disposed adjacent a side of the sealing groove relatively closer to the front end of the projectile. The abutment face 62 is straight when viewed in cross section and tapers inwardly in a
25 direction from the rear end of the projectile towards the front end thereof. As such, the distal engagement part 54 of the case is deformed inwardly to frictionally and mechanically engage the abutment face of the projectile in a consistent, repeatable and predictable manner.

30 The sealing groove 56 is located at a point of inflection at an intersection between the flat abutment face 62 and an adjoining wall portion 64 of the projectile. The abutment

face 62 is disposed at a taper angle of no less than 10 degrees relative to longitudinal axis Q of the projectile.

5 The inwardly tapered flat abutment face of the projectile permits the case to be deformed inwardly so as to frictionally and mechanically engage the abutment face in a consistent, repeatable and uniform manner, providing for positive engagement of the projectile. This results in a uniform frictional and mechanical holding force being applied to the projectile by the case which leads to a uniform release force being required to release the projectile from the case upon initiation of the propellant charge. The
10 inwardly extending distal engagement part of the case when frictionally and mechanically engaging the projectile, ensures correct location and entrapment of the O-ring 11 preventing the O-ring from becoming misaligned or damaged when assembling the projectile to the case. The tapered configuration of the case engagement groove also provides for compression of the O-ring within the sealing groove by the side wall of
15 the case so as to ensure an effective fluid-tight seal between the case and the projectile.

Claims:

1. A grenade round including:

a projectile defining a front end, a rear end and a longitudinal axis which extends between its front and rear ends, the projectile defining a circumferential sealing groove within which an annular sealing member is seated, the projectile defining a flat abutment face which extends circumferentially around the projectile and which is disposed adjacent a side of the sealing groove relatively closer to the front end of the projectile;

a case comprising a cylindrical side wall having an open distal end to which the projectile is attached and a base wall extending across the side wall at a proximal end of the case, the case having a distal end region within which a rear end portion of the projectile is received, a distal engagement part of the distal end region being deformed inwardly to frictionally and mechanically engage the abutment face of the projectile; and

a propellant propulsion system for initiating a propellant housed within the case for propelling the projectile along a barrel of a firing weapon,

the grenade round being characterised in that the projectile defines a circumferential case engagement groove wherein a wall formation of the projectile defining the case engagement groove, defines the abutment face, the wall formation extending circumferentially around the projectile, with the abutment face being straight when viewed in cross-section and tapering inwardly in a direction from the rear end of the projectile towards the front end thereof.

2. The grenade round as claimed in claim 1, wherein the abutment face of the projectile is disposed at a taper angle of no less than 10 degrees relative to the longitudinal axis of the projectile.

3. The grenade round as claimed in claim 1 or claim 2, wherein the projectile defines a circumferential sealing groove which extends circumferentially around the projectile and within which a resiliently deformable annular seal is seated.
4. The grenade round as claimed in claim 3, wherein the case engagement groove is disposed adjacent the sealing groove at a side thereof relatively closer to the front end of the projectile.
5. The grenade round as claimed in claim 4, wherein the sealing groove of the projectile is located at a point of inflection between the abutment face and an adjoining wall portion of the projectile.

