FULL METAL JACKET BULLETS WITH IMPROVED LETHALITY

Inventors: Kyle A. Masinelli, Staunton, IL (US); Gerald T. Eberhart, Bethalto, IL (US)

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An improved pistol bullet comprises a jacket having a generally cylindrical body portion and a tapering nose portion; a first material disposed in the tapering nose portion of the jacket, and a second material, having a higher density than the first material, disposed in the jacket behind the first material.
FULL METAL JACKET BULLETS WITH IMPROVED LETHALITY

FIELD

[0001] The present disclosure relates to ammunition, and in particular, to full metal jacket bullets with improved lethality.

BACKGROUND

[0002] This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] The Hague Convention of 1899, Declaration III, prohibits the use in warfare of bullets that easily expand or flatten in the body. NATO members do not use small arms ammunition that is prohibited by the Hague Convention. There is a need for ammunition that is Hague Convention compliant, yet is still effective. This need is particularly acute for pistol ammunition, which because of its typically lower muzzle velocities, is less energetic, and thus, is particularly disadvantaged by the restriction on expansion.

SUMMARY

[0004] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0005] Generally, embodiments of this invention provide full metal jacket bullets with improved lethality, and in particular, full metal jacket pistol bullets with improved lethality.

[0006] A preferred embodiment of the invention provides an improved pistol bullet comprising a jacket having a generally cylindrical body portion and a tapering nose portion, a first material disposed in the tapering nose portion of the jacket, and a second material, having a higher density than the first material, disposed in the jacket behind the first material. The first material preferably substantially fills the tapering nose portion of the jacket.

[0007] The first material is non-metallic material, such as sodium carbonate, which can be either a solid piece, but more preferably, is in the form of a compacted flowable powder. The second material is preferably a metallic material, or other high-density material. The second material can be lead, but it is preferably lead-free metal or metal alloys.

[0008] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only, and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0009] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0010] FIG. 1A is a side elevation view of a prior art 9 mm jacketed NATO bullet;

[0011] FIG. 1B is a side elevation view of the prior art 9 mm jacketed NATO bullet shown in FIG. 1A, with a portion removed to reveal the core;

[0012] FIG. 2A is a side elevation view of a preferred embodiment of a 9 mm jacketed bullet, in accordance with the principles of this invention;

[0013] FIG. 2B is a side elevation view of the preferred embodiment of a 9 mm jacketed bullet shown in FIG. 2A, with a portion removed to reveal the core;

[0014] FIG. 3 is a photograph of the prior art NATO bullet shot into gelatin, showing minimal gelatin disruption;

[0015] FIG. 4 is a photograph of the preferred embodiment shot into gelatin, showing a much larger disruption towards the end of the penetration path in the 7°-11° deep region, caused by the bullet tumbling while penetrating;

[0016] FIG. 5A is a photograph showing a prior art 9 mm jacketed NATO bullet, after being fired into and recovered from a level IIa bullet proof vest;

[0017] FIG. 5B is a photograph showing a preferred embodiment of a bullet constructed according to the principles of this invention, without a fluted profile, after being fired into and recovered from a level IIa bullet proof vest; and

[0018] FIG. 5C is a photograph showing a preferred embodiment of a bullet constructed according to the principles of this invention, with a fluted profile after being fired into and recovered from a level IIa bullet proof vest.

[0019] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0020] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0021] A prior art 9 mm NATO pistol bullet is indicated generally as 20 in FIGS. 1A and 1B, and has a generally cylindrical rear or aft section 22, a tapering front section 24, and a rounded nose section 26. The bullet 20 comprises a jacket 28 surrounding a core 30. The jacket 28 is made of copper or a copper alloy, such as CDA 226, and is thickest adjacent the nose section 26, where the thickness is about 0.016 inches, and thinnest adjacent the rear or aft portion 22, where the thickness is about 0.009 inches. The jacket 28 preferably extends around the heel of the core 30, forming an annular lip that covers a portion of the heel of the core. The core 30 is made of lead or a lead alloy.

[0022] The bullet 20 has a length of 0.6 inches, a diameter of 0.354 inches (9 mm), and a weight of 124 grains (comprising a jacket of 13.4 grains, and a core of 110.6 grains). The bullet 20 has a center of mass 32 located on the bullet's centerline, 0.363 inches from the tip of the nose section 26 of the bullet. The bullet 20 has a center of pressure 34 located on the bullet's centerline, 0.341 inches from the tip of the nose section 26.

