US012135198B2

(12) **United States Patent**
Peterson et al.

(10) **Patent No.: US 12,135,198 B2**
(45) **Date of Patent: Nov. 5, 2024**

(54) **HIGH PRESSURE RIFLE CARTRIDGE WITH PRIMER**

(71) Applicant: **Federal Cartridge Company**, Anoka, MN (US)

(72) Inventors: **Bryan Peterson**, Isanti, MN (US); **Jared Kutney**, Cambridge, MN (US); **Joel L. Sandstrom**, Corcoran, MN (US)

(73) Assignee: **Federal Cartridge Company**, Anoka, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/123,652**

(22) Filed: **Mar. 20, 2023**

(65) **Prior Publication Data**

US 2024/0060759 A1 Feb. 22, 2024

Related U.S. Application Data

(63) Continuation of application No. 17/226,931, filed on Apr. 9, 2021, now Pat. No. 11,609,077, which is a continuation of application No. 16/293,632, filed on Mar. 5, 2019, now Pat. No. 10,976,144.

(60) Provisional application No. 62/638,513, filed on Mar. 5, 2018.

(51) **Int. Cl.**
F42C 19/00 (2006.01)
F42C 19/08 (2006.01)

(52) **U.S. Cl.**
CPC ***F42C 19/083*** (2013.01); ***F42C 19/0807*** (2013.01)

(58) **Field of Classification Search**
CPC F42C 19/083; F42C 19/0807; F42C 19/10; F42B 5/307; F42B 5/02; F42B 5/36; F42B 5/32
USPC 102/470, 204, 430, 469
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

39,109	A	7/1863	Bakewell
40,491	A	11/1863	Mayall
415,707	A	11/1889	Emmens
624,146	A	5/1899	Young
679,792	A	8/1901	Stuart
712,826	A	11/1902	Mason

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2399808		8/2001
CH	231293	A	3/1944

(Continued)

OTHER PUBLICATIONS

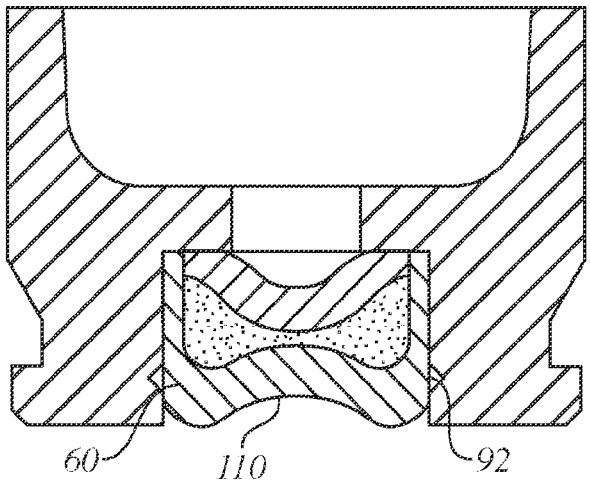
Gleichman, et al. Cartridges, Caps, and Flints: A primer for Archaeologists, *Natural Cultural Services* (2005) 26 pages.

Primary Examiner — Michael D David
(74) *Attorney, Agent, or Firm* — Christensen, Fonder, Dardi & Herbert PLLC; Timothy J. Busse

(57) **ABSTRACT**

A cartridge that generates higher than typical chamber pressures has an enhanced means of primer retention for retaining the primer in the primer recess of the casing. The means may be a lip folded onto a conical surface, a annular groove to receive deformed primer wall portion material upon detonation, a concavity in the rearward facing wall of the primer, a check valve in the flash tube to inhibit propellant gases from reaching the primer recess, or specifically configured primers with a greater length than diameter and with greater wall thicknesses.

17 Claims, 8 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

1,353,118	A	9/1920	Thompson
1,473,355	A	11/1923	Pillars et al.
1,485,404	A	3/1924	Martin et al.
1,571,510	A	2/1926	Dickerman
2,068,516	A	1/1937	Seavey
2,381,900	A	8/1945	Graumann et al.
2,423,837	A	7/1947	Martin
2,441,897	A	5/1948	Nichols
2,466,929	A	4/1949	Catlin et al.
2,480,149	A	8/1949	Liljegren
2,568,078	A	9/1951	McGahey, Jr.
2,708,878	A	5/1955	Eckstein
2,803,265	A	8/1957	Coffey
2,868,128	A	1/1959	Ramsey
2,915,972	A	12/1959	Hitchens et al.
2,926,607	A	3/1960	Muller, Jr. et al.
2,931,039	A	4/1960	Henning et al.
2,948,219	A	8/1960	Sapp
3,001,436	A	9/1961	Deitemeyer
3,055,302	A	9/1962	Bayard et al.
3,060,855	A	10/1962	Henning et al.
3,099,958	A	8/1963	Daubenspeck et al.
3,185,095	A	5/1965	Mayer et al.
3,195,463	A	7/1965	Foote et al.
3,312,168	A	4/1967	Stadler et al.
3,351,019	A	11/1967	Schaadt et al.
3,352,240	A	11/1967	Eckstein
3,415,192	A	12/1968	Stadler et al.
3,435,765	A	4/1969	Gawlick
3,719,148	A	3/1973	Gawlick et al.
3,771,453	A	11/1973	Ciccone et al.
3,855,900	A	12/1974	Barr et al.
4,014,264	A	3/1977	Bendler et al.
4,029,015	A	6/1977	Lachaussee et al.
4,083,307	A	4/1978	Beermann et al.
4,179,992	A	12/1979	Ramnarace et al.
4,361,093	A	11/1982	Saxby
4,464,990	A	8/1984	Bendler et al.
5,033,386	A	7/1991	Vatsvog
5,151,555	A	9/1992	Vatsvog
5,204,488	A	4/1993	Cimolino et al.
5,259,288	A	11/1993	Vatsvog
5,481,978	A	1/1996	Müller et al.
6,090,178	A	7/2000	Benini
6,095,051	A	8/2000	Saxby
6,415,718	B1	7/2002	Saxby
6,516,725	B2	2/2003	Jackson et al.
6,564,719	B2	5/2003	Saxby
6,962,113	B1	11/2005	Carlson
6,976,431	B2	12/2005	Westrom et al.
7,302,890	B2	12/2007	Saxby
7,458,322	B2	12/2008	Reynolds et al.
7,481,167	B2	1/2009	Engel et al.
7,690,310	B2	4/2010	Engel et al.
7,841,279	B2	11/2010	Reynolds et al.
8,365,669	B1	2/2013	Saxby
8,479,654	B2	7/2013	Rosales et al.
8,522,684	B2	9/2013	Davies et al.
8,524,018	B2	9/2013	Busky et al.
8,607,702	B1	12/2013	Donadio et al.
8,800,449	B2	8/2014	Schluckebier et al.
8,887,638	B1	11/2014	Calvert
8,978,559	B2	3/2015	Davies et al.
9,273,942	B1	3/2016	Burke et al.
9,989,343	B2	6/2018	Padgett et al.
10,048,049	B2	8/2018	Burrow
10,976,144	B1 *	4/2021	Peterson F42C 19/0807
11,609,077	B2 *	3/2023	Peterson F42C 19/083
2003/0145754	A1	8/2003	Saxby
2007/0151473	A1	7/2007	Brunn
2007/0272111	A1	11/2007	Saxby
2010/0126740	A1	5/2010	Hartmann et al.
2010/0162912	A1	7/2010	Kay et al.
2011/0214582	A1	9/2011	Glasser
2011/0308417	A1	12/2011	Glasser
2015/0020705	A1	1/2015	Hartmann et al.
2016/0018199	A1	1/2016	Nemec
2016/0238355	A1	8/2016	Dionne et al.
2016/0290774	A1	10/2016	Langenbeck
2018/0209768	A1	7/2018	Peterson