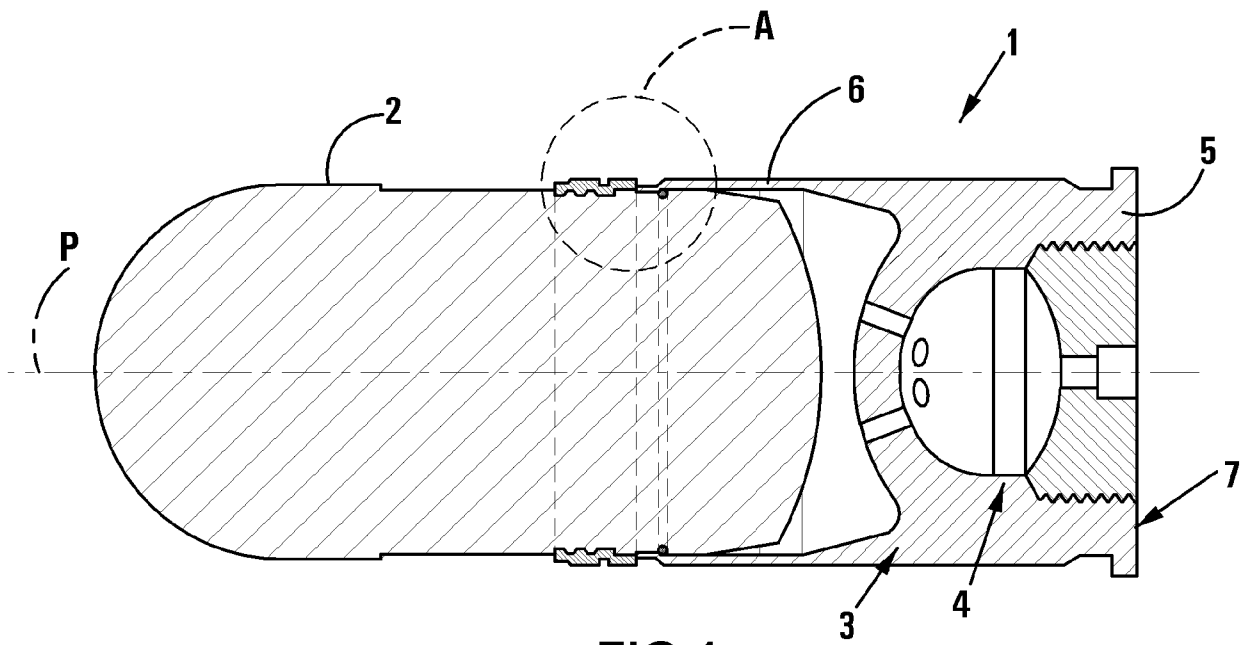


FIG 1
PRIOR ART

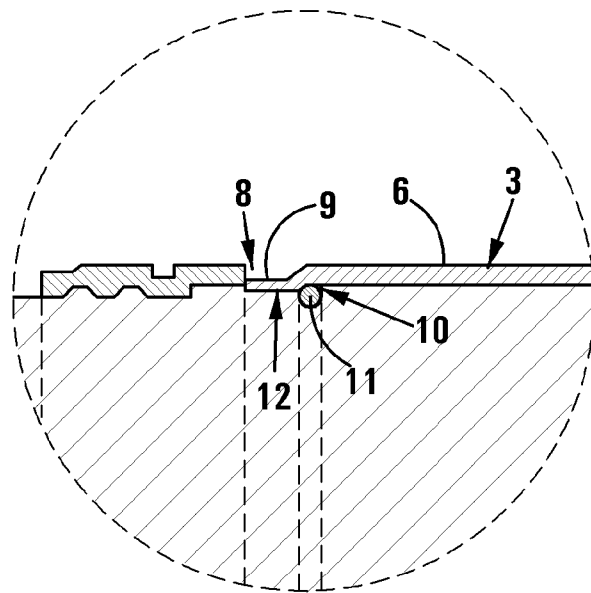


FIG 2
PRIOR ART

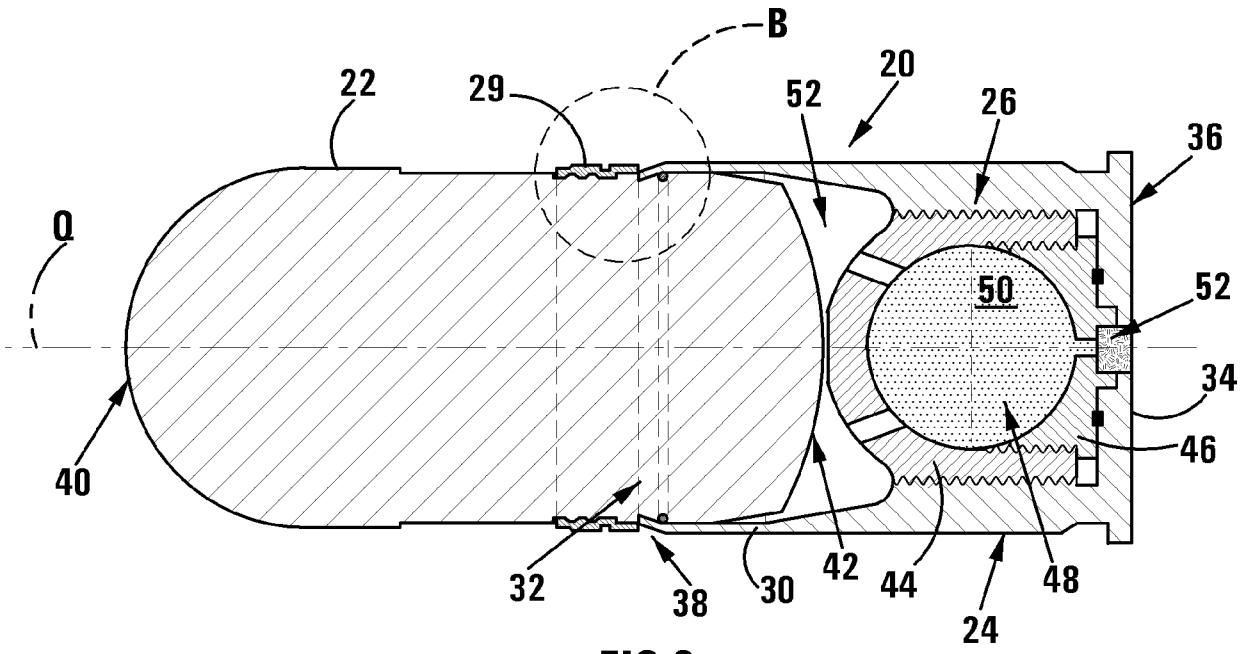


FIG 3

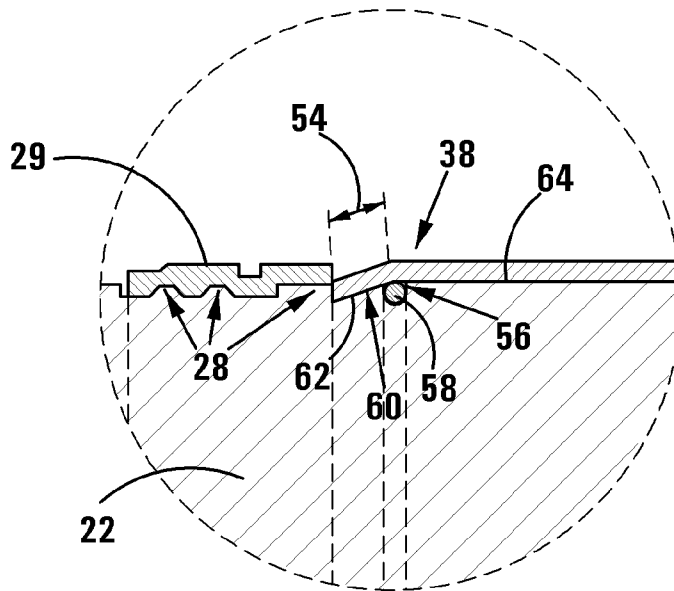


FIG 4

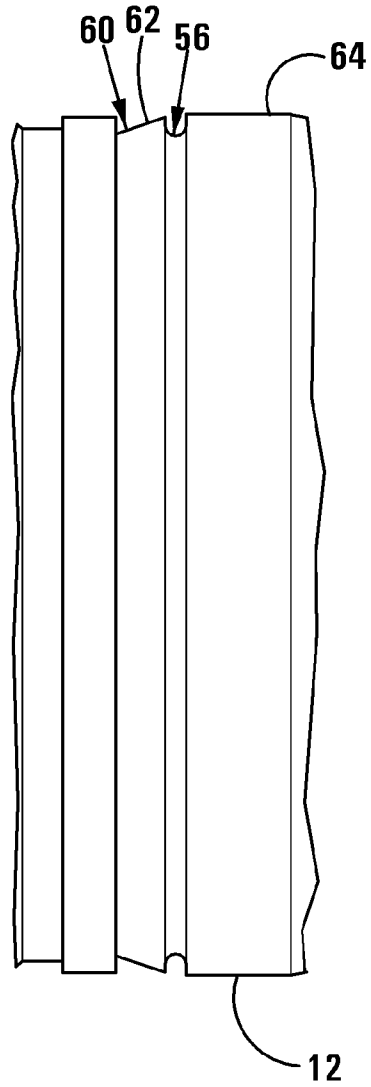


FIG 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/062476

A. CLASSIFICATION OF SUBJECT MATTER
INV. F42B5/067 F42B33/00
ADD.
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)
F42B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 936 189 A (LUBBERS WILLI [DE]) 10 August 1999 (1999-08-10) abstract column 1, lines 5-7 column 3, line 6 - column 4, line 16 figures 1-4	1-5
X	----- WO 2005/098344 A1 (NICO PYROTECHNIK [DE]; HAESLICH DETLEF [DE]) 20 October 2005 (2005-10-20) abstract page 8, paragraph 1 figure 1	1-5
A	----- EP 0 131 863 A2 (USAC INC [US]) 23 January 1985 (1985-01-23) ----- -/--	1

Further documents are listed in the continuation of Box C.

See patent family annex.

* 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
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- "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

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- "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 16 September 2014	Date of mailing of the international search report 24/09/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Menier, Renan

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/062476

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 83/00213 A1 (PALCHER JOSEPH J) 20 January 1983 (1983-01-20) -----	1
A	FR 2 331 770 A1 (SARMAC SA [CH]) 10 June 1977 (1977-06-10) figure 3 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

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