[0023] As shown in FIGS. 2A and 2B, a preferred embodiment of an improved pistol bullet, in accordance with the principles of this invention, is indicated generally as 100. As shown in FIGS. 2A and 2B, the pistol bullet 100 has a generally cylindrical rear or aft section 102, a tapering front section 104, and a rounded nose section 106. The bullet 100 comprises a jacket 108, surrounding a core 110. The jacket 108 is made of copper or a copper alloy, such as CDA 226, and is thickest adjacent the nose section 106, where the thickness is about 0.016 inches, and thinnest adjacent the rear or aft portion 102, where the thickness is about 0.009 inches. The jacket 108 preferably extends around the heel of the core 110, forming an annular lip that covers a portion of the heel of the core. The core 110 preferably comprises a first material 112, is disposed in the tapering front section 104 of the jacket 108,
adjacent the rounded nose section 106, and a second material 114, having a higher density than the first material, disposed in the jacket behind the first material.

[0024] The first material 112 preferably substantially fills the tapering front portion 104 of the jacket 108. The first material 112 is preferably very low density, and non-metallic, although the first material could be low density metal. The first material can be monolithic solid, but it is preferably a compacted flowable powder. In the preferred embodiment, the first material 112 is sodium carbonate (Na2CO3), which has a density of between about 2.54 g/cm³ (anhydrous) and about 2.25 g/cm³ (monohydrate).

[0025] The second material 114 is preferably a high density material, such as a metal or metal alloy, but could be a dense non-metallic material as well. Almost any metal or metal alloy composition that is denser than the first material 112 is functionally acceptable, although malleability, toxicity, and cost are related to the selection. The second material 114 is preferably lead-free, such as tin or tin alloy (although lead and lead alloys can be used in appropriate situations). Tin has a density of about 5.769 g/cm³ for gray or a tin, and about 7.565 g/cm³ for white or β tin, which is the stable allotrope at room temperature. The density of the second material 114 is preferably at least twice the density of the first material 112, and more preferable at least three times the density of the first material 112.

[0026] The bullet 100 is preferably configured so that the center of pressure of the bullet in air at STP (for the velocity at which it will be fired, which is between about 900 fps and about 1400 fps), is at least 0.070 inches from the center of mass of the bullet. The center of pressure 116 of bullet 100 can be calculated by methods well known in the art, but can also be conveniently determined using software, such as PRODAS, available from Arrow Tech Associates, Inc., Burlington, Vt. As shown in FIGS. 2A and 2B in this preferred embodiment, the center of pressure 116 of bullet 100 is located 0.120 inches forward of the center of mass 118.

[0027] The bullet 100 can optionally have a plurality of surface features that help destabilize the bullet and start it tumbling. For example in the preferred embodiment, flat surfaces 120 can be formed on the surface of the bullet. In the preferred embodiment, there are six such flat surfaces 120 equally spaced around the circumference of the tapering front section 104 of the bullet, which because of the rounded, tapering configuration of the front section 104 of the bullet, have a generally oval shape that is wider toward the rear.

[0028] The bullet 100 is preferably configured so that when the bullet is fired into 10% ballistic gelatin at its intended use velocity, which is between about 900 feet per second and 1400 feet per second, the bullet penetrates the ballistic gelatin between about 12 inches and about 18 inches, and more preferably, does not penetrate more than about 15 inches.

[0029] The bullet is preferably configured so that when the bullet is fired into 10% ballistic gelatin at its intended use velocity, between about 900 feet per second and about 1400 feet per second, the bullet yaws by at least 90° within about 6 inches of penetrating the ballistic gelatin. This yawing action allows the bullet to cause more disruption and damage to the target, than if the bullet continued traveling without yawing, without the need for expansion or flattening of the tip. More preferably, the bullet is configured so that when the bullet is fired into 10% ballistic gelatin at its intended use velocity, between about 900 feet per second and about 1400 feet per second, the bullet yaws by at least 90° within about 4.75 and about 5.25 inches of penetrating the ballistic gelatin.

[0030] It is desirable that a bullet efficiently transfer its kinetic energy to the target, to maximize the damage done to the intended target, and to minimize damage done to an unintended target. Thus, the bullet is preferably configured so that when the bullet is fired into 10% ballistic gelatin, at its intended use velocity, which is between about 900 feet per second and about 1400 feet per second, the bullet transfers 100% of its kinetic energy to the gelatin before the bullet penetrates 18 inches into the ballistic gelatin.