FOREIGN PATENT DOCUMENTS

EP	500462	A1	8/1992
EP	1079199	A2	2/2001
EP	1031006	B1	11/2002
ES	2251074	T3	4/2006
ES	2260939	T3	11/2006
FR	2431111	A1	2/1980
GB	440550	A	1/1936
GB	1591092		6/1981
GB	2446600	A	8/2008
RU	2096730	C1	11/1997
RU	2190181	C2	9/2002
RU	2240487	C2	11/2004
SE	519883	C2	4/2003
WO	WO2007119038	A1	10/2007
WO	WO2009025538	A1	2/2009
WO	WO2012081955	A2	6/2012

* cited by examiner

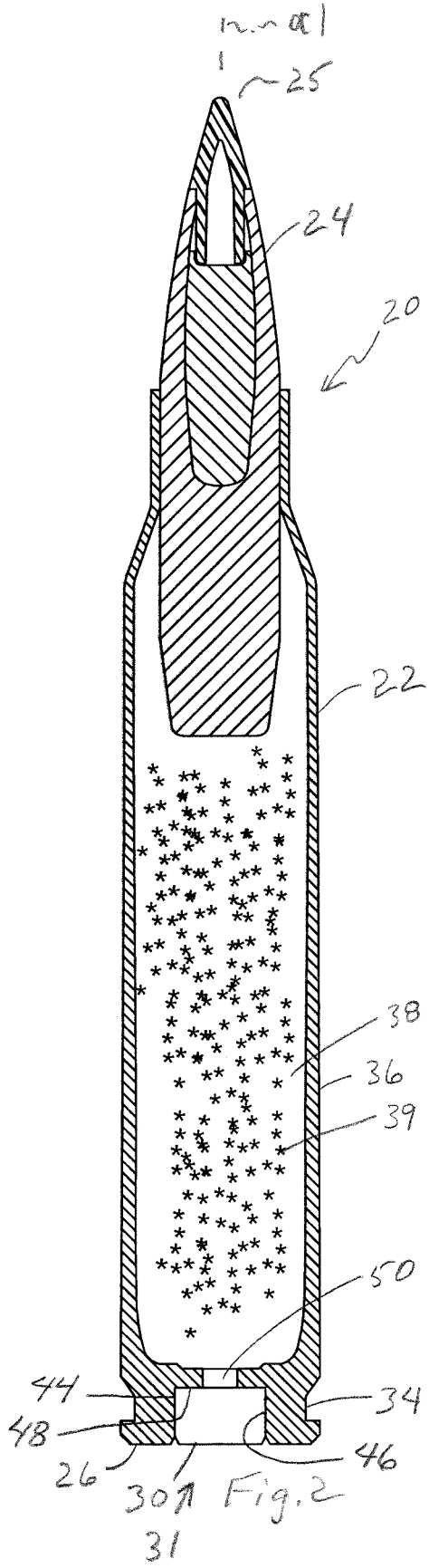


Fig. 2

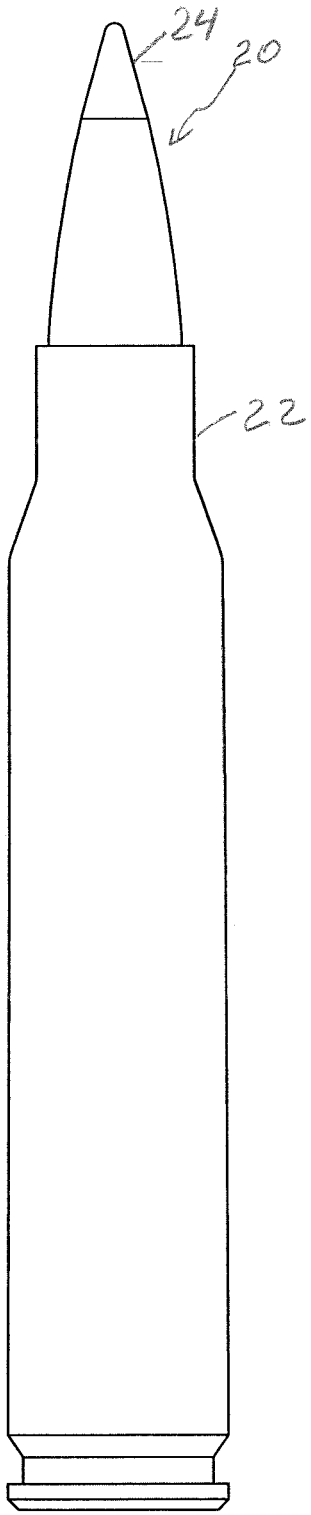


Fig. 1

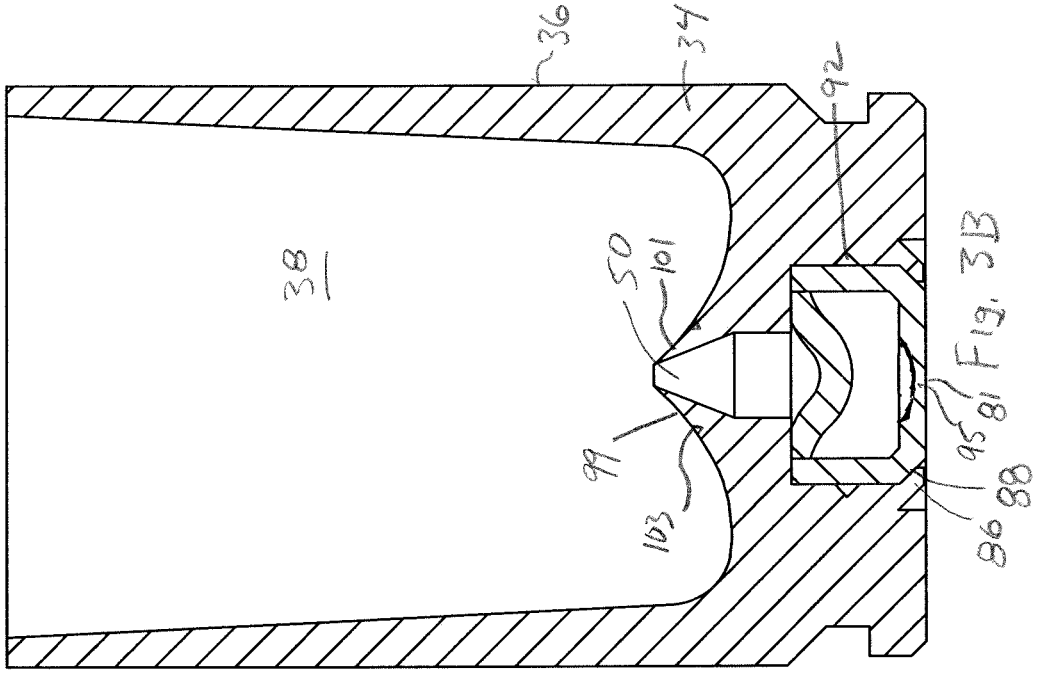

36
34
92
38
50
101
99
103
95
81
88
86

Fig. 33

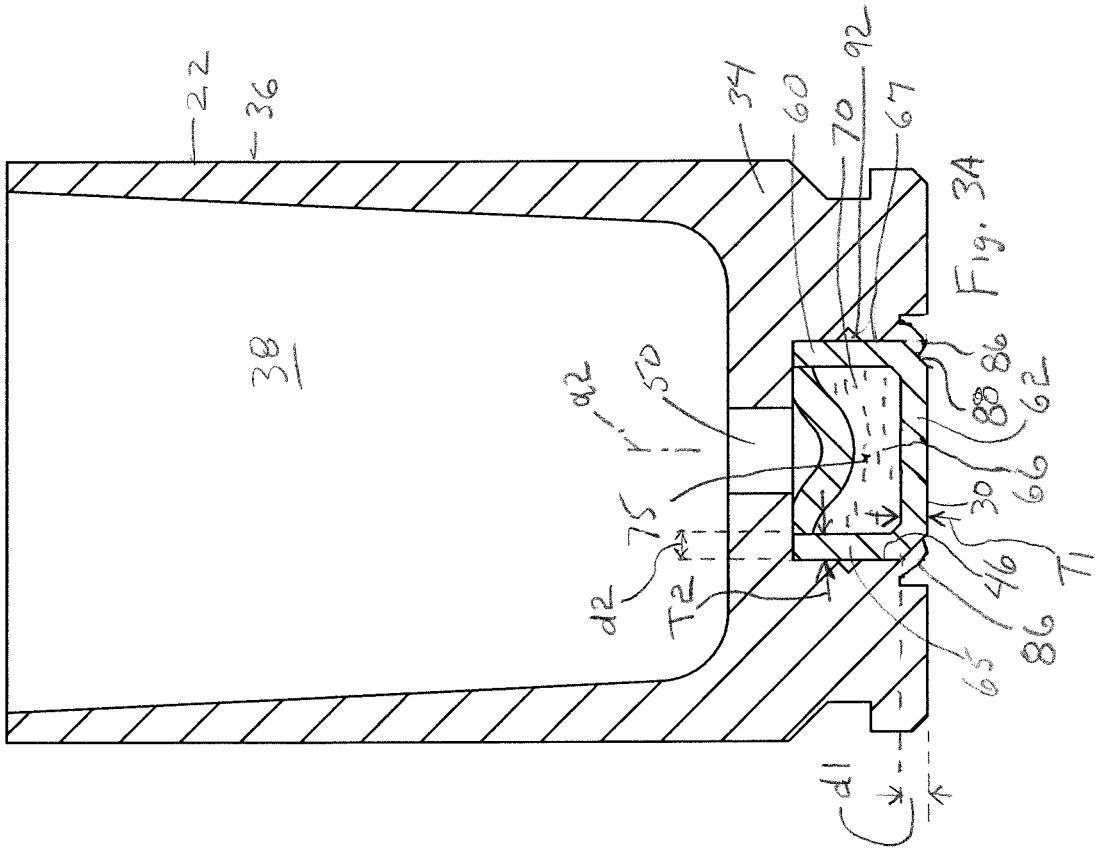

22
36
34
60
70
67
92
38
42
50
75
T2
d2
88
86
62
66
30
46
T1
65
d1

Fig. 34

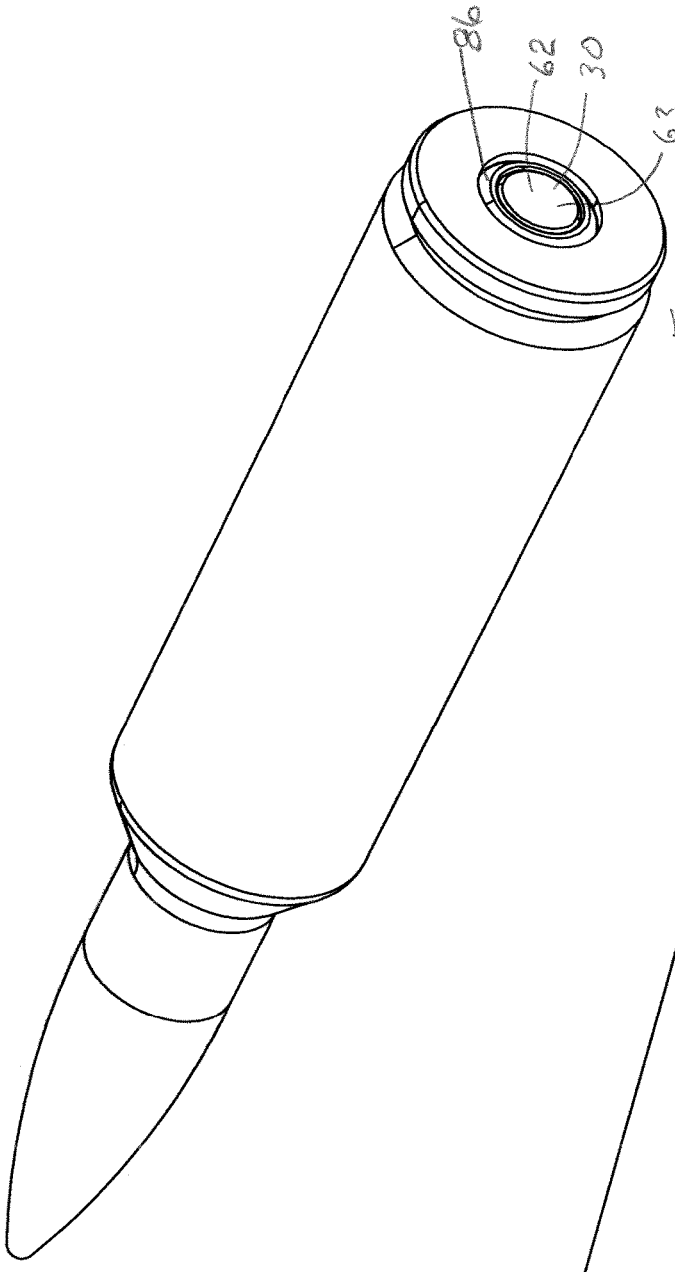


Fig. 4

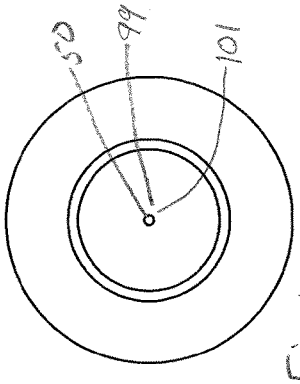


Fig. 6

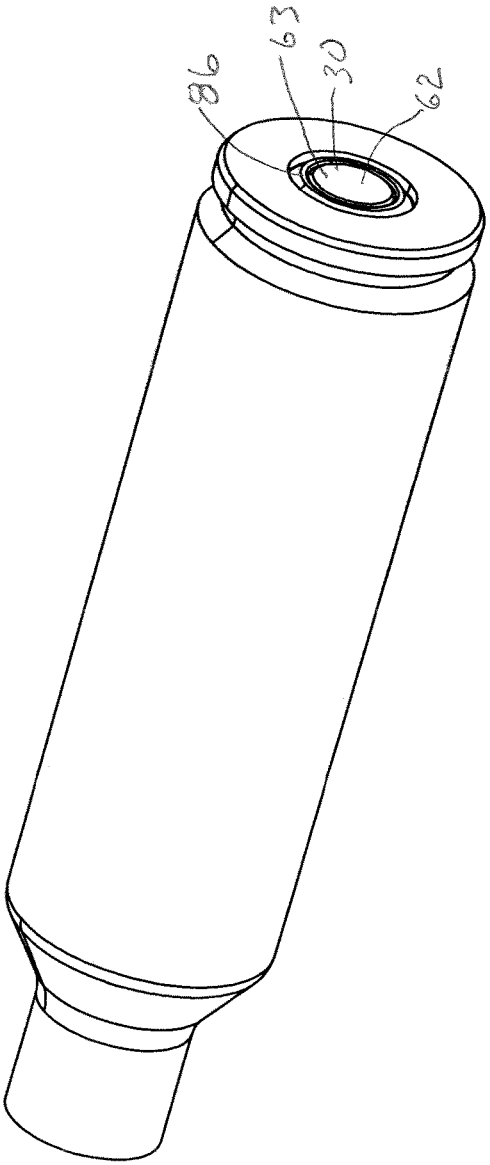


Fig. 5

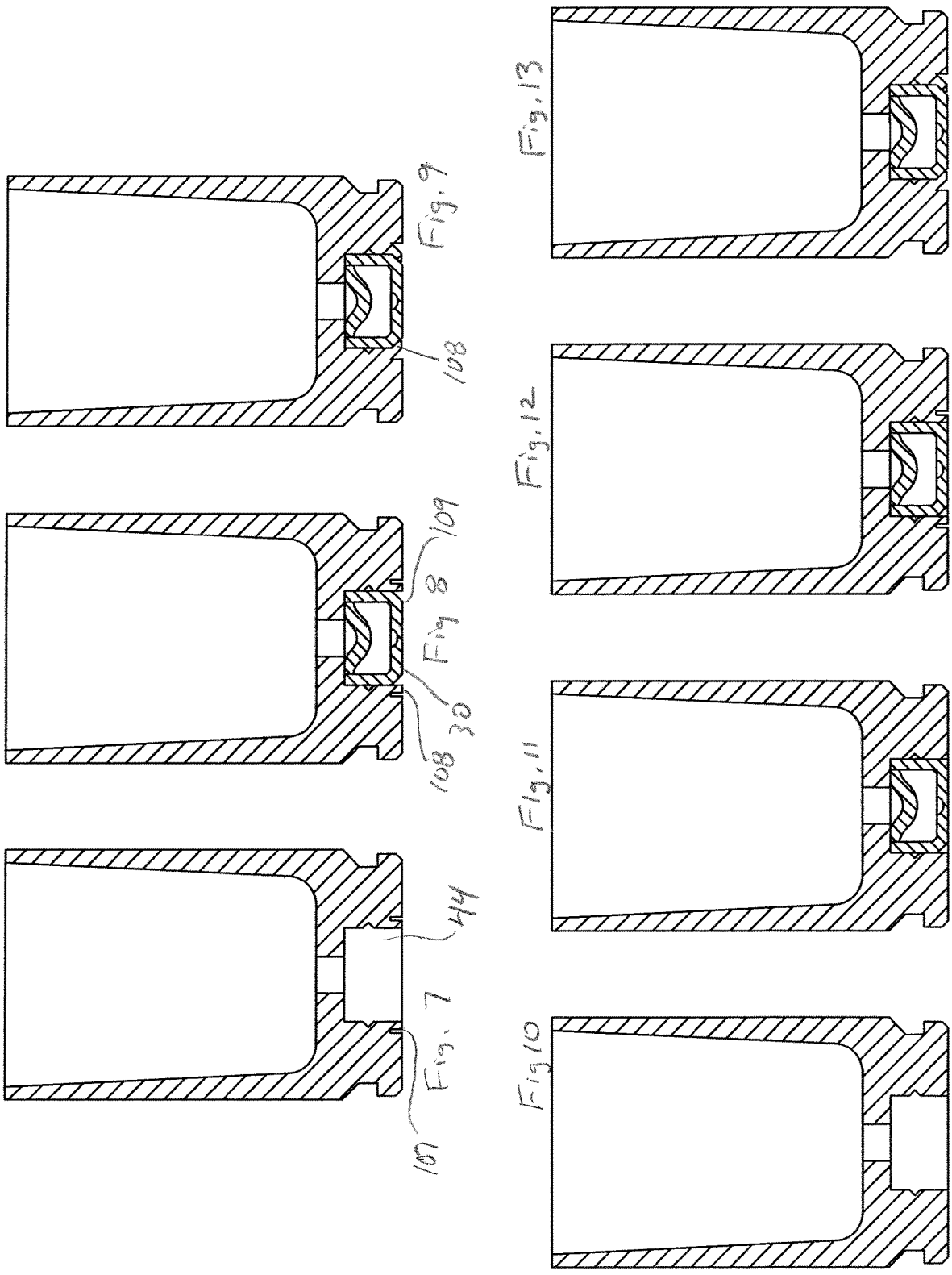


Fig. 13
Fig. 12
Fig. 11
Fig. 10
Fig. 9
108
Fig. 8
109
108
30
Fig. 7
44
10

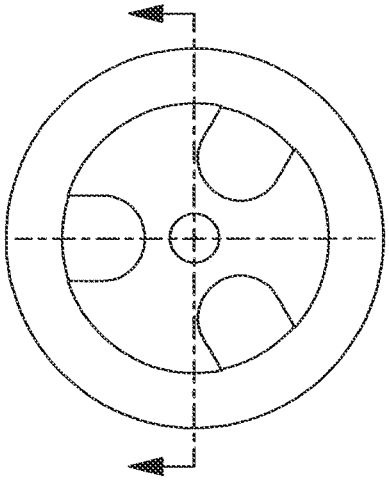


FIG. 18

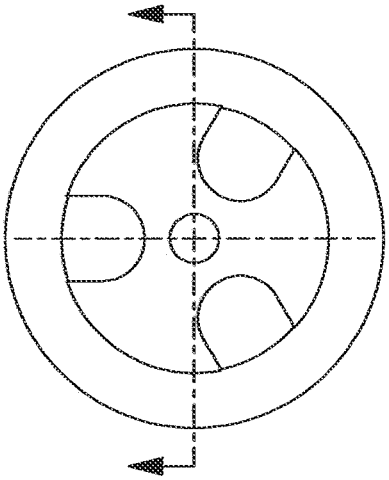


FIG. 16

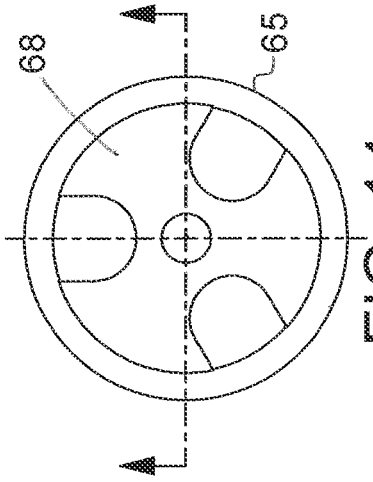


FIG. 14

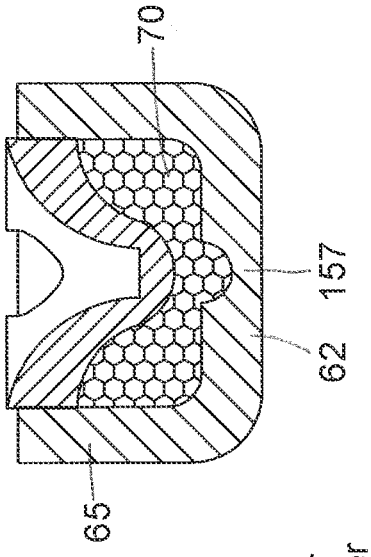


FIG. 19

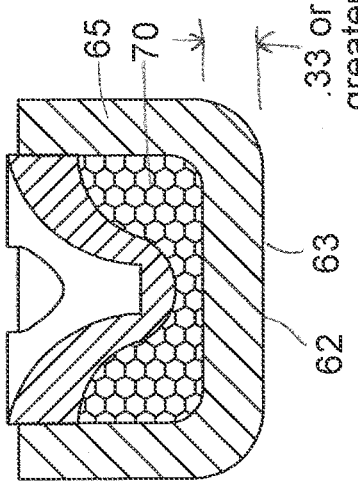


FIG. 17

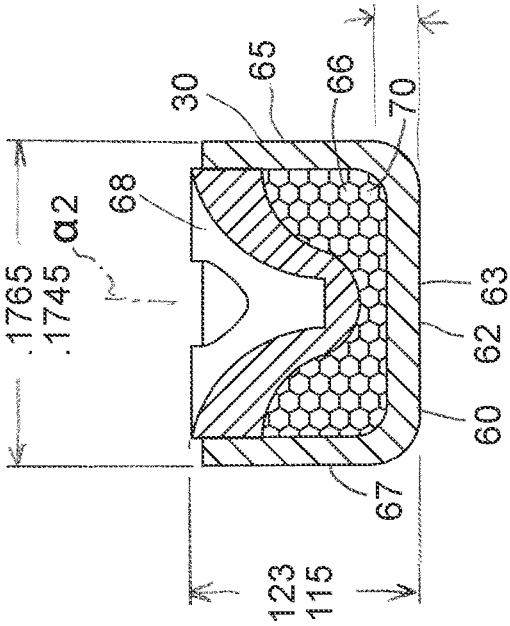


FIG. 15

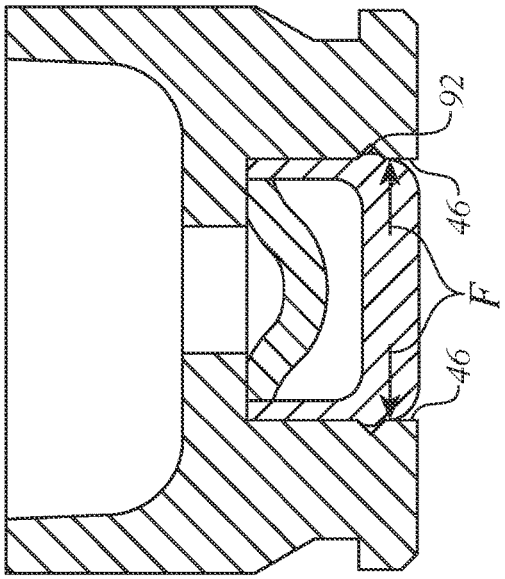


FIG. 23

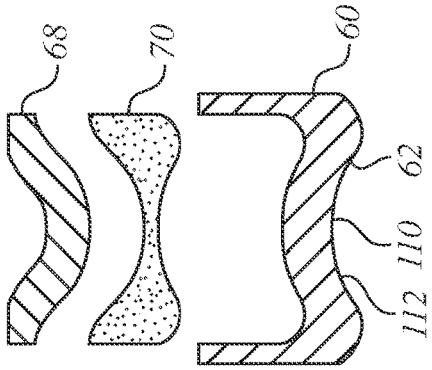


FIG. 21

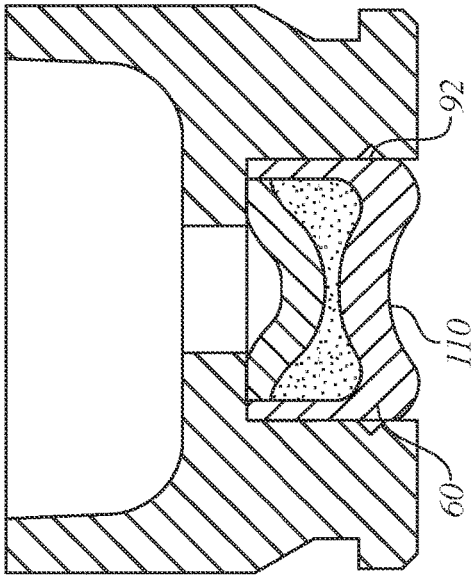


FIG. 22

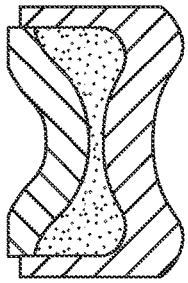


FIG. 20

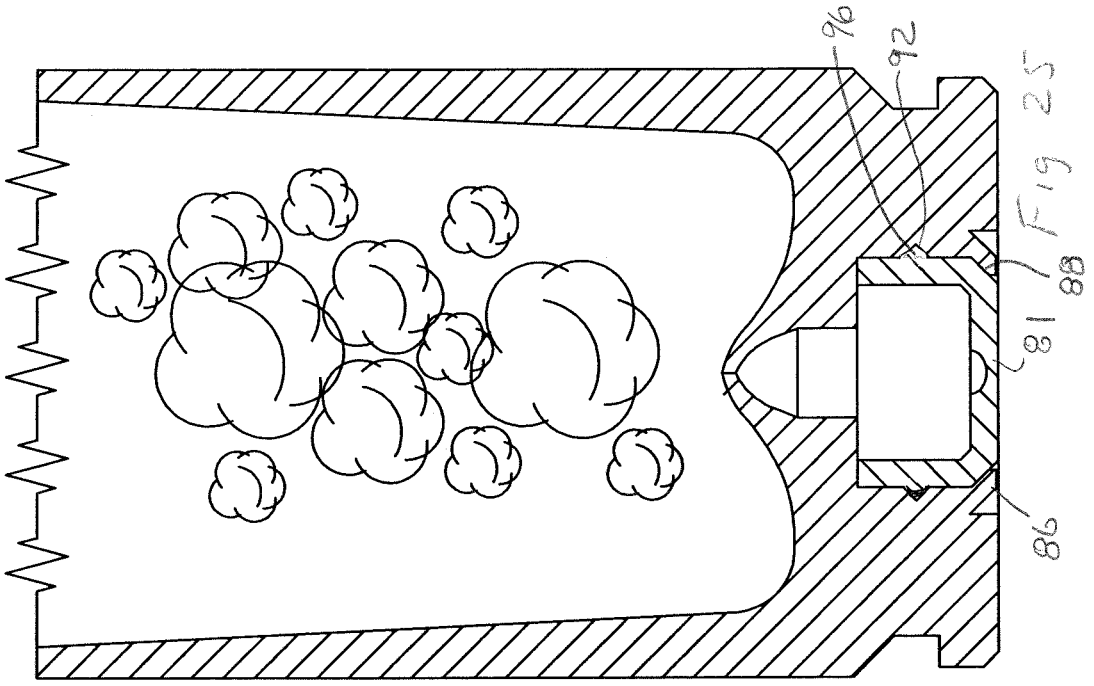


Fig 25

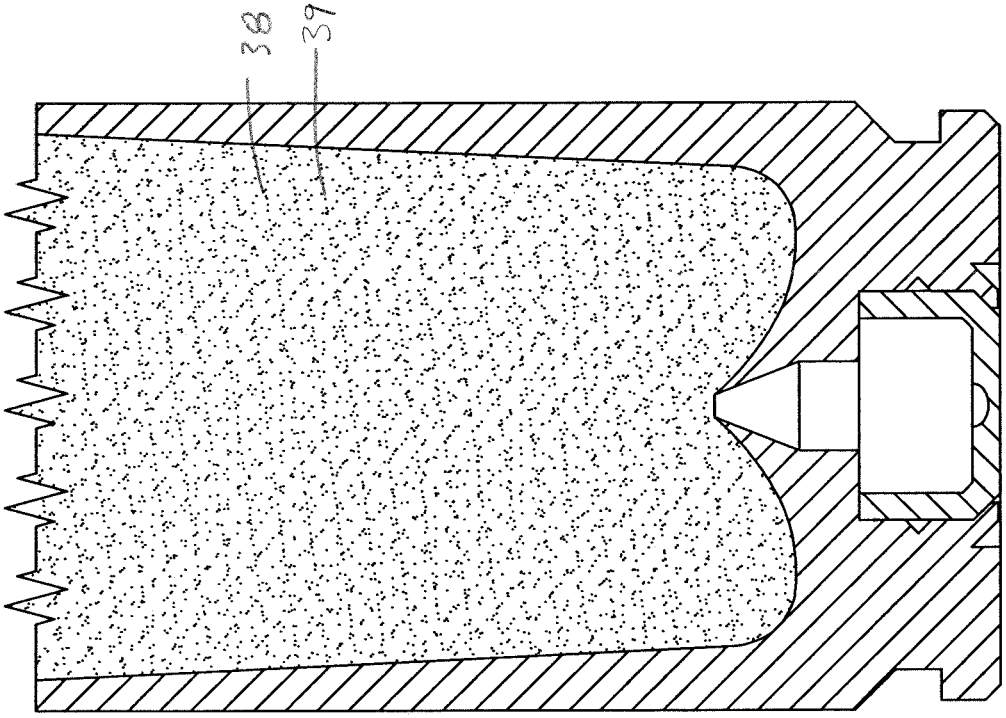


Fig 24

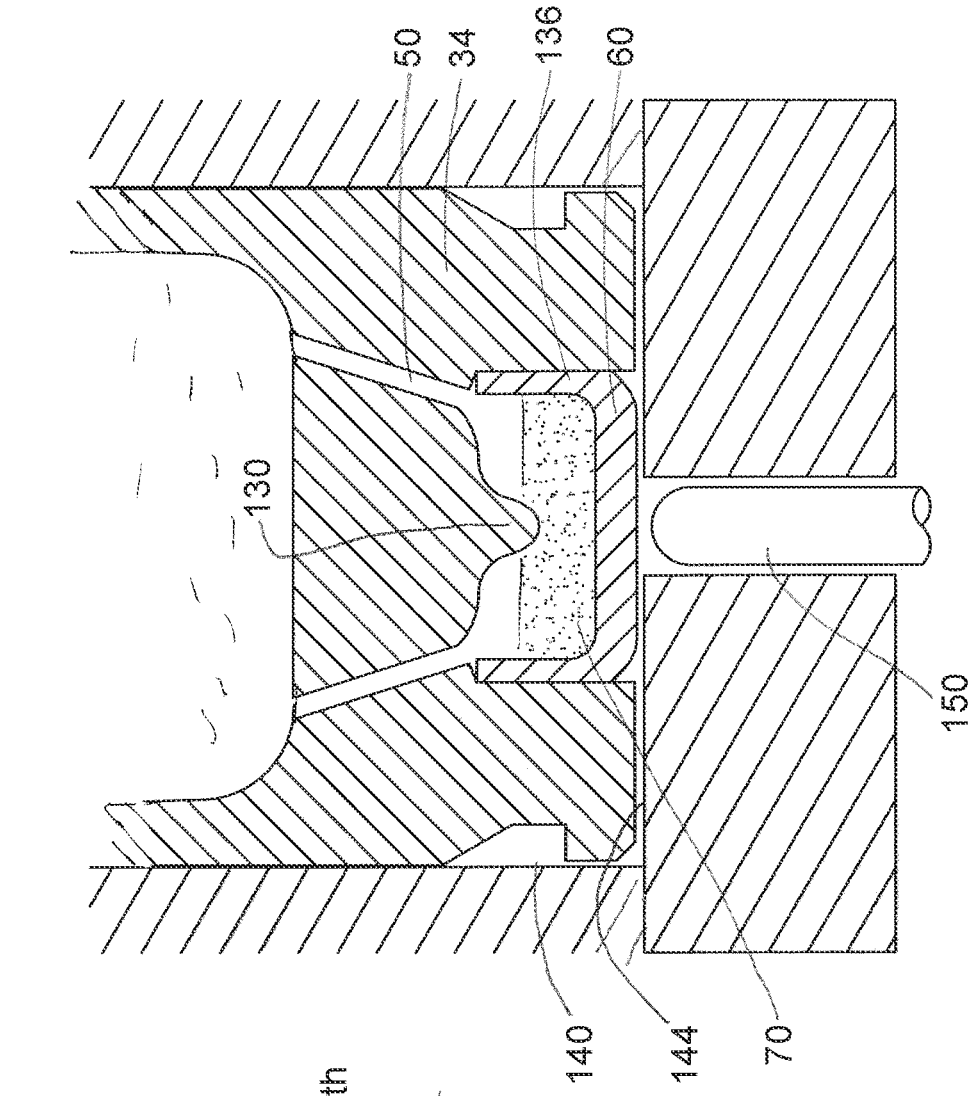


FIG. 27

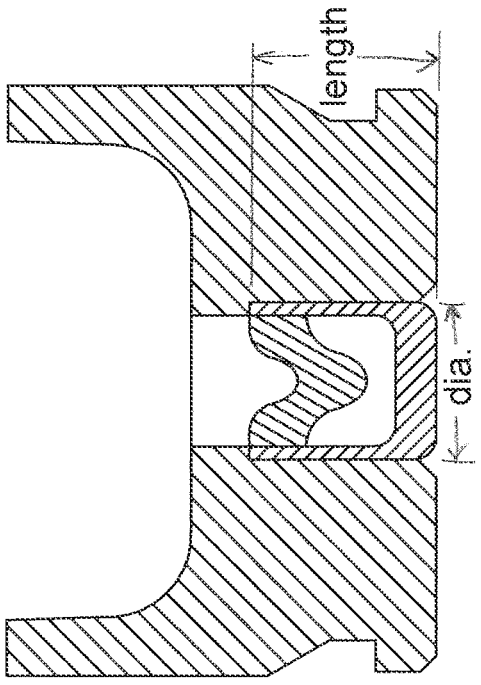


FIG. 26