[0031] The density of the first material is sufficiently lower than the density of the second material, so when the bullet is fired into 10% ballistic gelatin, the bullet achieves 90° yaw at least 3 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

[0032] An important feature in some embodiments is the difference in the density of the first material 112 and the second material 114, which helps contribute to the tumbling of the bullet after it strikes its target. Thus for a given bullet configuration, the density of the first material is sufficiently lower than the density of the second material, that when the bullet is fired into 10% ballistic gelatin, at its intended use velocity (between about 900 feet per second and about 1400 feet per second) the bullet stops at least 5 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

[0033] Thus, the difference in density between the first and second materials 112 and 114 is preferably also sufficient so that when the bullet is fired into 10% ballistic gelatin, at its intended use velocity (between about 900 feet per second and about 1400 feet per second) the bullet transfers 100% of its kinetic energy to the gelatin at least 5 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

[0034] The FBI developed a formula for measuring wound volume form expanding bullets: \( \pi r^2 P \), where \( r = \frac{1}{2} \) the total expanded diameter of the bullet and \( P \) is the total penetration in inches. The FBI further developed a formula which takes the adjusted volume and compares it to a minimum volume value for each caliber, based on an unexpanded bullet that only penetrated the minimum of 12". From this formula, a "wound efficiency" value can be generated. Wound efficiency values of 3.0 are considered ideal. While not developed for use with non-expanding bullets, these formulas do provide a basis for comparing the performance (in terms of target disruption) of two bullets.

[0035] Analyzing high-speed video of the bullets in ballistic gelatin, and estimating the cross-sectional area based upon the observed yaw angles, adjusted wound volumes for a 9 mm Lead Free—Sodium/Tin Core bullet constructed according to the principles of this invention and a conventional 9 mm NATO—M882 for comparison were determined. These are shown in Table 1. Yaw angles were broken into 15° increments from 0°-90°, and penetration values are broken into 1/4" increments. Because no expansion takes place, the \( (\pi r^2) \) value was replaced with cross-sectional area calculations at given yaw angles for each bullet. CAD models were used to calculate these. Only the penetration up to 15" were used in the adjusted volume summation—anything beyond 15" was disregarded. Two shots for each bullet type were used in this evaluation.
Table 1

<table>
<thead>
<tr>
<th>9 mm Green Wound Effectiveness Evaluation</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sectional Area at 0° Yaw</th>
<th>Sectional Area at 15° Yaw</th>
<th>Sectional Area at 30° Yaw</th>
<th>Sectional Area at 45° Yaw</th>
<th>Sectional Area at 60° Yaw</th>
<th>Sectional Area at 75° Yaw</th>
<th>Sectional Area at 90° Yaw</th>
<th>Total Volume</th>
<th>Wound Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0990</td>
<td>0.1021</td>
<td>0.1119</td>
<td>0.1322</td>
<td>0.1722</td>
<td>0.1825</td>
<td>1.901</td>
<td>1.195</td>
<td></td>
</tr>
<tr>
<td>Shot #2</td>
<td>Adjusted</td>
<td>0.594</td>
<td>0.128</td>
<td>0.231</td>
<td>0.832</td>
<td>1.137</td>
<td>0.891</td>
<td>1.184</td>
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<tr>
<td>Volume</td>
<td>0.594</td>
<td>0.128</td>
<td>0.252</td>
<td>0.909</td>
<td>0.872</td>
<td>1.154</td>
<td>0.997</td>
<td>1.151</td>
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<tr>
<td>Average</td>
<td></td>
<td>0.872</td>
<td>0.872</td>
<td>0.627</td>
<td>1.277</td>
<td>2.117</td>
<td>1.558</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Sectional Area at 0° Yaw</th>
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<th>Sectional Area at 30° Yaw</th>
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<th>Sectional Area at 90° Yaw</th>
<th>Total Volume</th>
<th>Wound Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0990</td>
<td>0.1021</td>
<td>0.1119</td>
<td>0.1322</td>
<td>0.1740</td>
<td>0.2090</td>
<td>0.2215</td>
<td>1.777</td>
<td></td>
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<tr>
<td>Shot #2</td>
<td>Adjusted</td>
<td>0.445</td>
<td>0.102</td>
<td>0.196</td>
<td>0.331</td>
<td>0.418</td>
<td>0.277</td>
<td>2.117</td>
</tr>
<tr>
<td>Volume</td>
<td>0.445</td>
<td>0.026</td>
<td>0.084</td>
<td>0.397</td>
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<td>0.277</td>
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<tr>
<td>Average</td>
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<td>1.282</td>
<td>1.667</td>
<td>1.558</td>
<td>1.777</td>
<td>2.117</td>
<td>1.558</td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 1, the bullets constructed according to the principles of this invention provided a 16.6% greater wound volume, and a 45.5% greater wound efficiency.