HIGH PRESSURE RIFLE CARTRIDGE WITH PRIMER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 17/226,931 filed Apr. 9, 2021, which is a continuation of U.S. patent application Ser. No. 16/293,632 filed Mar. 5, 2019, now U.S. Pat. No. 10,976,144, which claims the benefit of U.S. Provisional Application No. 62/638,513, filed Mar. 5, 2018, the entire contents of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

Conventional centerfire rifle cartridges develop maximum casing and barrel pressures of around 55,000 psi. In order to develop higher performance weaponry, higher firing pressures is an option for exploration. Such higher pressures are more demanding on equipment and ammunition.

SUMMARY OF THE INVENTION

The inventors have identified several failure modes, associated with rifle cartridges, and particularly associated with the primer, where the internal firing pressures are increased significantly above the conventional ranges. Such failures may include: rearward rupture of the primer allowing gas and debris to exit rearward of the cartridge in the chamber; dislocation of the primer from the cartridge casing; primer material lodging between the firing pin and bolt at the firing pin opening; primer flattening out.

In embodiments, the inventive aspects herein are for cartridges of 50 caliber and less.

A cartridge casing having a rearward head with a primer cavity, a primer disposed therein, a forward casing mouth leading into a propellant cavity, with propellant in the cavity, a projectile seated in the casing mouth. In embodiments, a cartridge casing utilizes specialized propellants for providing enhanced firing pressures of at least 75,000 psi. In embodiments, a cartridge casing utilizes specialized propellants and enhancements for providing enhanced firing pressures of at least 80,000 psi. In embodiments, a cartridge casing utilizes specialized propellants and structural enhancements for providing enhanced firing pressures at least 90,000 psi. In embodiments, a cartridge casing utilizes specialized propellants and enhanced structural features for providing enhanced firing pressures in embodiments at least 100.000 psi.

In embodiments, the cartridge casing has means for retention of the primer in the primer cavity during firing. Such means may include an annular rearwardly projecting ring that is crimped radially inward over a beveled or rounded rear corner surface of the primer. In embodiments, such means may include an annular inset groove extending radially outward in the inward facing cylindrical wall defining the primer cavity, whereby upon firing of the primer the primer housing material flows or deforms into the annular ring providing an axial lock to the primer.

In embodiments, the means for retention of the primer in the primer cavity includes a thickened housing wall of the primer providing enhanced strength of the primer, less deformation during firing and less likelihood of separation of the primer out of the primer cavity, the sensitivity of the primer is maintained by including a divot or hemispherical recess in one surface of the rearward wall thereby providing a thinned wall at the region immediately surrounding the impact point of the firing pin with the rearward face of the primer. The overall strength of the wall is not significantly diminished and the firing sensitivity is maintained.

In embodiments, the means for retention of the primer in the primer cavity includes a concave shape of the rearward facing wall of the primer such that when the firing pin engages the wall the wall surrounding the impact region of the firing pin is less likely to deform rearwarding around the firing pin and into the bolt opening from which the firing pin extends. Moreover the concave shape when forced rearwardly during detonation of the primer propellant, urges the concave shape towards a flat shape and as this happens the diameter of the concave wall portion increases providing an outward radial force on the rearward corner portion of the tubular axially extending housing forcing the corner portion into the inwardly facing surface of the casing that defines the primer cavity tending to lock the primer into the casing wall securing the primer in the cavity.

In embodiments, means for retaining the primer in the primer cavity of the casing may include means and/or structure to minimize the amount of pressure exerted on the forward face of the primer. One means or structure for this is a reduced diameter primer compared to conventional primers which are standardized to be 0.150 inches in diameter or larger. Reducing the diameter reduces the area upon which the firing pressure is distributed thus reducing the rearward force on the primer.

In embodiments, means for reducing the pressure exerted on the forward face of the primer is to provide a flash hole extending from the primer cavity to the propellant cavity wherein at the opening to the propellant cavity structure is provided to collapse or otherwise close the opening such that the firing pressure of the propellant is stopped by such closure. In embodiments a one way check valve is provided in or at the flash hole extending to the propellant chamber.

In embodiments, the casing may be manufactured of steel or brass. The primer housing and structure may be formed of steel or brass.

DESCRIPTION OF THE FIGURES

FIG. **1** is an elevation view of a cartridge in accord with embodiments.

FIG. **2** is cross sectional view of the cartridge of FIG. **1**.

FIG. **3**A is cross sectional view of a casing and primer illustrating embodiments.

FIG. **3**B is a cross sectional view of a casing and primer illustrating embodiments.

FIG. **4** is a perspective view of a cartridge in accord with embodiments.

FIG. **5** is a perspective view of the casing of the cartridge of FIG. **4**.

FIG. **6** is a forward end view of the casing of FIG. **5**.

FIGS. **5-9** illustrate a sequence of securing a primer to a casing in accord with embodiments.

FIGS. **10-13** illustrate a sequence of securing a primer to a casing in accord with embodiments.

FIG. **14** is a top plan view of a primer.

FIG. **15** is a cross sectional view of the primer of FIG. **14**.

FIG. **16** is a top plan view of a primer.

FIG. **17** is a cross sectional view of the primer of FIG. **16**.

FIG. **18** is a top plan view of a primer.

FIG. **19** is a cross sectional view of the primer of FIG. **18**.

FIG. **20** is a cross sectional view of a primer in accord with an embodiment.

FIG. **21** is an exploded view of the primer of FIG. **20**.

FIG. **22** is a view of the primer of FIG. **20** in a casing.

FIG. **23** is a view of the primer of FIG. **22** after detonation of the primer compound in the primer.

FIG. **24** is a cross sectional view of a cartridge in accord with embodiments.

FIG. **25** is the cartridge of FIG. **24** after detonation of the primer compound and propellant.

FIG. **26** is a cross sectional view of a primer in a recess, the primer having a aspect ratio of diameter to length of less than 0.8.

FIG. **27** is a cross sectional view of a Berdan primer in accord with embodiments.

While embodiments of the disclosure are amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the disclosure to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the disclosure.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2**, a rifle cartridge **20** is illustrated a casing **22**, a projectile **24**, primer **30**. The rifle cartridge has an axis α, a forward end **25** and a rearward end **26**. In embodiments, the propellant, projectile are selected for generating higher than typical chamber pressures upon firing; for example, greater than 75,000 psi. The cartridges also include means **31** for retaining the primer in the casing under such higher than typical pressures as described in detail below. The casing **22** has a rearward head portion **34** and a unitary casing wall portion **36** extending forwardly and defining an interior **38** containing with propellant **39**. The head portion having a primer recess **44** defined by a cylindrical wall surface **46** and a rearward facing stop surface **48**. A flash hole **50** extends from the primer recess **44** to the interior and the propellant therein.

Referring to FIGS. **3A-5**, and **15-18**, primers are illustrated. Generally the primers **30** in these particular embodiments have a cup **60** with a circular wall portion **62** having a rearwardly facing surface **63**, a skirt wall portion **65** unitary with the circular wall portion and defining a primer interior **66**, and an axis α**2**. The primer cup circular wall portion having a cylindrical exterior wall surface **67** that is engaged with the cylindrical wall surface **46** of the head portion **34**. An anvil **68** is positioned in the primer interior with primer compound **70** positioned between the cup and anvil and adhered to the inside surface **74** of the cup. A detonation zone **75** is defined between the rearward tip **78** of the anvil and the central portion **80** of the circular wall portion where the primer compound **70** is compressed upon striking of the center **81** of the circular wall portion **62** by a firing pin, not shown in these figures.

Referring to FIG. **3A**, two distinct means for retention of a primers in the casing is depicted. First, a circular lip **86**, also shown in FIGS. **5** and **6**, is crimped over a chamfer **88** configured conical surface at the exterior corner of the circular wall portion and skirt wall portion. The conical surface, in embodiments, may extend an axial distance d**1** that is about the thickness T**1** of the circular wall portion. In embodiments the axial distance d**1** is 80% of the thickness T**1** of the circular wall portion. In embodiments, the radial distance d**2** of the chamfer is about the thickness T**2** of the skirt wall portion **65**. In embodiments the axial distance d**2** is 80% of the thickness T**2** of the circular wall portion. In embodiments, the lip **86** mostly covers the conical surface **88**. Secondly, an annual recess **92** in the cylindrical all surface **46** defining the primer recess received deformed cup material upon detonation of the primer compound **70**, discussed in more detail below with reference to FIGS. **24** and **25**.

Referring to FIGS. **3B**, **24**, and **25**, the circular wall portion may have a centrally positioned thinning at a thinned wall portion **95**. This may provide for easier deformation of the circular wall portion by the firing pin for detonating the primer compound, particularly when thicker primer wall portions than typical are utilized. The lips **86** are crimped or staked over the conical surface **88** of the primer and an annular recess **92** may received deformed primer wall portion material. Additionally, in the embodiment of FIG. **3B**, the flash hole **50** is defined by a tapering nozzle **99** formed from the head portion **34** of the casing. See also FIG. **6**. The flash tube wall portions **101** may be configured to collapse under pressure when the propellant in the casing interior **38** ignites. Additional structure such as fold grooves **103** may be added to facilitate the inward folding of the wall portions **101**. The flash hole structure effectively operates as a check valve. Other structure accomplishing the check valve effect may also be utilized.

Referring to FIGS. **7-9**, steps in securing a primer **30** in a primer recess **44** accord with embodiments are depicted. The head portion **34** has a annular groove **107** formed before insertion of the primer. The primer is inserted and the lip **108** defined by the groove is crimped over onto the corner **109** of the primer. The corner may have a conical surface.

Referring to FIG. **10-13**, the groove may be stamped into the face of the head portion after insertion of the primer. The groove may be in one step and the crimping over in another step. In embodiments, a single step may form the groove and fold the lip over the corner of the primer, that is, leaving out the step illustrated in FIG. **12**.