Figs. 5A-5C shows a conventional NATO bullet (Fig. 5A), a non-fluted version of the preferred embodiment (Fig. 5B), and a fluted version of the preferred embodiment (Fig. 5C) after being fired into and recovered from a level IIa bullet proof vest. The photos show that even though the bullets of the preferred embodiment are comprised of much harder materials than the standard NATO bullet, they can still "mushroom" on impact, increasing the disruption of the target.

The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the invention, and all such modifications are intended to be included within the scope of the invention.

What is claimed is:

1. An improved pistol bullet comprising:
   a jacket having a generally cylindrical body portion and a tapering nose portion; and
   a first material disposed in the tapering nose portion of the jacket, and a second material, having a higher density than the first material, disposed in the jacket behind the first material.

2. The improved pistol bullet according to claim 1, wherein the first material substantially fills the tapering nose portion of the jacket.

3. The improved pistol bullet according to claim 1, wherein the first material is non-metallic, and the second material is metallic.

4. The improved pistol bullet according to claim 1, wherein the first material is a compacted, flowable powder.

5. The improved pistol bullet according to claim 4, wherein the first material is sodium carbonate.

6. The improved pistol bullet according to claim 5, wherein the second material is tin or a tin alloy.

7. The improved pistol bullet according to claim 5, wherein the second material is lead or a lead alloy.

8. The improved pistol bullet according to claim 1, wherein the density of the second material is at least twice the density of the first material.

9. The improved pistol bullet according to claim 8, wherein the density of the second material is at least three times the density of the first material.

10. The improved pistol bullet according to claim 1, wherein the location of the center of pressure of the bullet in air at STP (for velocities of between about 900 and about 1400) is at least 70/1000 from the center of mass of the bullet.

11. The improved pistol bullet according to claim 1, further comprising flat faces on the exterior nose portion of the jacket.

12. The improved pistol bullet according to claim 1, configured so that when the bullet is fired into 10% ballistic gelatin at a velocity of between about 900 feet per second and about 1400 feet per second, the bullet penetrates the ballistic gelatin between about 12 inches and about 18 inches.

13. The improved pistol bullet according to claim 12, wherein when the bullet is fired into 10% ballistic gelatin at a velocity of between about 900 feet per second and about 1400 feet per second, the bullet does not penetrate more than about 15 inches.

14. The improved pistol bullet according to claim 1, configured so that when the bullet is fired into 10% ballistic gelatin at a velocity of between about 900 feet per second and about 1400 feet per second, the bullet yaws by at least 90° within about 4.75 and about 5.25 inches of penetrating the ballistic gelatin.

15. The improved pistol bullet according to claim 14, configured so that when the bullet is fired into 10% ballistic gelatin at a velocity of between about 900 feet per second and about 1400 feet per second, the bullet yaws by at least 90° within about 4.75 and about 5.25 inches of penetrating the ballistic gelatin.
16. The bullet according to claim 1, configured so that when the bullet is fired into 10% ballistic gelatin, the bullet transfers 100% of its kinetic energy to 10% to the gelatin before the bullet penetrates 18 inches into the ballistic gelatin.

17. The bullet according to claim 1, wherein the density of the first material is sufficiently lower than the density of the second material that when the bullet is fired into 10% ballistic gelatin, the bullet achieves 90° yaw at least 5 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

18. The bullet according to claim 1, wherein the density of the first material is sufficiently lower than the density of the second material that when the bullet is fired into 10% ballistic gelatin, the bullet stops at least 5 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

19. The bullet according to claim 1, wherein the density of the first material is sufficiently lower than the density of the second material such that when the bullet is fired into 10% ballistic gelatin, the bullet transfers 100% of its kinetic energy to the gelatin at least 5 inches earlier than a bullet of the same configuration that contains only the second material, fired into 10% ballistic gelatin at the same speed.

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