Referring to FIGS. **20-23**, and additional means for retaining a primer in a casing is illustrated. The circular wall portion may have a concave portion **110** with a concavity **112**. The concavity as shown in FIG. **22** may, upon detonation, expand outwardly, losing the concavity as shown in FIG. **23**. The effect of the concave portion becoming essentially planar as shown in FIG. **23** is to effect an outward radial force F against the wall surface **46** defining the primer recess **44** which can facilitate the skirt portion deformation into the recess **92** and otherwise clamp the primer into the recess.

Referring to FIG. **26**, a primer with a aspect ratio of diameter to length of less than 1.0 in embodiments is illustrated. In embodiments the aspect ratio may be less than 0.8. Such a primer provides less surface area in communication with the propellant gases and therefore less ejection force from the primer recess. Moreover, the reduced size provides a more robust package for handling higher than typical chamber pressures. A conventional primer may have a diameter of 0.1745 to 1765 inches, and a length of 0.115 to 0.123 inches, see FIG. **15**. An embodiment with an aspect ratio of 1.0 or less may have a reduced diameter of 0.160 or less in embodiments and a like size length or a greater length. Embodiments may have a diameter of 1.50 or less and a like size length or a greater length.

Referring to FIG. **27**, a Berdan primer **136** with the anvil portion **130** being unitary with the head portion **34** and two or more flash holes **50**. The cartridge **20** is seated in a firearm chamber **140** with a bolt face **144** in the in-battery position

and a firing pin **150** ready to strike the primer. Embodiments described herein may also be suitable for use with the Berdan primer.

FIGS. **17** and **18** illustrate primers with thicker than typical cup wall thickness, particularly compared to a primer with typical wall thicknesses shown in FIG. **15**. The skirt wall portions **65** may be substantially the same thickness as the circular wall portion **62**. The thicknesses, may be in embodiments greater than 0.030 inches. In embodiments, greater than 0.035 inches. A thinned portion **157** of the circular wall portion may facilitate the detonation of the propellant compound.

These examples illustrate that different structures, each having a primer retention function, can be combined in different combinations as may be appropriate. on the primer n A and **3**B, and FIG. **2** illustrates a cross section of the casing **20** with a primer **30** therein illustrating several aspects that may be included in combination or individually. The primer received in a primer recess **36**, the recess may have an annular projection **40** that is crimped inwardly on the primer beveled shoulders **42**. The rearward wall **46** may have a divot **48** on the inside surface **50** of said wall. An annular groove **52** may allow deformation of the outer wall of the primer to enter the groove to lock the primer into the primer cavity.

Continuing to refer to FIG. **2**, a flash hole **54** from the primer **30** to the propellant chamber **58** may have structure **60** that closes off the flash hole upon ignition of the propellant in the propellant chamber.

Referring to FIGS. **3-5**, in an embodiment, the primer may have a elongate axially configuration where the diameter d is less that the traditional minimal dimension of rifle primers. In embodiments, the diameter to length **1** is less than conventional rifle primers.

Referring to FIGS. **6-8**, a primer has a concave rear wall portion **70** that may deform upon firing to radially expand the rearward wall effectively clamping the primer into the cavity.

The following United States patents are hereby incorporated by reference herein in their entirety: U.S. Pat. Nos. U.S. Pat. Nos. 1,485,404, 2,068,516, 2,423,837, 2,868,128, 2,926,607, 3,195,463, 3,312,168, 3,351,019, 3,352,240, 3,415,192, 3,719,148, 4,029,015, 4,083,307, 5,481,978, 6,516,725, 7,458,322, 9,989,343, and U.S. Ser. No. 10/048,049. The above references in all sections of this application are herein incorporated by references in their entirety for all purposes. Components illustrated in such patents may be utilized with embodiments herein. Incorporation by reference is discussed, for example, in MPEP section 2163.07(B).

"Substantially" when referring to a quality means mostly, unless otherwise defined, when referring to a quantified parameter, unless otherwise defined, means within 10% of that quantified parameter.

All of the features disclosed in this specification (including the references incorporated by reference, including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including references incorporated by reference, any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any incorporated by reference references, any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed. The above references in all sections of this application are herein incorporated by references in their entirety for all purposes.

Although specific examples have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement calculated to achieve the same purpose could be substituted for the specific examples shown. This application is intended to cover adaptations or variations of the present subject matter. Therefore, it is intended that the invention be defined by the attached claims and their legal equivalents, as well as the following illustrative aspects. The above described aspects embodiments of the invention are merely descriptive of its principles and are not to be considered limiting. Further modifications of the invention herein disclosed will occur to those skilled in the respective arts and all such modifications are deemed to be within the scope of the invention.

We claim:

1. A cartridge, comprising:

a cartridge casing formed of a rearward head portion and a casing wall portion extending forwardly from the rearward head portion and defining an interior, the rearward head portion having a rearward primer recess and a flash hole extending to the interior, the casing wall portion defining an open forward mouth,

a bullet seated in the open forward mouth;

propellant disposed in the interior rearward of the bullet; and

a primer seated in the rearward primer opening, the primer having a cup portion with a base portion configured as rearward circular wall portion, a forward extending skirt wall portion unitary with the rearward circular wall portion and defining a primer interior, primer compound disposed in the primer interior, wherein the rearward circular wall portion has an interior surface with a central wall surface portion that projects into the primer interior.

2. The cartridge of claim **1**, wherein the interior surface is directly adjacent the primer compound.

3. The cartridge of claim **1**, wherein the interior surface defines a convex surface of the rearward circular wall portion.

4. The cartridge of claim **1**, wherein the rearward circular wall portion further comprises a concave exterior surface.

5. The cartridge of claim **4**, wherein the concave exterior surface is substantially centered on the rearward circular wall portion and extends inwardly toward the primer interior.

6. The cartridge of claim **1**, wherein, upon detonation of the primer compound, the interior surface is configured to expand outwardly to exert an outward radial force against the rearward primer opening.

7. The cartridge of claim **1**, wherein the rearward primer opening defines an annular groove, and wherein the skirt wall is configured to deform into at least a portion of the annular groove defined by the rearward primer opening.

8. The cartridge of claim **7**, wherein the rearward primer opening has a depth and the annular groove has an annular center that is positioned a distance from a rearward face of the head portion that is less than 40% of the depth of the rearward primer opening.

9. The cartridge of claim 7, wherein the rearward primer opening has a cylindrical wall surface with an axial length and the annular groove is positioned at the midpoint of the axial length of the cylindrical wall surface.

10. The cartridge of claim 1, wherein the primer further comprises an anvil seated on the primer interior, wherein the primer compound is disposed between the anvil and the rearward circular wall portion.

11. The cartridge of claim 10, wherein the anvil defines a concave surface extending toward the rearward circular wall portion, and wherein the primer interior defines a biconcave disc.

12. A primer for ammunition that develops chamber pressures exceeding 75,000 psi, comprising:

a cup portion with a base portion configured as rearward circular wall portion and a forward extending skirt wall portion unitary with the rearward circular wall portion and defining a primer interior, wherein the rearward circular wall portion has an interior surface with a central wall surface portion that projects into the primer interior, and wherein the skirt wall portion is configured to be received in a rearward primer opening of a cartridge casing; and

a primer compound disposed in the primer interior.

13. The primer of claim 12, wherein the interior surface is directly adjacent the primer compound.

14. The primer of claim 12, wherein the interior surface is defines a convex surface of the rearward circular wall portion.

15. The primer of claim 12, wherein the rearward circular wall portion further comprises a concave exterior surface, and wherein the concave exterior surface is substantially centered on the rearward circular wall portion and extends inwardly toward the primer interior.

16. The primer of claim 15, wherein, upon detonation of the primer compound, the concave interior surface is configured to deform into a non-concave shape.

17. The primer of claim 12, further comprising an anvil seated on the primer interior, wherein the primer compound is disposed between the anvil and the rearward circular wall portion.

* * * * *